Appendix A

Notice of Preparation and
Comments Received

NOTICE OF PREPARATION AND PROGRAM EIR PUBLIC SCOPING MEETING

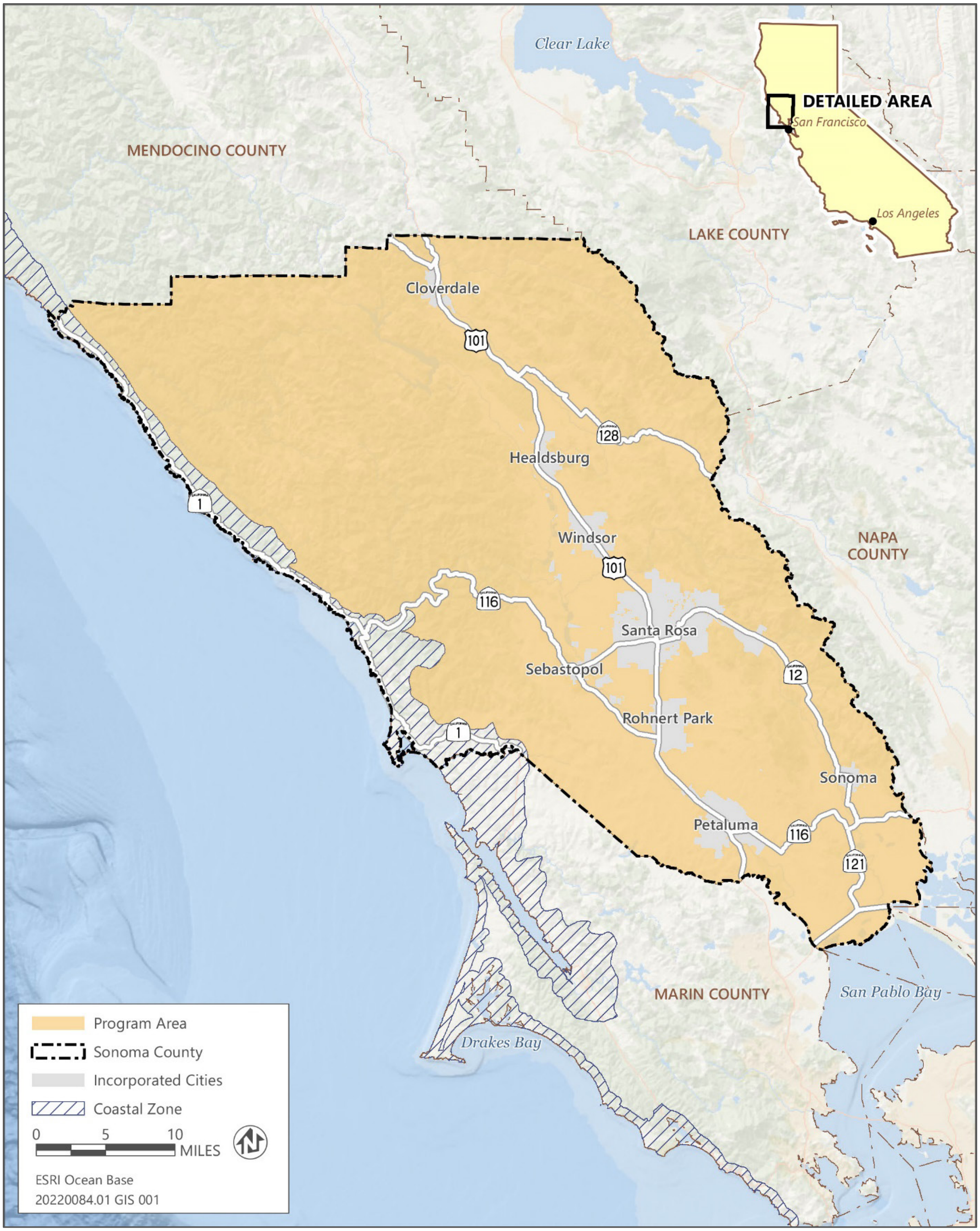
Sonoma County Comprehensive Cannabis Program Update

Date:	February 6, 2023
To:	State Clearinghouse, Responsible and Trustee Agencies, and Interested Parties and Organizations
Project Title:	Sonoma County Comprehensive Cannabis Program Update
Comment Period:	February 6, 2023 through March 23, 2023
Scoping Meeting:	March 8 , 2023, at 6:00 p.m. PST
Lead Agency:	County of Sonoma
Project Location:	Unincorporated Countywide, outside of coastal zone (refer to Figure 1)
Lead Agency Contact:	Crystal Acker, Supervising Planner County of Sonoma 2550 Ventura Avenue Santa Rosa, California 95403 Cannabis@sonoma-county.org

The Sonoma County Permit and Resource Management Department (Permit Sonoma) is preparing a comprehensive cannabis program update, including a new commercial cannabis land use ordinance and potential General Plan Amendments. Permit Sonoma has determined that a Program Environmental Impact Report (EIR) will be necessary to evaluate the potential physical environmental impacts of the Cannabis Program Update pursuant to the California Environmental Quality Act (CEQA). The County requests comments and guidance on the scope and content of the Program EIR from responsible and trustee agencies, interested public agencies, organizations, and the general public in compliance with CEQA (California Public Resources Code, Section 21000 et seq.), and the State CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3). In accordance with State CEQA Guidelines Sections 15082(a) and 15375, the County prepared and released this Notice of Preparation (NOP) of an EIR.

This NOP provides a brief summary of the Comprehensive Cannabis Program Update, the County's preliminary identification of the potential environmental issues to be analyzed in the EIR, and information on how to provide written comments and verbal comment (as part of a Public Scoping Meeting) on the scope of the EIR.

The County invites any and all input and comments regarding the preparation of the Program EIR. If applicable, please indicate a contact person for your agency or organization. If your agency is a responsible agency as defined by CEQA Guidelines Section 15381, your agency may use the environmental documents prepared by the County when considering permits or approvals for actions regarding the project.



Source: adapted by Ascent Environmental in 20231

Figure 1 Program Area

Public Scoping Meeting:

The County will hold a public scoping meeting to provide an opportunity for agency staff and interested members of the public to submit verbal comments on the scope of the environmental issues to be addressed in the EIR. The scoping meeting will be held on Wednesday, March 8, 2023, at 6:00 p.m. pacific standard time (PST). To join the meeting by computer or provide comment by phone, use the Zoom link or phone number on the Cannabis Program Update webpage:
https://sonomacounty.zoom.us/j/93030525461?pwd=NndtNWVvSkVmZ0Y0K0ViK2Z6c0swUT09

The scoping meeting will include a presentation on elements of the Cannabis Program Update, a summary of the NOP and broader CEQA process to come, and an opportunity to provide comments on the scope of the EIR.

The scoping presentation will be recorded and available to view after March 15, 2023 at: :
https://sonomacounty.ca.gov/administrative-support-and-fiscal-services/county-administrators-office/projects/cannabis-program/cannabis-program-update-and-eir

If you have questions regarding this NOP or the scoping meeting, please contact Crystal Acker at 707-565-8357 or via email at Cannabis@sonoma-county.org.

Written Comments:

If applicable, please indicate a contact person for your agency or organization when submitting comments. Submit written comments to either of the below within 45 days of the date of this notice by 5:00 p.m. on March 23, 2023:

- Email: Cannabis@sonoma-county.org
- Regular mail: Permit Sonoma, Attn: Crystal Acker
  2550 Ventura Avenue, Santa Rosa, California 95403

All commenters who provide an email address will be added to the Interested Parties List for future updates on the Cannabis Program. Individuals may also be added to the list through the County's Electronic Subscription Services
https://service.govdelivery.com/accounts/CASONOMA/subscriber/new?topic_id=CASONOMA_312 or by sending a request to be added to Cannabis@sonoma-county.org.

Project Background:

Sonoma County's first regulation of cannabis as an industry was the County's original dispensary ordinance (Ord. No. 5715), as adopted March 20, 2007 and amended on February 7, 2012 and which imposed a cap of nine dispensaries in the unincorporated County (Ord. No. 5967). The County's first comprehensive Cannabis Land Use Ordinance (Ord. No. 6189) was adopted under a Negative Declaration on December 20, 2016, and amended in 2018 to make minor changes to allowed uses (e.g., allow adult use) and enhance neighborhood compatibility (e.g., 10-acre minimum parcel size for cultivation) within the scope of the adopted Negative Declaration.

Sonoma County currently regulates commercial cannabis land uses in the unincorporated areas of the County under Zoning Code Sections 26-88-250 through 26-88-256 and regulates personal cannabis cultivation under Section 26-88-258. These provisions contain allowable cannabis uses and permit requirements by zoning district and include development criteria and operating standards for commercial cannabis activities.

The proposed Cannabis Program Update complies with a June 8, 2021 directive from the Board of Supervisors to complete a comprehensive update of the cannabis program and prepare an EIR in compliance with CEQA. On March 15, 2022, the Board adopted a Cannabis Program Update Framework (Attachment 1) to guide development of the project description, CEQA alternatives, and draft ordinance.

Project Description:

The Cannabis Program Update would result in a series of zoning changes that may retain, replace, expand on, or eliminate existing provisions of the current cannabis ordinance. The primary goals of the Cannabis Program Update are to consider the need for expanded or new cannabis land uses within the unincorporated County, further enhance neighborhood compatibility and environmental protections (which could result in restriction or elimination of cannabis land uses), and streamline the cannabis permitting process. The Cannabis Program Update is currently being developed consistent with County Resolution No. 22-0088, “Cannabis Program Update Framework” (Framework), which requires:

- Defining which activities are allowed or prohibited, and what authorization is required for allowed activities (i.e.) by right; ministerial zoning permit; discretionary use permit; business license.
- Consideration of one or more General Plan Amendments, including to address the relationship between cannabis and traditional agriculture and other existing uses.
- Policy development informed by data and factual analyses, including:
    - Neighborhood separation criteria, based on residential and cannabis use types, as it relates to odor, groundwater, visual, safety (including road access and wildfire), and noise impacts.
    - Criteria for and mapping of “Rural Neighborhood Enclave,” based on residential density and community character.
    - Criteria for and mapping of Exclusion Zones related to groundwater availability, topography, infrastructure (e.g., road access, lack of electrical/other utilities), safety concerns (including wildfire risk and emergency response times), and biological habitat protection. If designated Exclusion Zones are adopted, the cannabis land use ordinance will include Exclusion Zone maps.
- Permit streamlining, consisting of:
    - site development and operating standards for ministerial permits and by right uses;
    - criteria for and mapping of establish Inclusion Zones, based on groundwater availability, infrastructure (e.g., road access, availability of electrical/public water/sewer/ stormwater facilities), safety concerns (including wildfire risk and emergency response times), biological habitat protection, and proximity/density of sensitive uses; and
    - other permit streamlining options, such as development of a CEQA streamlining checklist for discretionary permits to limit additional project-specific environmental review.

The Program area consists of all non-coastal General Plan Land Use categories and corresponding Zoning Districts. The Local Coastal Plan does not allow commercial cannabis activities; the Cannabis Ordinance Update will not result in changes to the Local Coastal Plan or inclusion of cannabis land uses within the Coastal Zone.

Project Alternatives:

The EIR will evaluate a reasonable range of project alternatives that, consistent with CEQA, meet most of the project objectives and would avoid or substantially lessen any potential significant effects that may be identified. To ensure the County has a range of scenarios to consider during future discretionary proceedings, alternatives will include a No Project Alternative (continuation of existing regulations), and one or more reduced project alternatives tied to various policy options.

The EIR will identify the environmentally superior alternative, and also will identify any alternatives that were considered but rejected by the lead agency as infeasible and briefly explain the reasons why.

Next Steps:

After the Draft EIR is completed, the County will issue a Notice of Availability of a Draft EIR to inform the public and interested agencies, groups, and individuals of how to access the Draft EIR and provide comments.

The draft EIR will be available for review at Permit Sonoma, located at 2550 Ventura Avenue, Santa Rosa, California 95403 and on the Cannabis Program Update & Environmental Impact Report webpage at: https://sonomacounty.ca.gov/administrative-support-and-fiscal-services/county-administrators-office/projects/cannabis-program/cannabis-program-update-and-eir.

Potential Environmental Effects:

The County has determined that implementing the Cannabis Program Update may result in significant environmental impacts; therefore, an EIR will be prepared. As allowed under State CEQA Guidelines Section 15060(d) and 15063 (when it has been determined that an EIR will clearly be required), the County has elected not to prepare an initial study and will instead begin work directly on the EIR.

The EIR will analyze the reasonably foreseeable and potentially significant adverse effects of the proposed project (both direct and indirect). The EIR also will evaluate the cumulative impacts of the project when considered in conjunction with other related past, present, and reasonably foreseeable future projects. The analysis in the EIR will be programmatic and will evaluate the effectiveness of the proposed land use requirements and development performance standards to address environmental impacts associated with the regulated cannabis activities. Where potentially significant environmental impacts are identified, the EIR will also discuss mitigation measures (e.g., in the form of modifications to the ordinance) that may reduce or avoid significant impacts. The EIR will analyze the potential for significant environmental impacts (direct and indirect) in the following topic areas:

Aesthetics/Visual Resources
Agricultural & Forest Resources
Air Quality
Biological Resources
Cultural Resources
Energy
Geology and Soils
Greenhouse Gas Emissions
Hazards and Hazardous Materials
Hydrology and Water Quality
Land Use and Planning
Mineral Resources
Noise
Public Services
Transportation
Tribal Cultural Resources
Utilities and Service Systems
Wildfire
Cumulative Impacts

These topic areas will be evaluated in the EIR, and feasible and practicable mitigation measures will be recommended to reduce any potentially significant impacts. The Cannabis Ordinance Update is not anticipated to result in significant impacts to population and housing or recreation because it would not involve the generation of substantial new employment or a need for housing that could generate additional demand on recreation resources. Brief descriptions of proposed analyses follow:

Aesthetics/Visual Resources. The analysis will address whether project implementation could generally change visual character within the County, especially from important viewpoints (i.e., designated Scenic Resources: Scenic Corridors, Scenic Landscape Units, and Community Separators). The EIR will consider, at minimum, fencing, lighting, stockpiles of equipment used in outdoor cultivation operations such as containers and growth media, temporary hoop houses, and permanent structural development. The analysis will also include a discussion of potential impacts from light and/or glare associated with mixed-light cultivation greenhouses.

Agricultural & Forest Resources. The EIR will describe the County's current agricultural resources and land uses, including lands subject to Williamson Act Land Conservation contracts, consistent with the Sonoma County General Plan. The General Plan identifies preservation of agricultural land for agricultural uses as the primary goal for the three agricultural land use categories: Land Intensive Agriculture, Land Extensive Agriculture, and Diverse Agriculture. To support that goal, the General Plan includes many policies to protect and enhance agricultural lands and to encourage land uses related to agricultural production, agricultural support, and visitor-serving uses that promote agriculture. The analysis will address compatibility of cannabis operations with traditional agricultural land uses and potential conversion of agricultural lands to non-agricultural uses. The analysis will also include a discussion of potential impacts associated with a General Plan Amendment to include cannabis within the meaning of "agriculture" and "agricultural use" as used in the Sonoma County General Plan.

The EIR will describe the County's current forested/timber resources and land uses consistent with the Sonoma County General Plan. The analysis will address compatibility of cannabis operations with timber resources and potential conversion of timberlands.

Air Quality. The EIR will evaluate the potential criteria air pollutant emissions associated with construction- and operation-related activities associated with cannabis operations. The analysis will address toxic air contaminants, potential impacts on sensitive receptors, and generator use from cannabis operations. The EIR will evaluate potential cannabis plant odor impacts associated with cannabis activities, including cultivation and processing.

Biological Resources. The EIR will analyze potential impacts on biological resources from project implementation. It will include a description of known biological resources, including regionally sensitive and locally-important watersheds, fish-bearing streams, riparian habitat, the Laguna de Santa Rosa and other wetland areas, sensitive natural communities, sensitive habitats, movement corridors, wildlife nursery sites, special-status plant and wildlife species, and federal-designated Critical Habitat. The impact analysis will also consider potential conflicts with applicable policies or regulations protecting biological resources, including General Plan polices for Biotic Resources and provisions of the State Water Resources Control Board Cannabis Cultivation Policy – Guidelines for Cannabis Cultivation. The EIR will address other mandatory findings of significance related to biological resources.

Cultural Resources and Tribal Cultural Resources. The EIR will include a discussion of applicable federal, state, and local policies and regulations related to defined cultural resources; a brief summary of the prehistory and history of the County; a description of known historic properties or historical resources; and an evaluation of impacts on historical, archaeological, and tribal cultural resources. The EIR will address other mandatory findings of significance related to cultural resources.

Energy. The EIR will evaluate whether cannabis operations allowed under the Cannabis Program Update would result in a wasteful, inefficient, or unnecessary use of energy (stationary and mobile). The section will consider Title 24 building efficiency requirements, including renewable energy, and state cannabis licensing provisions regarding the use of renewable energy, especially related to high energy consumption indoor and mixed light cultivation activities. Construction energy use will also be addressed in the EIR.

Geology, Soils, and Mineral Resources. The EIR will describe the geological setting of the County, including topography and soil characteristics, as well as County and state regulations related to geology, soils, paleontological resources, and seismicity. This information will be used to evaluate impacts related to geological hazards, seismic-related effects, unstable soil and slopes, soil erosion, impacts on paleontological resources, loss of availability to mineral resources of value, and other geologic issues.

Greenhouse Gas Emissions. The EIR analysis will determine whether commercial cannabis operations under the Cannabis Program Update would generate significant greenhouse gas (GHG) emissions and result in a cumulatively considerable contribution to the global impact of climate change. The analysis will factor in the degree to which cannabis cultivation replaces other agricultural production or forest conditions. Changes in carbon sequestration associated with changes in vegetation from establishment of cultivation areas and plant growing cycles will be considered. Proposed GHG reduction measures will be real, permanent, quantifiable, verifiable, and enforceable.

Hazards and Hazardous Materials. Cannabis operations may involve the use of potentially hazardous materials that could result in impacts on public health and the environment or the accidental release of hazardous materials into the environment. Applicable local and state regulations and databases will be identified and considered. Using available information, including the California Department of Pesticide Regulation's standards and guidance on pest management practices for cannabis cultivation, Sonoma County Agriculture / Weights and Measures Best Management Practices for Cannabis Cultivation, and measures included in the State Water Resources Control Board Cannabis Policy, the EIR will identify typical hazardous materials used in cannabis operations and associated impacts. The EIR will also consider any impacts related to proximity to schools and airports, the effect on emergency response and evacuation plans, the potential for increased wildland fires, and the program's effect on vector control.

Hydrology and Water Quality. The EIR will describe the existing hydrologic setting of the County and surrounding area and will summarize appropriate federal, state, and County regulations and policies related to these issues, including the State Water Resources Control Board Cannabis Policy. The EIR will evaluate the effects of the Proposed Ordinance on runoff and drainage patterns, pollutant discharges to surface water and groundwater related to agricultural chemical use, groundwater overdraft, well interference, streamflow depletion, and potential flooding hazards. The analysis will also address surface water and groundwater resource impacts associated with the water supply needs of cannabis operations under normal, dry, and multiple-dry years.

Land Use and Planning. The EIR will evaluate the Cannabis Program Update relative to Sonoma County General Plan Land Use policies, focusing on consistency with existing policies adopted for the purpose of reducing environmental impacts. The EIR will examine the potential for impacts associated with land use compatibility and will evaluate any potential for division of existing communities. It also will address other mandatory findings of significance related to impacts on human beings.

Noise. The EIR will describe the existing noise environment within the County and will identify existing areas with concentrations of noise-sensitive receptors and major noise sources; ambient levels; and natural factors, if any, that relate to the attenuation of noise, including topographic features. The impact of noise from specific equipment used for construction, cultivation (e.g., generators, air filtration and ventilation equipment, well pumps, and mechanical trimmers), manufacturing, and processing activities. The EIR will also assess exposure to excessive noise from allowed cannabis activities under the Cannabis Program Update, including cannabis tourism and related visitor-serving uses.

Public Services. The Cannabis Program Update would allow for expanded or new cannabis operations that could generate additional need for law enforcement and fire protection services. The EIR will evaluate whether new cannabis operations under the Cannabis Program Update could result in new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives related to these public services.

Transportation. The EIR will describe the existing transportation system and will analyze how cannabis operations under the Cannabis Program Update may affect the operation of County roadway facilities and state highway facilities, as well as increased vehicle miles traveled. The EIR will evaluate the potential increase in vehicle miles traveled associated with cannabis operations under the Cannabis Program Update and address potential impacts on roadway conditions from increased operational truck traffic and visitor-serving uses, as well as on traffic safety. Impacts on transit, bicycle, and pedestrian transportation will also be addressed.

Utilities and Service Systems. The EIR will evaluate whether implementing the Cannabis Program Update may affect the provision of utilities and related service systems, including the need to construct new or expanded water, wastewater, stormwater drainage, electrical, natural gas, or telecommunication facilities, the construction of which would result in significant environmental effects. The impact analysis will also consider solid waste service demands associated with cannabis operations (e.g., cultivation waste products, including hoop house membrane materials, growth media and containers, and green waste) and whether there would be adverse impacts on disposal capacity or reduction goals.

Wildfire. The EIR will describe the existing wildland fire hazard setting in the County, including all available information resources, such as fire hazard severity zones designated in the County General Plan, California Public Utility Commission Fire Threat Districts, Sonoma County Wildfire Risk Index, and will discuss recent and historic wildfire-prone areas in the County. The EIR will evaluate the Cannabis Program Update relative to Sonoma County General Plan Public Safety policies, focusing on consistency with existing policies adopted for the purpose of reducing environmental impacts associated with wildfire risk. The analysis will address cannabis operations' potential effects on the severity of wildfire hazards and evacuation conflicts (i.e., physical road condition and configuration to support concurrent emergency access by first responders and evacuation by residents), wildfire risk (i.e., site characteristics which influence fire likelihood and fire behavior), emergency response times, and availability of water for fire-fighting purposes.

Cumulative Impacts. The cumulative impact analysis will be based on existing land use plans for the County and the surrounding counties. The analysis will evaluate whether implementing the Cannabis Program Update would result in an incremental contribution to significant cumulative impacts that is considerable. The EIR will also evaluate potential impacts related to multiple cannabis operations in specific geographical areas (i.e., over-concentration).

Other CEQA Required Analyses. The EIR will evaluate whether the Cannabis Program would have the potential to induce population and economic growth within the County, identify any significant and unavoidable impacts, and disclose significant irreversible changes to the environment.

From: Val
To: Cannabis
Subject: Water
Date: Sunday, February 12, 2023 9:58:19 AM

EXTERNAL

Has anyone there thought about the impact of issuing more permits on our water supply?? We are in a drought in case you didn't know.

From: Liz Brock
To: Cannabis
Subject: Too much cannabis!
Date: Wednesday, February 15, 2023 4:03:08 PM

EXTERNAL

Going forward with increased cannabis activity in Sonoma County feels like an abuse and assault on public and youth safety!
Reading in the Press Democrat about the increased thieving and associated high speed chases endangers us all. Plus the many health reports on long term mental health issues for cannabis users. Making a recreational drug more accessible to all will definitely increase young peoples usage.
Please, put as strict of regulations as possible, for the safety of the rest of us who feel endangered by free flowing cannabis.
Very sincerely, Liz Brock.

From:	Crystal Acker
To:	Cannabis
Subject:	FW: Comment on Notice of Preparation of Cannabis EIR
Date:	Wednesday, February 15, 2023 7:40:40 AM
Attachments:	2_15_23_cannabis_scoping_ltr_1_final_1.pdf

-----Original Message-----
From: Sonia Taylor <great6@sonic.net>
Sent: February 15, 2023 7:06 AM
To: Crystal Acker <Crystal.Acker@sonoma-county.org>
Subject: Re: Comment on Notice of Preparation of Cannabis EIR

EXTERNAL

Crystal, attached please find my letter with an early comment on the scoping of the Cannabis EIR.

Of course, please don't hesitate to contact me if you have any questions or would like additional information.

Thanks for your consideration.

Sonia

Sonia Taylor
707-579-8875
great6@sonic.net

Sonia E. Taylor
306 Lomitas Lane
Santa Rosa, CA 95404
707-579-8875
Great6@sonic.net

15 February 2023

Crystal Acker, Supervising Planner
cannabis@sonoma-county.org

Via email

Re: Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR

Gentlepersons:

I am in receipt of the Notice of Preparation (NOP) for the Sonoma County Comprehensive Cannabis Program Update.

At this early stage, I just have one comment I'd like to make for the record, as follows.

I support the Cannabis Environmental Impact Report (EIR) researching, evaluating and identifying both "inclusion zones" and "exclusion zones," the former where cannabis is permitted to be grown and the later where cannabis is not permitted to be grown. Oddly, however, in the Framework for the Cannabis EIR, the criteria for evaluating inclusion and exclusion zones are different, and are missing what I believe are crucial concerns.

I would make the argument that the Cannabis EIR should use the most expansive criteria possible for defining inclusion and exclusion zones, and, in fact, that the criteria should be the same. For example, the Framework criteria for an exclusion zone includes "topography," while that is not listed as a criteria for an inclusion zone. Of course, topography is equally important to evaluate for both zones – if a site is relatively flat, that would be a point in favor of an inclusion zone, while a site with 20% slopes would be a point in favor of an exclusion zone. For example.

I would propose the following criteria, which is an amalgamation of the existing Framework criteria with the addition of other important issues not included in the Framework, for the EIR to use to evaluate and identify inclusion and exclusion zones – I have made the items to be considered as bullet points for clarity:

Criteria to establish Inclusion Zones and Exclusion Zones shall consider, at minimum:

- Groundwater availability,
- Topography,
- Infrastructure (e.g., road access, availability of electrical/ public water/sewer/ stormwater facilities/other utilities),
- Safety concerns (including wildfire risk, emergency response times for fire and crime),

- Site access (including dead end roads and road widths),
- Ability of the property to comply with state Fire Safe Regulations and other laws,
- Biological habitat protection,
- Natural resources (if the lands include resources such as water, timber, geothermal, mineral, habitat, etc.),
- Visual impacts (including impacts on parks, Community Separators, Scenic Landscape Units, Scenic Highways and Corridors and Greenbelts, Greenways and Expanded Greenbelts),
- Whether the property is located in a voter protected Community Separator,
- Likelihood of Cultural Resources on the property,
- Proximity/density of sensitive uses who will be affected by issues such as air quality, possible crime, noise, light, etc. (including schools, parks, residential uses, unincorporated towns and cohesive rural neighborhoods)
- Existing General Plan designations/requirements, existing zoning requirements, existing area plan requirements, and existing uses.

Thank you for your consideration. As always, please don't hesitate to contact me if you have any questions or require additional information.

Very truly yours,

Sonia E. Taylor

From: marcus pizzorno
To: Cannabis
Subject: EIR for cannabis operations in Sonoma County
Date: Friday, February 17, 2023 11:30:16 PM

EXTERNAL

As an absolute minimum, the EIR must include:
-Neighborhood Comparability (when did growing drugs become compatible with raising children?)
-Average minimums
-Ground water pollution

Please save the life we enjoy in Sonoma County by not legalizing the growing of drugs.

Marcus Pizzorno

Sent from Yahoo Mail for iPhone

From:	Loe Dispensaries
To:	Cannabis
Subject:	Consumption at dispensaries
Date:	Tuesday, February 21, 2023 9:43:30 PM

EXTERNAL

To the cannabis staff,

Sonoma county is falling behind again as other jurisdictions allow consumption rooms at dispensaries to help them attract customers away from the black market.

This is a needed revenue source for county dispensary owners who spent 5 years being processed and have suffered tremendous expense because of these unreasonable county delays. Does anyone think it's reasonable to take 4-5 years to process a CUP for a simple retail location with zero opposition?

Dispensaries with parcels that can accommodate the additional space for the cafe or lounge should be allowed. And consumption lounges should be limited to dispensary permit holders only. No extra cannabis rules. Stop that stuff. Treat it like a coffee shop. That's it. No need to be overwhelmingly burdensome on the operators.

Dispensaries with suitable land should be able to do special events and outdoor cannabis events on their land.

Cotati, Sonoma, and Santa Rosa are already doing consumption lounges. Sonoma county should mimic those laws and allow the county dispensary owners to compete instead of continuing to hold them back with grossly unreasonable/incompetent discriminatory 5 year processing and prmd crap that no other jurisdiction has to suffer through.

Give independent county cannabis retail operators a chance to compete with the banker owned mini-chains through the county.

Cannabis farmers should be able to distribute their own material to dispensaries, distributors, and manufacturers.

Cannabis co2 extraction should be allowed in ag zones DA, LEA, LIA. Hemp cement extraction is allowed and it the same machines and process. With the correct use bldg (F-1) an ag parcel should be able to do type 6 extraction of thc.

Thank you for considering,
John Loe
Loe Dispensaries
Loe Cannabis
707-708-6380

NATIVE AMERICAN HERITAGE COMMISSION

NAHC HEADQUARTERS
1550 Harbor Boulevard
Suite 100
West Sacramento, California 95691
(916) 373-3710
nahc@nahc.ca.gov
NAHC.ca.gov

February 8, 2023

Crystal Acker
County of Sonoma
2550 Ventura Avenue
Santa Rosa, CA 95403

Re: 2023020144, Sonoma County Comprehensive Cannabis Program Update Project, Sonoma County

Dear Ms. Acker:

The Native American Heritage Commission (NAHC) has received the Notice of Preparation (NOP), Draft Environmental Impact Report (DEIR) or Early Consultation for the project referenced above. The California Environmental Quality Act (CEQA) (Pub. Resources Code §21000 et seq.), specifically Public Resources Code §21084.1, states that a project that may cause a substantial adverse change in the significance of a historical resource, is a project that may have a significant effect on the environment. (Pub. Resources Code § 21084.1; Cal. Code Regs., tit.14, §15064.5 (b) (CEQA Guidelines §15064.5 (b)). If there is substantial evidence, in light of the whole record before a lead agency, that a project may have a significant effect on the environment, an Environmental Impact Report (EIR) shall be prepared. (Pub. Resources Code §21080 (d); Cal. Code Regs., tit. 14, § 5064 subd.(a)(1) (CEQA Guidelines §15064 (a)(1)). In order to determine whether a project will cause a substantial adverse change in the significance of a historical resource, a lead agency will need to determine whether there are historical resources within the area of potential effect (APE).

CEQA was amended significantly in 2014. Assembly Bill 52 (Gatto, Chapter 532, Statutes of 2014) (AB 52) amended CEQA to create a separate category of cultural resources, "tribal cultural resources" (Pub. Resources Code §21074) and provides that a project with an effect that may cause a substantial adverse change in the significance of a tribal cultural resource is a project that may have a significant effect on the environment. (Pub. Resources Code §21084.2). Public agencies shall, when feasible, avoid damaging effects to any tribal cultural resource. (Pub. Resources Code §21084.3 (a)). **AB 52 applies to any project for which a notice of preparation, a notice of negative declaration, or a mitigated negative declaration is filed on or after July 1, 2015.** If your project involves the adoption of or amendment to a general plan or a specific plan, or the designation or proposed designation of open space, on or after March 1, 2005, it may also be subject to Senate Bill 18 (Burton, Chapter 905, Statutes of 2004) (SB 18). **Both SB 18 and AB 52 have tribal consultation requirements**. If your project is also subject to the federal National Environmental Policy Act (42 U.S.C. § 4321 et seq.) (NEPA), the tribal consultation requirements of Section 106 of the National Historic Preservation Act of 1966 (154 U.S.C. 300101, 36 C.F.R. §800 et seq.) may also apply.

The NAHC recommends consultation with California Native American tribes that are traditionally and culturally affiliated with the geographic area of your proposed project as early as possible in order to avoid inadvertent discoveries of Native American human remains and best protect tribal cultural resources. Below is a brief summary of portions of AB 52 and SB 18 as well as the NAHC's recommendations for conducting cultural resources assessments.

Consult your legal counsel about compliance with AB 52 and SB 18 as well as compliance with any other applicable laws.

AB 52

AB 52 has added to CEQA the additional requirements listed below, along with many other requirements:

1. Fourteen Day Period to Provide Notice of Completion of an Application/Decision to Undertake a Project: Within fourteen (14) days of determining that an application for a project is complete or of a decision by a public agency to undertake a project, a lead agency shall provide formal notification to a designated contact of, or tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, to be accomplished by at least one written notice that includes:

- **a.** A brief description of the project.
- **b.** The lead agency contact information.
- **c.** Notification that the California Native American tribe has 30 days to request consultation. (Pub. Resources Code §21080.3.1 (d)).
- **d.** A "California Native American tribe" is defined as a Native American tribe located in California that is on the contact list maintained by the NAHC for the purposes of Chapter 905 of Statutes of 2004 (SB 18). (Pub. Resources Code §21073).

2. Begin Consultation Within 30 Days of Receiving a Tribe's Request for Consultation and Before Releasing a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report: A lead agency shall begin the consultation process within 30 days of receiving a request for consultation from a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project. (Pub. Resources Code §21080.3.1, subds. (d) and (e)) and prior to the release of a negative declaration, mitigated negative declaration or Environmental Impact Report. (Pub. Resources Code §21080.3.1(b)).

- **a.** For purposes of AB 52, "consultation shall have the same meaning as provided in Gov. Code §65352.4 (SB 18). (Pub. Resources Code §21080.3.1 (b)).

3. Mandatory Topics of Consultation If Requested by a Tribe: The following topics of consultation, if a tribe requests to discuss them, are mandatory topics of consultation:

- **a.** Alternatives to the project.
- **b.** Recommended mitigation measures.
- **c.** Significant effects. (Pub. Resources Code §21080.3.2 (a)).

4. Discretionary Topics of Consultation: The following topics are discretionary topics of consultation:

- **a.** Type of environmental review necessary.
- **b.** Significance of the tribal cultural resources.
- **c.** Significance of the project's impacts on tribal cultural resources.
- **d.** If necessary, project alternatives or appropriate measures for preservation or mitigation that the tribe may recommend to the lead agency. (Pub. Resources Code §21080.3.2 (a)).

5. Confidentiality of Information Submitted by a Tribe During the Environmental Review Process: With some exceptions, any information, including but not limited to, the location, description, and use of tribal cultural resources submitted by a California Native American tribe during the environmental review process shall not be included in the environmental document or otherwise disclosed by the lead agency or any other public agency to the public, consistent with Government Code §6254 (r) and §6254.10. Any information submitted by a California Native American tribe during the consultation or environmental review process shall be published in a confidential appendix to the environmental document unless the tribe that provided the information consents, in writing, to the disclosure of some or all of the information to the public. (Pub. Resources Code §21082.3 (c)(1)).

6. Discussion of Impacts to Tribal Cultural Resources in the Environmental Document: If a project may have a significant impact on a tribal cultural resource, the lead agency's environmental document shall discuss both of the following:

- **a.** Whether the proposed project has a significant impact on an identified tribal cultural resource.
- **b.** Whether feasible alternatives or mitigation measures, including those measures that may be agreed to pursuant to Public Resources Code §21082.3, subdivision (a), avoid or substantially lessen the impact on the identified tribal cultural resource. (Pub. Resources Code §21082.3 (b)).

7. Conclusion of Consultation: Consultation with a tribe shall be considered concluded when either of the following occurs:

a. The parties agree to measures to mitigate or avoid a significant effect, if a significant effect exists, on a tribal cultural resource; or

b. A party, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached. (Pub. Resources Code §21080.3.2 (b)).

8. Recommending Mitigation Measures Agreed Upon in Consultation in the Environmental Document: Any mitigation measures agreed upon in the consultation conducted pursuant to Public Resources Code §21080.3.2 shall be recommended for inclusion in the environmental document and in an adopted mitigation monitoring and reporting program, if determined to avoid or lessen the impact pursuant to Public Resources Code §21082.3, subdivision (b), paragraph 2, and shall be fully enforceable. (Pub. Resources Code §21082.3 (a)).

9. Required Consideration of Feasible Mitigation: If mitigation measures recommended by the staff of the lead agency as a result of the consultation process are not included in the environmental document or if there are no agreed upon mitigation measures at the conclusion of consultation, or if consultation does not occur, and if substantial evidence demonstrates that a project will cause a significant effect to a tribal cultural resource, the lead agency shall consider feasible mitigation pursuant to Public Resources Code §21084.3 (b). (Pub. Resources Code §21082.3 (e)).

10. Examples of Mitigation Measures That, If Feasible, May Be Considered to Avoid or Minimize Significant Adverse Impacts to Tribal Cultural Resources:

a. Avoidance and preservation of the resources in place, including, but not limited to:

i. Planning and construction to avoid the resources and protect the cultural and natural context.

ii. Planning greenspace, parks, or other open space, to incorporate the resources with culturally appropriate protection and management criteria.

b. Treating the resource with culturally appropriate dignity, taking into account the tribal cultural values and meaning of the resource, including, but not limited to, the following:

i. Protecting the cultural character and integrity of the resource.

ii. Protecting the traditional use of the resource.

iii. Protecting the confidentiality of the resource.

c. Permanent conservation easements or other interests in real property, with culturally appropriate management criteria for the purposes of preserving or utilizing the resources or places.

d. Protecting the resource. (Pub. Resource Code §21084.3 (b)).

e. Please note that a federally recognized California Native American tribe or a non-federally recognized California Native American tribe that is on the contact list maintained by the NAHC to protect a California prehistoric, archaeological, cultural, spiritual, or ceremonial place may acquire and hold conservation easements if the conservation easement is voluntarily conveyed. (Civ. Code §815.3 (c)).

f. Please note that it is the policy of the state that Native American remains and associated grave artifacts shall be repatriated. (Pub. Resources Code §5097.991).

11. Prerequisites for Certifying an Environmental Impact Report or Adopting a Mitigated Negative Declaration or Negative Declaration with a Significant Impact on an Identified Tribal Cultural Resource: An Environmental Impact Report may not be certified, nor may a mitigated negative declaration or a negative declaration be adopted unless one of the following occurs:

a. The consultation process between the tribes and the lead agency has occurred as provided in Public Resources Code §21080.3.1 and §21080.3.2 and concluded pursuant to Public Resources Code §21080.3.2.

b. The tribe that requested consultation failed to provide comments to the lead agency or otherwise failed to engage in the consultation process.

c. The lead agency provided notice of the project to the tribe in compliance with Public Resources Code §21080.3.1 (d) and the tribe failed to request consultation within 30 days. (Pub. Resources Code §21082.3 (d)).

The NAHC's PowerPoint presentation titled, "Tribal Consultation Under AB 52: Requirements and Best Practices" may be found online at: http://nahc.ca.gov/wp-content/uploads/2015/10/AB52TribalConsultation_CalEPAPDF.pdf

SB 18

SB 18 applies to local governments and requires local governments to contact, provide notice to, refer plans to, and consult with tribes prior to the adoption or amendment of a general plan or a specific plan, or the designation of open space. (Gov. Code §65352.3). Local governments should consult the Governor's Office of Planning and Research's "Tribal Consultation Guidelines," which can be found online at: https://www.opr.ca.gov/docs/09_14_05_Updated_Guidelines_922.pdf.

Some of SB 18's provisions include:

1. Tribal Consultation: If a local government considers a proposal to adopt or amend a general plan or a specific plan, or to designate open space it is required to contact the appropriate tribes identified by the NAHC by requesting a "Tribal Consultation List." If a tribe, once contacted, requests consultation the local government must consult with the tribe on the plan proposal. **A tribe has 90 days from the date of receipt of notification to request consultation unless a shorter timeframe has been agreed to by the tribe.** (Gov. Code §65352.3 (a)(2)).
2. No Statutory Time Limit on SB 18 Tribal Consultation. There is no statutory time limit on SB 18 tribal consultation.
3. Confidentiality: Consistent with the guidelines developed and adopted by the Office of Planning and Research pursuant to Gov. Code §65040.2, the city or county shall protect the confidentiality of the information concerning the specific identity, location, character, and use of places, features and objects described in Public Resources Code §5097.9 and §5097.993 that are within the city's or county's jurisdiction. (Gov. Code §65352.3 (b)).
4. Conclusion of SB 18 Tribal Consultation: Consultation should be concluded at the point in which:
  a. The parties to the consultation come to a mutual agreement concerning the appropriate measures for preservation or mitigation; or
  b. Either the local government or the tribe, acting in good faith and after reasonable effort, concludes that mutual agreement cannot be reached concerning the appropriate measures of preservation or mitigation. (Tribal Consultation Guidelines, Governor's Office of Planning and Research (2005) at p. 18).

Agencies should be aware that neither AB 52 nor SB 18 precludes agencies from initiating tribal consultation with tribes that are traditionally and culturally affiliated with their jurisdictions before the timeframes provided in AB 52 and SB 18. For that reason, we urge you to continue to request Native American Tribal Contact Lists and "Sacred Lands File" searches from the NAHC. The request forms can be found online at: http://nahc.ca.gov/resources/forms/.

NAHC Recommendations for Cultural Resources Assessments

To adequately assess the existence and significance of tribal cultural resources and plan for avoidance, preservation in place, or barring both, mitigation of project-related impacts to tribal cultural resources, the NAHC recommends the following actions:

1. Contact the appropriate regional California Historical Research Information System (CHRIS) Center (https://ohp.parks.ca.gov/?page_id=30331) for an archaeological records search. The records search will determine:
  a. If part or all of the APE has been previously surveyed for cultural resources.
  b. If any known cultural resources have already been recorded on or adjacent to the APE.
  c. If the probability is low, moderate, or high that cultural resources are located in the APE.
  d. If a survey is required to determine whether previously unrecorded cultural resources are present.

2. If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  a. The final report containing site forms, site significance, and mitigation measures should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum and not be made available for public disclosure.
  b. The final written report should be submitted within 3 months after work has been completed to the appropriate regional CHRIS center.

3. Contact the NAHC for:

a. A Sacred Lands File search. Remember that tribes do not always record their sacred sites in the Sacred Lands File, nor are they required to do so. A Sacred Lands File search is not a substitute for consultation with tribes that are traditionally and culturally affiliated with the geographic area of the project's APE.

b. A Native American Tribal Consultation List of appropriate tribes for consultation concerning the project site and to assist in planning for avoidance, preservation in place, or, failing both, mitigation measures.

4. Remember that the lack of surface evidence of archaeological resources (including tribal cultural resources) does not preclude their subsurface existence.

a. Lead agencies should include in their mitigation and monitoring reporting program plan provisions for the identification and evaluation of inadvertently discovered archaeological resources per Cal. Code Regs., tit. 14, §15064.5(f) (CEQA Guidelines §15064.5(f)). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American with knowledge of cultural resources should monitor all ground-disturbing activities.

b. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the disposition of recovered cultural items that are not burial associated in consultation with culturally affiliated Native Americans.

c. Lead agencies should include in their mitigation and monitoring reporting program plans provisions for the treatment and disposition of inadvertently discovered Native American human remains. Health and Safety Code §7050.5, Public Resources Code §5097.98, and Cal. Code Regs., tit. 14, §15064.5, subdivisions (d) and (e) (CEQA Guidelines §15064.5, subds. (d) and (e)) address the processes to be followed in the event of an inadvertent discovery of any Native American human remains and associated grave goods in a location other than a dedicated cemetery.

If you have any questions or need additional information, please contact me at my email address: Cameron.Vela@nahc.ca.gov.

Sincerely,

Cameron Vela

Cameron Vela
Cultural Resources Analyst

cc: State Clearinghouse

From: outlook_C42CADA24ACFF4E4@outlook.com
To: Cannabis
Subject: cannibis
Date: Wednesday, February 22, 2023 2:40:44 PM

EXTERNAL

Does this mean there is no longer a restriction on square footage for growing cannabis? I pray this is not the case. Water is not plentiful. I'm doing what I can to limit water usage.

Thank You
Lisa Boyadjieff

Sent from Mail for Windows

From: Dominique Pfahl
To: Cannabis
Subject: Cannabis cultivation EIR
Date: Thursday, February 23, 2023 9:14:44 AM

EXTERNAL

To whom it may concern,
The biggest issue to affect our health, welfare, and way of life is Neighborhood Compatibility.
Commercial operations that have a high-value products are incompatible with our residential neighborhoods.
The recent increase in cannabis burglaries, weapons, and high-speed pursuits brings home this point.
The County should properly address Neighborhood Compatibility. I demand that the County Ordinance include Neighborhood separation criteria that ensure sufficient separation of a cannabis operation from a residential type neighborhood that, at a minimum, considers odor, groundwater, visual, safety (including crime, road access, and wildfire), and noise impacts.
Setbacks of 1000 ft. and 20-acre minimum parcel size should be studied and required.
Respectfully,
Dominique Pfahl

From: Patrick Pfahl
To: Cannabis
Subject: Cannabis in Sonoma County
Date: Thursday, February 23, 2023 9:10:44 AM

EXTERNAL

To whom it may concern,
The biggest issue to affect our health, welfare, and way of life is Neighborhood Compatibility.
Commercial operations that have a high-value products are incompatible with our residential neighborhoods.
The recent increase in cannabis burglaries, weapons, and high-speed pursuits brings home this point.
The County should properly address Neighborhood Compatibility. We demand that the County Ordinance include Neighborhood separation criteria that ensure sufficient separation of a cannabis operation from a residential type neighborhood that, at a minimum, considers odor, groundwater, visual, safety (including crime, road access, and wildfire), and noise impacts.
Setbacks of 1000 ft. and 20-acre minimum parcel size should be studied and required.
Respectfully,
Patrick Pfahl

From: Rachel Zierdt
To: Cannabis; Crystal Acker
Subject: Cannabis and tourism
Date: Monday, February 27, 2023 1:55:09 PM

EXTERNAL

Notes regarding cannabis effects on tourism:

Potential of adverse impacts such as odor and other nuisances from cannabis cultivation and processing

are acute for lodging facilities, resorts, wineries, restaurants....500 foot setback from private residences

and 1000 foot setback from certain schools may not suffice to avoid adverse odors and nuisance issues.

(pg. 8 in Napa report)

There is no significant data that tourists are attracted to a destination specifically because of the local

cannabis industry. (in Colorado tourists consume significant amounts of cannabis, but only 5% called

cannabis a motivation for their trip (2016 survey) (pg. 10 in Napa report)

Questions to ask....how many visitors did we host (2018 as an example)

How many are daytrippers? How many days did the average visitor spend? How much did they spend?

How many sites (like wineries) did they visit?

What do visitors value – in Napa its wine (47.8%), scenery (31.1%), atmosphere (16%)

Annual household income

How much did visitors spend, supporting how many jobs, generating how much in taxes.

Negatively impact by detracting form highly valued wineries, restaurants, outdoor dining, resort and

lodging facilities, scenery, atmosphere.

Odor impacts could detract from dining and outdoor activities at adjacent wineries

Visible cannabis operations could detract from scenic beauty, impairing visitor experience.

Cannabis related crime, odor, aesthetic could change the perceptionand attitudes about Sonoma

generate adverse media attention. This change cold induce affluent visitors to spend their vacation

money elsewhere.

Odor impacts have potential of impact resorts and lodging facilities affecting the TOT and other revenue.

How much did the county and each city derive in TOT funds.

Would new tourists come specifically to Sonoma County because of cannatourism?

Multiple cannabis tours per day (unlike that of visiting 3.7 wineries per day) is limited by the potency of

cannabis products so its unlikely that visitors could sample cannabis products at 3.7 facilities as they do

with wineries. (pg. 15)

There is no cannabis equivalent of a winery's tasting room and it is unclear what form cannabis tourism

will take.

Legislation and decriminalization of commercial cannabis businesses has not reduced crime and ample

evidence that the illegal market persists despite legalization. 2018

Regards,

Rachel zierdt

From: Vivien Hoyt
To: Cannabis
Subject: Cannabis
Date: Tuesday, February 21, 2023 2:29:42 PM

EXTERNAL

Dear Sir/Madam,

I'm a big advocate for another dispensary in Sonoma. This healing medicine saved me during my chemotherapy and afterwards. Please allow another dispensary in Sonoma. Thank you.

Best regards,
Vivien Hoyt

From:	Rachel Zierdt
To:	Cannabis; Crystal Acker
Subject:	Here is the link.
Date:	Monday, February 27, 2023 4:56:15 PM

EXTERNAL

https://www.winebusiness.com/content/file/9111_Report_082019.pdf

From: Charlene Stone
To: Crystal Acker; Cannabis
Subject: Cannabis update program/scoping/Hydrology and Water Quality
Date: Wednesday, March 1, 2023 2:02:45 PM

EXTERNAL

3/1/2023

Crystal Acker, Supervising Planner crystal.acker@sonoma-county.org

cannabis@sonoma-county.org

Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR

Hydrology and Water Quality

Scientifically analyze with accompanying data the following:

<!--[if !supportLists]-->1. <!--[endif]-->Water consumption of one acre of outdoor cannabis for one or more harvests per year

<!--[if !supportLists]-->2. <!--[endif]-->Water consumption of one acre of mixed light cannabis cultivation for one or more harvests per year

<!--[if !supportLists]-->3. <!--[endif]-->Water consumption of one acre of greenhouse cultivation for one or more harvests per year

<!--[if !supportLists]-->4. <!--[endif]-->Water consumption of one acre of indoor cultivation for one or more harvests per year

<!--[if !supportLists]-->5. <!--[endif]--> Water consumption per each variety of plant per day.

Identify existing and projected water consumption by all current and reasonably foreseeable future users. Calculate total water resources available to current and future users during dry, flood and historically normal years. Indicate the number and percentage of current growers signed up for disaster relief indicating lack of water in the recent drought cycle. Calculate the amount of acre feet of feet not being consumed currently or projected to potentially be consumed in the future while still protecting the residents, the environment including the public trust review areas (PTRA). Provide a figure available for cannabis cultivation. Convert that figure into amount of acreage of outdoor, mixed light, greenhouse and indoor combinations desirable.

After establishing standard guidelines for water usage per square foot by different types of cultivation and clarifying how these standard guidelines vary in drought conditions, scientifically establish the “minimum” amount when evaluating individual projects and the cumulative impacts. Answer the question: How much water truly exists to be divided with fluctuations exacerbated by climate change. The current guidelines allow the individual applicant to make their own assessment of water use. Scientifically evaluate that method for accuracy.

Thank you for your consideration, Charlene Stone, Santa Rosa, CA

From: marthacopeland@comcast.net
To: Cannabis
Subject: Cannabis meeting -
Date: Thursday, March 2, 2023 11:17:44 AM

As a resident – and one directly by a large parcel – are you even hearing from residents, seniors, and people with health issues – or is this already determined? I am genuinely afraid of the consequences, both of breathing the stank for 10 months a year – and the public outcry to opposing it.

Where are you all in the process, and am I outnumbered 1000 to one, and therefore completely disregarded? Just be honest with me. It's my life, and I live here. Thank you.

(me: about 30 neighbors are in close proximity, mostly seniors, and some with young children. Pick parcels for cannabis with at least 3,000 feet between the boundaries of the grow, and equipment, - and the neighbors. Pick parcels that won't deplete our water in our wells. Pick parcels that have a neutral impact on the surrounding area. Why do the neighbors have to suffer the impact of stank, herbicides, noise, 24/7 farming? We know you won't enforce anything you promise. Prove us wrong. Please don't put in rules you will ignore. Play fair with us. Let us trust you.

From:	Becky Bass
To:	Cannabis
Cc:	Becky Bass
Subject:	Comments on the NOP for the comprehensive cannabis program update
Date:	Friday, March 3, 2023 5:05:08 PM
Attachments:	comments on NOP comprehensive cannabis program update March 3, 2023.docx

EXTERNAL

Dear PRMD Cannabis Program staff,

Attached please find my comments pertaining to the NOP for the EIR for the comprehensive cannabis program update.

Thanks,

Rebecca Bass
2810 Bardy Road
Santa Rosa, CA 95404

March 3, 2023

Permit and Resource Management Department of Sonoma County,

Here are some thoughts I wish to share after reading the NOP for the comprehensive cannabis program update.

It is somewhat alarming to see among your stated goals the *expansion* of cannabis land uses within unincorporated Sonoma County, and the *streamlining* of the permitting process, when so many residents have voiced concern that they and their environment have not been adequately protected by the existing ordinance. Maybe more neutral language could have been used to describe these goals (e.g. determining *appropriate* or *compatible* cannabis land use, *improving efficiency* of the permitting process, etc.)? However, it is relieving to see that enhancing neighborhood compatibility and environmental protections are also on the list!

The scope of the potential impacts to be studied seems very thorough to me, and I'm especially pleased to see that *cumulative* effects will be considered. Will defining a maximum allowable density of projects per land use category or area be included in this?

My biggest concern regards the <u>sampling techniques</u> for the EIR – from what locations will data be collected? Sampling from roadways alone is inadequate – it does not capture the true impact to homeowners on their properties. For example, in my neighborhood of Bennett Ridge, sampling visual or odor impacts from Bardy Road would greatly underestimate the visual and odor impacts on parcels that overlook Bennett Valley – the view and smell from our building sites is very different than from along the roadway. How can the data collection be made transparent so that we will know that the impacts on us have been accurately measured?

With regards to the determination of criteria for "Rural Neighborhood Enclaves" and "Exclusion Zones", will local population desires be taken into account? My friends in various Colorado communities have had the opportunity to weigh in via ballot measure regarding whether or not their areas would allow cannabis cultivation and/or sales (e.g. Manitou Springs allows, Monument does not, etc. as determined by the local population voting in favor or against).

Thanks for your consideration of my input,

Rebecca Bass
2810 Bardy Road
Santa Rosa, CA 95404

From:	Richard R. Rudnansky
To:	Cannabis; crystal.aker@sonoma-county.org
Cc:	Susan Gorin; David Rabbitt; Chris Coursey; Lynda Hopkins; district4; Crystal Acker
Subject:	Comment on Notice of Preparation of EIR re Cannabis / Scoping Meeting of March 8, 2023
Date:	Sunday, March 5, 2023 1:45:31 PM
Attachments:	BRCA Pettition.pdf

EXTERNAL

Crystal

Although it is inconceivable to me that the Board, with or without an EIR, would allow ***any type*** of commercial cannabis cultivation in the Bennett Ridge neighborhood (which is in a Rural Residential Zoning District and included in the Bennett Valley Area Plan), in an abundance of caution I am providing these comments.

As you are undoubtedly aware, the current Cannabis Ordinance restricts any type of commercial cultivation in the Rural Residential Zoning District (RR District) I urge that this prohibition continue and that it be made clear from the beginning of this process that the RR districts are off limits to ***any*** type of commercial cannabis cultivation.

Short of that, I ask that the following residential neighborhood be designated as an Exclusion Zone: **Bennett Ridge Neighborhood consisting of properties located on Old Bennett Ridge Road, Bardy Road, Rollo Road, and Bennett Ridge Road.**

Also, analyze neighborhood areas and designate all neighborhood areas as exclusion zones where any residential neighborhood meets any one of the following criteria:

(1) residential neighborhoods that relies on a mutual water system

(2) residential neighborhoods and areas in the Rural Residential Zoning District where any parcel is less than 10 acres

(3) neighborhoods and areas whose CC&Rs are inconsistent with or do not allow cannabis cultivation

(4) areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.

(5) areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought.

(6) areas that are in a high fire or very high severity zone designated by any competent authority such as the Board of Forestry, Sonoma County Community Wildfire Protection Plan, or the Public Utilities Commission.

(7) areas where commercial cannabis activity is detrimental to the residential character of a neighborhood.

(8) areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together.

(9) areas in traditional agriculture-zoned area’s that are now primarily residential in nature. • Areas where the scenic vistas or character are to be preserved.

(10) areas where law enforcement is inadequate because average response times are more than 20 minutes.

(11) areas where there is strong local resistance to commercial cannabis activity.

(12) areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

For your information I have attached a petition from the Board of Directors of the Bennett Ridge Community Association that has previously been provided.

Thank you for your attention.

Richard R. Rudnansky

Bennett Ridge Resident

Subject	**No to Commercial Cannibis Cultivation on Bennett Ridge**
From	Kent Dellinger <kdell58@hotmail.com>
To	Susan.Gorin@sonoma-county.org <Susan.Gorin@sonoma-county.org>, David.rabbitt@sonoma-county.org <David.rabbitt@sonoma-county.org>, Chris.coursey@sonoma-county.org <Chris.coursey@sonoma-county.org>, district4@sonoma-county.org <district4@sonoma-county.org>, Lynda.hopkins@sonoma-county-org <Lynda.hopkins@sonoma-county-org>, marcie.woychik@sonoma-county.org <marcie.woychik@sonoma-county.org>, cannabis@sonoma-county.org <cannabis@sonoma-county.org>
Date	2021-10-07 14:44

The Bennett Ridge Community Association (BRCA) strongly opposes any action and legislation by the Board of Supervisors to allow any commercial cannabis cultivation in the Bennett Ridge neighborhood and adjacent properties in Bennett Valley.

The BRCA is a not-for profit organization that works to maintain the quality of life on Bennett Ridge. Bennett Ridge is a residential neighborhood consisting of 136 homes and properties on Old Bennett Ridge Road, Bardy Road, Rollo Road, and Bennett Ridge Road. Bennett Ridge is a true neighborhood in every sense of the word. We have residents of all ages including young children. Commercial Cannabis Cultivation simply is not appropriate in or compatible with our neighborhood and would have significant adverse impacts on resources and our quality of life for a number of reasons including, but not limited to:
(1) Visual and Aesthetics: the configuration, size and topography of lots results in homes being in close proximity to neighboring lots and other residences and therefore cannabis structures and any attendant lighting would be in violation of the Bennett Ridge Architectural Review Committee guidelines and would have significant visual and aesthetic impacts on residents.
(2) Water: our water is from a mutual water company with two wells for the entire neighborhood. Any non-residential use and pesticides would have a significant impact on the quantity and quality of our residential water supply
(3) Odor: given the configuration and the proximity of lots and homes if commercial cannabis cultivation with its odor was allowed in the Bennet Ridge neighborhood it would adversely impact the quality of our life and the enjoyment of our properties.
(4) Zoning, Area Plan, CC&Rs: would be contrary to the purpose of the Rural Residential zoning district, the Bennett Ridge CC&Rs and the Bennett Valley Area Plan of which the Ridge is a part. Further, the Bennett Ridge CC&Rs prohibit conducting any type of business in the neighborhood.
(5) Safety: Bennett Ridge (a) has only one narrow and winding road in and out (b) is in a high fire risk area (c) abuts Annadel State Park with hiking trails open to the public in close proximity to homes (d) has a Sheriff response time of over 30 minutes

We invite any member of the Board of Supervisors to visit the Bennett Ridge neighborhood to see for yourself how clearly incompatible commercial cannabis cultivation is with our neighborhood.

Therefore the BRCA, on behalf of the Bennett Ridge residents, strongly urge the Board of Supervisors prohibit commercial cannabis cultivation on Bennett Ridge either by prohibiting such activity in the Rural Residential Zoning Districts, placing an Exclusion Combining District on the Ridge, or by any other legislative mechanism.

We ask that you include these comments in the official record for this issue.

Respectfully Submitted:
Bennett Ridge Community Association
Board members:
Les De La Briandais
Kent Dellinger
Marilee Jensen
George Mangan

Kathie Schmid
David Southwick, M.D.
George von Haunalter

From: Richard R. Rudnansky
To: Scott Orr; Crystal Acker; Marcie.Woyc; Cannabis
Subject: Fwd: Comment on Notice of Preparation of EIR re Cannabis / Scoping Meeting of March 8, 2023
Date: Sunday, March 5, 2023 2:05:09 PM
Attachments: BRCA Pettition.pdf

EXTERNAL

Please include the email below and attachment as part of the record for the Notice of Preparation Scoping meeting of March 8, 2023

Thank you.

Richard Rudnansky

-------- Original Message --------

Subject: Comment on Notice of Preparation of EIR re Cannabis / Scoping Meeting of March 8, 2023
Date: 2023-03-05 13:43
From: "Richard R. Rudnansky" <rrudnansky@sonic.net>
To: cannabis@sonoma-county.org, crystal.aker@sonoma-county.org
Cc: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, District4 <District4@sonoma-county.org>, Crystal Acker <crystal.acker@sonoma-county.org>

Crystal

Although it is inconceivable to me that the Board, with or without an EIR, would allow ***any type*** of commercial cannabis cultivation in the Bennett Ridge neighborhood (which is in a Rural Residential Zoning District and included in the Bennett Valley Area Plan), in an abundance of caution I am providing these comments.

As you are undoubtedly aware, the current Cannabis Ordinance restricts any type of commercial cultivation in the Rural Residential Zoning District (RR District) I urge that this prohibition continue and that it be made clear from the beginning of this process that the RR districts are off limits to ***any*** type of commercial cannabis cultivation.

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than 10 acres

(3) neighborhoods and areas whose CC&Rs are inconsistent with or do not allow cannabis cultivation

(4) areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.

(5) areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought.

(6) areas that are in a high fire or very high severity zone designated by any competent authority such as the Board of Forestry, Sonoma County Community Wildfire Protection Plan, or the Public Utilities Commission.

(7) areas where commercial cannabis activity is detrimental to the residential character of a neighborhood.

(8) areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together.

(9) areas in traditional agriculture-zoned area's that are now primarily residential in nature. • Areas where the scenic vistas or character are to be preserved.

(10) areas where law enforcement is inadequate because average response times are more than 20 minutes.

(11) areas where there is strong local resistance to commercial cannabis activity.

(12) areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

For your information I have attached a petition from the Board of Directors of the Bennett Ridge Community Association that has previously been provided.

Thank you for your attention.

Richard R. Rudnansky

Bennett Ridge Resident

From:	Cal Lewis
To:	Cannabis
Cc:	Susan Gorin; district4
Subject:	So Co Comprehensive Cannabis Program
Date:	Monday, March 6, 2023 6:33:38 PM

EXTERNAL

I have read through the 2/6/2023 NOP & Program EIR Public Scoping Document published in that day's Press Democrat. I have questions below which pertain to the need for thoroughness in the EIR to address all impacts of multiple commercial grow operations on Rural Residential zoned parcels within the County. A bit of background - we have lived just off Wilshire Drive in the Riebli Valley for almost 37 years on a 1 acre parcel. We have a well and septic/leach field system. Our parcel is in a R-R Zone, 5 AC min per house. The only commercial agricultural activity I am aware of in "our" valley is grape growing.

#1: It is my understanding the County had stopped drilling of new wells within its jurisdiction, and we are constantly requested to conserve our use of water. Yet, the County is still actively seeking and funding new housing over the next several years. In addition, it appears now the County is actively endorsing commercial cannabis grow facilities on R-R zoned parcels which require significant water use demands on the local (and undefinable) aquifers. To my knowledge, even ground water experts cannot determine the boundaries or quantities of an aquifer or from where it's water comes from.

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#5 Additional vehicular traffic on rural roads

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#7 How will hazardous materials be controlled?

#8 How will the County monitor each operation? Or, will it take complaints to get code enforcement personnel to come out to inspect?

#9 How does the County reconcile multiple structures being permitted on an R-R, 5 AC zoned parcel when I can only build one house and one ADU (if I choose to)?

I'm sure many more questions addressing other aspects of getting this EIR completed have been and will be raised at the upcoming and subsequent hearing.

Thank you for the opportunity to participate in these discussions.

Cal Lewis
(707)528-9617
Sent from my iPad

From:	Dodesr
To:	Crystal Acker
Cc:	leonaj@sonic.net
Subject:	Comments from the League of Women Voters
Date:	Monday, March 6, 2023 9:34:24 AM
Attachments:	LWV CANNABIS EIR.docx

EXTERNAL

Please see attached letter

Donna Roper

LEAGUE OF WOMEN VOTERS® OF SONOMA COUNTY

Crystal Acker, Supervising Planner crystal.acker@sonoma-county.org
cannabis@sonoma-county.org

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR 3/23

The League of Women Voters of Sonoma County is in receipt of the Notice of Preparation (NOP) for the Sonoma County Comprehensive Cannabis Program Update.

We support the cannabis environmental Impact report (EIR) water element: researching, evaluating and identifying the existing hydrologic setting and add the following criteria for clarity. A clearly defined baseline is critical in order to measure future environmental impacts.

Criteria to establish a baseline analysis shall consider:

1. all cannabis permits already issued, all operators growing without a permit in the Penalty Relief Program, and all pending and reasonably foreseeable future permits.
2. other residential, police protection, fire protection and agricultural users in the unincorporated areas. Assess their present and future needs.
3. evaluation of all constraints on our water supply by all users in the County, including everyone the Sonoma County Water Agency (SCWA) sells water to including users in Marin County. Include all users with any water rights so they can be evaluated as a draw on our overall water "system".
4. identify areas where public water and sewer, storm water drainage etc. are located.
5. review all sources and uses of water, comply with the Sustainable Groundwater Management Act to ensure future sustainability including but not limited to public trust resources.
6. identify the half dozen impaired and critical watersheds. Assess impacts of cultivation in these areas.

7. identify areas where the construction of catchment ponds will affect replenishment and the future health of the underlying aquifers and downstream flows.
8. conduct an analysis of drought year water availability in areas considered for cultivation. A drought year benchmark analysis is an important factor combined with projections of current and future water needs for all users county-wide.
9. accurately reach a data supported conclusion about how much total water is available and how much can be used for cannabis cultivation in the unincorporated areas. Identify and map the areas and assess how much suitable land can be projected as reasonably necessary to meet current and future demand (20 years for a General Plan).
10. identify and map potential areas that **have the least negative** impact where cannabis can be grown and present these areas to the public.

Donna Roper-President
Leona Judson- Chair of Advocacy
League of Women Voters of Sonoma County

555 Fifth Street
Suite 300 O
Santa Rosa, CA 95401
Lwvsonoma.org

From: Ellen McKnight
To: Cannabis
Subject: Glen Ellen should be in a cannabis exclusion zone
Date: Monday, March 6, 2023 8:37:08 AM

EXTERNAL

I have at least one close neighbor to me on Hill Rd in Glen Ellen who has had an un-permitted cannabis grow for many years and it has been a nightmare!
I strongly recommend making Glen Ellen, especially Hill Rd, an exclusion zone!

From: Hessel Farmers Grange
To: Cannabis; Tennis Wick; McCall Miller; Andrew Smith; Crystal Acker; BOS
Cc: Executives
Subject: Comments on EIR Scoping Session
Date: Monday, March 6, 2023 12:24:41 PM
Attachments: EIR Feb 2023.docx.pdf

EXTERNAL

Hello, Supervisors and County Staff,

Please find Hessel Farmers Grange's comments on the EIR scoping session and the items we believe need to be discussed and assessed to create a functional and economically beneficial Cannabis ordinance in Sonoma County.

Thank you for your time and inclusion of these comments.

Sincerely,

Hessel Farmers Grange Membership

Sam De La Paz Vice President, Hessel Farmers Grange

707.827.3045 | 707.354.3884 | VP@hesselfarmersgrange.com

5400 Blank Rd
Sebastopol Ca, 95472
www.hesselfarmersgrange.com

Click to schedule a meeting

2550 Ventura Ave
Santa Rosa, CA 95403
Sent via email:

Cannabis@sonoma-county.org

bos@sonoma-county.org

Crystal.Acker@sonoma-county.org

tennis.Wick@sonoma-county.org

mccall.miller@sonoma-county.org

andrew.smith@sonoma-county.org

March 6th, 2023

Dear Sonoma County Board of Supervisors,

We are writing as representatives of the Hessel Farmer's Grange and the California State Grange; California's oldest agricultural organization, established in 1874 and currently representing over 5,000 members.

Hessel Farmer's Grange has been an integral part in shaping the cannabis program here in Sonoma County. After our devastating loss with Chapter 38 being voted down, and the use of this environmental study as a stalling tactic by the anti-cannabis minority, our local cannabis industry is in shambles. This is too little, too late for most of our small farmers. We would like to see this programmatic study address ways to reinvigorate the small farming community, as well as allow larger cultivation so we can compete with other local jurisdictions. We propose you study the following areas:

- Parity in treatment to other agricultural and commercial ag uses - Treat cannabis like an agricultural crop:
    - Centralized and on-site processing.

    - Revisit need for ADA uses on private farms (not open to the public for events or sales).
    - Allow for production agriculture/increase sq footage.
- Direct to consumer sales:
    - Farmer's markets.
    - Farm stands.
    - Allow farms to be open to the public (if they choose) and have on-site sales and consumption.
    - On site consumption and tasting rooms.
- Specific rules for nurseries:
    - More canopy allowance.
    - Propagation does not count towards square footage.
    - Direct personal use plant and seed sales being open to the public.
- Cannabis tourism - educational /recreational farm tours, overnight events, destinations, pairings, wine and weed events:
    - On site Cannabis tastings and events.
- Revisit the way in which the Cannabis Program interacts with Native Tribes, and Native Tribe feedback for ministerial permits.
- Making the processing quicker and more streamlined and cost effective.
- Add back AR and RR zoning for small farms.
- No more landscaping screening or fencing of cannabis plants.
- No carbon filters.
- Allow water hauling.
- We want generators for backup power without a declared emergency.
- Stop-work letters must have arbitration first/no misdemeanors.
- Allow self transportation.
- Allow self distribution.
- Cannabis permits run with the land.
- Divide the allowed county-wide canopy into percentages of specific use:
    - A percent of Sonoma county's canopy must go to legacy/equity farmers. Pioneers are getting stamped out (50%).
    - A percentage of Sonoma County expansion goes to small, regenerative farms (25%).
    - A percentage of Sonoma County can go to bigger canopy/medium scale farms. (25%).
- Allow growing other crops and crop rotation.
- Allow fallowing of sq. footage for health of soil.
- Align license types with the state.

- Allow use for existing greenhouses to exceed the current 10,000 sq. ft. limit and use indoor setbacks.
- Allow up to 10% of the property to be used for cannabis canopy.
- Allow Nursery stock that is not counted towards square footage.

Below are additional items we want to see added to the next round of the Cannabis Ordinance:

- Parity in treatment to other agricultural and commercial ag uses.
- Better relations with licensees and code enforcement. No code inspections with routine ag / farm inspections. Code enforcement visits should be complaint-based only.
- Allow cannabis for Williamson Act contracted income and agricultural use.
- Fee forgiveness for operators who were stuck in the Penalty Relief Program or early applicants who were guinea pigs for Permit Sonoma.
- Taxes based on gross receipts and not square footage to live-adjust to market value.
- Supporting farmers through increased suicide prevention programs.
- Incentivize water catchment.
- Incentivize regenerative agriculture.

Sincerely,

Vince Scholten, President - Hessel Farmers Grange/Vice President - California State Grange

Hessel Grange Hemp and Cannabis Committee

Hessel Farmers Grange Membership

From: Joe Rogoway
To: Cannabis
Subject: Letter to the Sonoma County Board of Supervisors Providing Comment to the Program EIR Scope
Date: Monday, March 6, 2023 9:28:11 AM
Attachments: 20230306 Letter to the Sonoma County Board of Supervisors Providing Comment to EIR Scope and Draft Ordinance.pdf

EXTERNAL

Dear Crystal,
Please find the enclosed letter with respect to the above referenced matter.
Regards,
Joe

--

JOE ROGOWAY
Managing Partner, Rogoway Law Group, P.C.

A 115 4th St., Second Flr, Ste. B |
Santa Rosa, CA 95401
P (707) 526-0420

E joerogoway@rogowaylaw.com
W www.rogowaylaw.com

LA | SF | SR | PDX

ROGOWAY

March 6, 2023

VIA EMAIL ONLY

To the Sonoma County Board of Supervisors
c/o Crystal Acker, Supervising Planner
County of Sonoma
2550 Ventura Avenue
Santa Rosa, California 95403
cannabis@sonoma-county.org

Re: Comments on the Scope and Contents of the Sonoma County Cannabis Program EIR

On February 6, 2023, The County of Sonoma ("County") issued a Notice of Preparation and Program EIR Public Scoping Meeting to the State Clearinghouse, responsible and trustee agencies, and interested parties and organizations as part of the "Sonoma County Comprehensive Cannabis Program Update" ("NOP").

In the NOP, the County stated that a "Program Environmental Impact Report (EIR) will be necessary to evaluate the potential physical environmental impacts of the Cannabis Program Update pursuant to the California Environmental Quality Act (CEQA)". Through the NOP, the County has requested comments from, amongst others, interested parties, in accordance with the statutes and regulations pertaining to CEQA.

I am submitting the comments contained herein in response to this County's request for comments to the NOP.

Project Background:
The County's first municipal cannabis ordinance (Ord. No. 5715) which was adopted on March 20, 2007, and later amended on February 7, 2012, was limited in scope and only imposed a cap of nine (9) medical cannabis dispensaries in the unincorporated County. On December 20, 2016, following the enactment of Proposition 64, the *Medicinal and Adult Use Cannabis Regulation and Safety Act of 2016* ("*MAUCRSA*"), the County adopted its first comprehensive Cannabis Land Use Ordinance (Ord. No. 6189) under a negative declaration which was later amended in 2018.

The County currently regulates commercial cannabis land uses in the unincorporated areas of the County under Zoning Code Sections 26-88-250 through 26-88-256. These current County regulations purport to contain allowable cannabis uses and permit requirements by zoning district that include development criteria and operating standards for commercial cannabis activities.

On June 9, 2021, the Board of Supervisors directed the County to complete a comprehensive update of the cannabis program and prepare an EIR in compliance with CEQA. On March 15, 2022, the Board adopted a Cannabis Program Update Framework to guide the development of the project description, CEQA alternatives, and draft ordinance.

Nearly one year later, on March 8, 2023, the County is scheduled discuss the scope of the program EIR.

<u>County Program's Devastating Impact to Local Cannabis Businesses:</u>
The detrimental impact of the County's cannabis program to commercial cannabis businesses operating within the unincorporated areas of County cannot be overstated. The unequivocal failure of the County's cannabis program to effectively regulate cannabis businesses has caused most local cannabis businesses to fail, which has, in turn, led to the collapse of the once vibrant local industry that existed for decades prior to the County's enactment of its land use ordinance in 2016.

The numbers are clear. Out of the estimated approximately 10,000 cannabis cultivators that the County believed to be operating within the County[1] prior to the enactment of *MAUCRSA*, only 31 annual cultivation licenses have been issued by the Department of Cannabis Control[2] ("DCC") to Sonoma County cultivators[3]. This means that only 0.003% of the cultivators estimated by the County to have operated within the County prior to 2016 have been able to obtain annual cultivation licenses as of the date of this letter.

Moreover, the County has failed to modernize its ordinance and failed to allow for the scope of activities allowed by *MAUCRSA*. This is exemplified by the County's continued and arbitrary limitation of only 9 retail cannabis businesses within the unincorporated areas of the County, none of which are allowed to offer on-site consumption of cannabis. This 2007 era policy is particularly onerous because it limits consumer accessibility to the legal market and limits the legal market's accessibility to consumers. The County has evidently decided to disregard the event of California's legalization of cannabis when it comes to perhaps the most crucial element of the legal supply chain, retail sales, and has instead has chosen to leave in place bad policy which was first enacted 15 years ago (or 10 years prior to legalization).

Since 2017, rather than enacting an effective permitting system to meaningfully implement *MAUCRSA*, the County has instead fashioned an unworkable and Kafkaesque process which has been primarily used as a vehicle to punish, through overzealous code enforcement practices, local businesses seeking to participate in the County's program rather than enabling local cannabis businesses to succeed. Further, dozens, if not hundreds, of local cannabis businesses languished in the conditional use permit application process while the County's planning department failed to progress applications, suffered from extensive staff turnover which substantially delayed applications, subjected applicants to "reinterpretation" of the County's land use ordinance, or otherwise added expensive and unnecessary hurdles required for the application to be deemed "complete" which set the respective applicants back indefinitely.

Meanwhile, as local cannabis business applicants were given the Chutes and Ladders treatment by Permit Sonoma, the County acquiesced to the most fringe ideological opponents of legal cannabis in our community who have pursued, and continue to pursue, a maximalist strategy of opposing all efforts to amend the ordinance, threaten the County and local businesses with litigation, and

[1] See County's Negative Declaration referenced herein.
[2] According to the DCC's website.
[3] This number may actually be lower as it is unclear whether the DCC reporting includes licenses issued in incorporated cities.

opposed and appealed nearly all individual projects which come before the BZA and Board of Supervisors.

The local cannabis businesses, for their part, after years of futile attempts to engage in productive policy discussions with the County, have largely given up hope that the County will meaningfully implement *MAUCRSA*. Writ large, these businesses have left the County's regulated market and are no longer participants within the framework passed by the strong majority of Sonoma County voters. This is because the County has ignored the mandate of its own electorate, cowered to extreme ideological opponents of cannabis legalization, and entirely failed to effectively implement *MAUCRSA* at a local level.

Adding insult to injury, the County has refused to meaningfully include cannabis industry stakeholders in cannabis program policy discussions and instead relegated the people most knowledgeable on these issues, and the businesses most impacted by these policies, to the same status as any other constituent. The thought of the County taking a similar approach to regulating the wine industry without working closely with wine industry stakeholders is unfathomable.

Program EIR and Ordinance Scope:
This is the County's opportunity to make good on the promises made to cannabis industry businesses by Sonoma County voters in 2016. To do so, however, the County should scrap the entirety of the existing program and begin anew, with fresh policy ideas and a north star oriented towards the safe, effective, and complete implementation of *MAUCRSA*. This means that the County must leave its own echo-chamber and not add any new prohibitions, new limitations on land use, promulgate artificial caps on licenses types and ownership interests, or otherwise disallow any commercial cannabis conduct which is allowed under California law. There is simply no rational, current, justification for the County to prohibit or limit conduct which is not limited or prohibited by the same California law which was enacted, in part, by a strong majority Sonoma County voters.

Instead of taking a limited scope of the Program EIR and eventual ordinance amendments, the County should direct that the Program EIR to comprehensively evaluate all environmental impacts from all commercial cannabis activities allowed under California law through the following:

1. **Scope the EIR to evaluate the total environmental impact for all activities allowed under California state law.** This will provide the County the greatest number of options in drafting and implementing the later ordinance. This includes, not just evaluating the environmental impact of cultivation, but also the total environmental impact for retail, distribution, and manufacturing.
2. Include within the scope of the EIR, the co-siting of retail, with onsite consumption, as well as self-distribution facilities and manufacturing in agriculturally zoned lands so as to provide parity with similar wine-related activities for tasing and tours.
3. Include within the scope of the EIR removal of the County's limitations on cultivation such as the 1-acre cap for ownership interests, 10,000 sq. ft. limit on mixed light facilities, and include the ability to construct ag-exempt drying structure prior to the issuance of the permit.

4. Include within the scope of the EIR, the County adopting and maintaining parity with all California state definitions, including, but not limited to, the definitions of outdoor and mixed light cultivation.
5. Evaluate the environmental impact of the removal of the 9 retail permit limit and replace the antiquated numerical limitation model with reasonable rules based on principles of zoning and land use that would be on parity with businesses serving alcohol. This includes removal of unnecessary and onerous setback requirements. The ethos of the EIR, and later ordinance, should be that the County will allow for a wide range of cannabis retail businesses to operate in a manner that has parity with wine and beverage. This is allowed under California law, yet, currently, the County's ordinance prevents otherwise legal businesses from operating in the unincorporated areas of the County.

Once the EIR is complete, the County should enact an ordinance as follows:

1. Create a ministerial permitting regime parallel to the County's vineyard grading and drainage ordinance ("*VESCO*"). The County's *VESCO* ordinance has already survived CEQA challenge through the published opinion of *Sierra Club v. County of Sonoma* (2017) 11 Cal. App. 5th 11. The County should enact a parallel ordinance with respect to commercial cannabis activities once the Program EIR is complete.
2. Allow for all activities allowed by *MAUCRSA*. The County must abandon the philosophy that it should prohibit conduct which is otherwise allowed by state law. Doing so only imperils the viability of local businesses and of the County's program.
3. Allow for onsite consumption of cannabis pursuant to DCC license requirements pursuant to California state law. This is a crucial element related to tourism and general consumer participation in the regulated market.
4. Allow for retail, self-distribution, and manufacturing licenses to be co-sited on agriculturally zoned lands with cultivation licenses. This would allow for the cannabis equivalent of wine tasting at the winery overlooking the vineyard.
5. Remove all local cultivation and supply chain taxes and only tax cannabis locally through sales tax. This will treat cannabis commensurate with wine and beverage taxation policies and will insure business and program viability.
6. Do not enact any additional land use, zoning, or licensed facility location limitations. The County has already excessively prohibited and limited the location of cannabis businesses.
7. Adopt California's definitions as contained within the cannabis related statutes and regulations.

It is my hope that the County implements the items discussed above. I will not be able to attend the upcoming meeting on March 8, 2023, but I can make myself available to otherwise answer any questions, respond to any comments, or otherwise discuss the above with the County.

Regards,
Rogoway Law Group, P.C.

Joe Rogoway

Joe Rogoway, Esq.
Managing Partner

From:	mbenziger@aol.com
To:	Cannabis
Subject:	Farm Direct Sales
Date:	Monday, March 6, 2023 2:56:10 PM
Attachments:	DTC POT GLENTUCKY FAMILY FARM POT .pdf

EXTERNAL

Thank you for reading this and considering how much selling direct to our customers can help small farmers. mikebz

GLENTUCKY FAMILY FARM
SONOMA MOUNTAIN

To whom it may concern,
I am writing this letter to let you know as a small farmer how critical it is to be able to sell the cannabis we grow on site. The term is direct to consumer sales. As a small farmer when we were planning our business model back when cannabis was a medical crop we were able to get a decent price per pound, supply was somewhat in balance and we were able to squeak by financially. For once there was some light at the end of the tunnel. Then very soon after it went recreational the supply quickly grew out of balance with a major reason (not the only) being the small number of dispensaries open to the public.

This was double troubling to small independent growers because not only did dispensaries not need another gram of marijuana but many dispensaries also grew their own. In 2022 prices crashed. And on top of that many dispensaries had room for only a handful of independent growers, who were second in line after they sold and promoted their own stuff.

As we learned in the wine business direct sales did not compete against the dispensaries and hurt sales, but it actually help sales because now the consumer was educated about the small growers products and the industry in general and then sought them out on their next trip to the store, which are located closer to the public.

Direct Sales also had another positive impact on the wine industry and one I also see for cannabis in that it made the grower and producers open to the public more conscious about their practices and how their property was perceived by the public. In presenting themselves to the public they want to talk about and showoff their "best practices" and quality initiatives. I don't know a better way to encourage and keep producers responsible and environmentally sensitive.
Showcasing best practices and environmental stewardship is great marketing for all including Sonoma County.
It's hard to exaggerate how important this is to small farmers, we can barely squeak by selling vegetables at farmers markets and direct to the public, when cannabis became available to us it was a god-send. Very quickly that advantage disappeared as the market for cannabis

collapsed. Allowing us to meet our customers, and show and tell them personally about the effort that goes into farming will not only be great for the farmer it will be great for the reputation of Sonoma County and it’s agricultural heritage.

Thank you,
mike Benziger
Glentucky Family Farm
UPC17-0012

From:	McCall Miller
To:	Cannabis
Subject:	FW: So Co Comprehensive Cannabis Program
Date:	Tuesday, March 7, 2023 10:20:03 AM

McCall
707.565.7099

From: Susan Gorin <Susan.Gorin@sonoma-county.org>
Sent: Tuesday, March 7, 2023 10:17 AM
To: Cal Lewis <clewis1828@hotmail.com>
Cc: McCall Miller <McCall.Miller@sonoma-county.org>; Arielle Kubu-Jones <Arielle.Kubu-Jones@sonoma-county.org>
Subject: Re: So Co Comprehensive Cannabis Program

Thanks Cal for your comments and questions.

The well moratorium is temporary while the policy and technical committees work through the data and policy options on this issue.

But I will forward your comments and questions to those working on the EIR for consideration.

Susan Gorin | 1st District Sonoma County Supervisor
575 Administration Drive, Room 100A
Santa Rosa, CA. 95403
Office 707-565-2241 | Cell 707-321-2788

From: Cal Lewis <clewis1828@hotmail.com>
Sent: Monday, March 6, 2023 6:33 PM
To: Cannabis <Cannabis@sonoma-county.org>
Cc: Susan Gorin <Susan.Gorin@sonoma-county.org>; district4 <district4@sonoma-county.org>
Subject: So Co Comprehensive Cannabis Program

EXTERNAL

I have read through the 2/6/2023 NOP & Program EIR Public Scoping Document published in that day's Press Democrat. I have questions below which pertain to the need for thoroughness in the EIR to address all impacts of multiple commercial grow operations on Rural Residential zoned parcels within the County. A bit of background - we have lived just off Wilshire Drive in the Riebli Valley for almost 37 years on a 1 acre parcel. We have a well and septic/leach field system. Our parcel is in a R-R Zone, 5 AC min per house. The only commercial agricultural activity I am aware of in "our" valley is grape growing.

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I'm sure many more questions addressing other aspects of getting this EIR completed have been and will be raised at the upcoming and subsequent hearing.

Thank you for the opportunity to participate in these discussions.

Cal Lewis
(707)528-9617
Sent from my iPad

From: Gail
To: Cannabis
Subject: Cannabis EIR-Aesthetics & Safety
Date: Tuesday, March 7, 2023 11:04:17 AM

Please consider the following two issues for the EIR of the cannabis program, to meet the needs of neighboring residents the beauty of our countryside.

Aesthetics (fence requirement):
Due to the security fence requirement, the unsightly tall, plastic mesh fences (as seen in construction sites) are commonly used for screening cannabis plants. This type of fence creates a huge eyesore covering many acres of a parcel, and is not in character with other properties in rural neighborhoods. Traditional farms have fencing that allows scenic views and still keeps people out such as barbed wire, deer fencing, etc. We would prefer to see the cannabis plants growing rather than eight foot tall plastic screens.

We do not want to see those construction fences all over Sonoma County's beautiful countryside!

Safety (setbacks):
Because of your requirement for security fencing, screening and setbacks I am concerned about our safety since we live next door to a cannabis farm. Why is security fencing required? I assume because of potential criminal activity? The current setback is from residential *houses,* not the property line, which makes no sense as we use all of our property up to the property line. The required setback should be at least 300 feet from our *property lines.*

Additional, due to the high value of the crop and the security fence requirement, it is obvious cannabis cannot be treated as *traditional* agriculture.

Sincerely,
Gail Frederickson
Fulton, CA

From:	Alexa Wall
To:	Cannabis; BOS
Cc:	Susan Gorin; Arielle Kubu-Jones; David Rabbitt; Andrea Krout; Chris Coursey; Sean Hamlin; district4; Jenny Chamberlain; district5; Leo Chyi; Crystal Acker
Subject:	Public Scoping Comments - Cannabis EIR & Ordinance Update
Date:	Wednesday, March 8, 2023 9:28:14 AM

EXTERNAL

Dear Sonoma County Supervisors, County Officials, and Staff,

I hope this message finds you all well. I am writing as a current permitted and licensed cannabis operator in Sonoma County, and I want to express my deep concern regarding the extra restrictions imposed on my business, which no other ag businesses face. As a plant that grows in soil, cannabis should be treated as true agriculture in the county. I really hope this new ordinance update finally once and for all treats cannabis how we should be treated. While I appreciate the efforts being made through the EIR update to establish more fair regulations for the cannabis industry in Sonoma County, I cannot help but feel a bit jaded after years of waiting for real change. It's been a long and difficult road for the cannabis industry, and we've heard many promises of reform over the years that have yet to be fully realized. Nevertheless, I remain optimistic that this time around, the county will listen to our concerns and work to create policies that truly support and promote the cannabis industry as an important part of the local economy. I urge the county to seize this opportunity to make real progress and show that it is committed to supporting all agricultural businesses in the region, including cannabis.

One thing I must bring up is that I find it a bit baffling that the county has a comprehensive plan in place, the Agricultural Resources Element (ARE), that outlines the County's specific goals and objectives for preserving and promoting agriculture, yet cannabis is not included in this document. The goals outlined in the ARE are exactly what the cannabis industry is doing, from promoting a healthy and competitive agricultural industry to limiting the intrusion of new residential uses into agricultural areas and stabilizing ag uses at the urban fringe. We are helping the county achieve its objectives, yet we are not being treated as true agricultural businesses. It is a profound injustice to have a document that highlights all of the positive attributes of the agricultural industry and its goals for success, while turning a blind eye to the cannabis industry's significant contributions to the county's agricultural economy. This exclusion reeks of hypocrisy and a blatant disregard for the countless **decades** of hard work and dedication that the cannabis industry has put into growing, producing, and selling top-quality products for Sonoma County. If cannabis were considered a "crop" instead of an "agricultural product" and included in the main county crop report, it would be the third highest-valued crop in Sonoma County after wine grapes and dairy, with a total countywide value of $122,752,360.00 in 2021. This highlights the important contribution that the cannabis industry makes to the Sonoma County agricultural sector, and the incredible economic value of the industry is clear.

It's important to recognize that the cannabis industry doesn't just provide tax revenue to the county government, we are also contributing members of the local economy and society. We are your neighbors, we shop locally, and we spend our dollars within the communities. We are customers of local supply stores, hardware stores, garden stores, and many other local businesses. The county cannot afford to keep losing our dollars and our people. Young farmers who want to get into the industry are moving away due to the restrictions and limitations placed on the cannabis industry. This is not only extremely sad, but it's also a missed opportunity for the county to retain young, skilled professionals who are passionate about agriculture and want to make a positive contribution to the community.

Despite all this, and the fact that the cannabis industry faces some of the greatest environmental restrictions and regulations of any agricultural industry, we are still treated as if we are somehow different from other crops grown in the county. This is simply unfair and unjust. The county should recognize the significant contributions that the cannabis industry can make to the local economy and take steps to ensure that we are treated just like any other agricultural business in the area.

Additionally, the current local restrictions on our business are detrimental to our specific operations. We are only allowed to grow our own product, and we cannot process it on our farm. And by 'process' I mean using ice and water, that's it. Instead, we have to work with companies oftentimes outside of Sonoma County, causing the county to lose out on potential tax revenue. These limitations are hindering our ability to maximize profits, operate effectively and are causing us to miss out on potential business opportunities.

This is why it's so important that all areas of the cannabis industry, beyond just cultivation, are studied. It is imperative that the Cannabis Program Update & Environmental Impact Report (EIR) comprehensively evaluates all environmental impacts from **all** commercial cannabis activities allowed under California law. This will provide the county with the greatest number of options in drafting and implementing the later ordinance. Allowing for **all** activities allowed by MAUCRSA will help us thrive in a regulated market, which is what the voters of Sonoma County intended when they legalized cannabis in 2016. This means including things in the scope like manufacturing & processing on ag lands, retail on ag lands, consumption lounges, cannabis tourism, and more.

Sonoma County is already world-renowned for its exceptional wine and farm-to-table cuisine, making it a top destination for tourists from all over the world. But it's time for the county to recognize the potential of the cannabis industry and its potential for enhancing the region's tourism experiences. According to a recent survey, young people are drinking less alcohol and consuming more cannabis, which means that the cannabis industry has the potential to become an integral part of the county's tourism sector. By embracing the cannabis industry, the county can not only benefit from the economic growth that it brings but also provide visitors with a unique and diverse experience. The county has the opportunity to be at the forefront of cannabis tourism and showcase the best of what Sonoma County has to offer.

I implore the county to listen to our concerns and work towards creating an environment that allows cannabis businesses to thrive in Sonoma County. Let's make Sonoma County the premier destination for cannabis and wine tourism, let's treat cannabis like any other agricultural crop and let's have the EIR scoped as wide as possible. Thank you for your time and consideration.

Sincerely,
Alexa Wall

--

Alexa Wall, Owner
512.826.0462

www.lumacalifornia.com
Sonoma County Cannabis Farm

From:	concerned citizens
To:	Crystal Acker; Cannabis
Cc:	David Rabbitt; Andrea Krout
Subject:	Bloomfield Comments to NOP
Date:	Wednesday, March 8, 2023 8:45:16 AM
Attachments:	2023-BLOOMFIELD COMMENTS-Notice of Preparation 4.pdf

EXTERNAL

TO: Crystal Acker, Supervising Planner, crystal.acker@sonoma-county.org cannabis@sonoma-county.org

FROM: CCOBloomfield by Veva Edelsen and Vi Strain

DATE: March 8, 2023

BLOOMFIELD COMMENTS
ORGANIZED UNDER RELEVANT CEQA CATEGORIES
FOR
SONOMA COUNTY COMPREHENSIVE CANNABIS PROGRAM UPDATE
COMMENTS ON NOTICE OF PREPARATION FOR EIR

Goal: Limit cannabis cultivation and processing to areas that do not create noise and odor nuisances for residences, are not in public view, and are not in impaired watersheds, high fire risk zones or areas without fire safe roads. Permit cannabis processing on designated commercial and industrial zoned land.

Land Use Vision: Cannabis program Ordinances/ zoning code are based on the results of the full Programmatic Environmental Impact Report.

Proactive Environmental Review: Conduct a full Programmatic Environmental Impact Report, per State CEQA and CalCannabis requirements. (CalCannabis)

- Prepare two additional Project Description Alternatives to what is proposed in the NOP as follows: 1) to significantly reduce the size, type and scope of cannabis cultivation in Sonoma County. 2) the elimination of all cannabis cultivation in the County. To make an informed decision the County must look at the full range of options so the public and County can make informed decisions.
-
- Prepare accurate, stable and finite Project Descriptions defining all the activities and uses within the scope of the comprehensive cannabis permitting program and the alternatives with reduced cannabis cultivation and eliminating cannabis cultivation in the County.

In the Project Description, identify the number of existing permanent structures that can be converted to cannabis cultivation and the square footage. Identify the additional impact of cannabis grown in existing
Permanent structures and determine potential impacts. Include stacked shelving and increased number of grows per year. Identify the increased
potential cannabis above what would be allowed outdoors and identify issues and mitigations including but not limited to setbacks of existing building to other uses, ability to meet current building codes, subletting, additional traffic, noise, concentrated odors and all other CEQA requirements. Determine regulations on the total coverage of indoor and outdoor cultivation allowed on parcels with existing permanent structures.
Determine impacts and mitigation measures for or prohibition of reuse of existing buildings in the vicinity of residential neighborhoods and the impacts upon such neighborhoods such as increased traffic, noise, hours of operation, influx of seasonal employees resource use and discharge, storage of hazardous material, security fencing, sensor night lights concentration of cannabis in one location and other potential commercial/industrial impacts.

- Prepare a baseline document identifying all known cannabis cultivation and processing operations: PRP operations, existing cannabis permits and applications in process by square footage of cultivation, location, zoning code, and Groundwater Zone 1, 2, 3 or 4.
- Prepare an environmental setting document that fully addresses existing conditions, especially as related to public utilities, groundwater, and public safety services. Identify water availability and current water allocations based on historic records as well as a continued drought scenario, and define the capacity of fire and police services to address additional commercial development in high fire severity zones and areas lacking fire safe roads.

- Use technical analyses, siting criteria, setbacks and acreage caps to proactively identify the most suitable locations for cannabis cultivation.
- All findings, siting criteria, setbacks and mitigation measures are based on facts, reasonable assumptions predicated upon facts and expert opinion supported by facts.
- Complete cumulative impact assessment based on definition and analyses of the full development potential of all uses and activities within the cannabis cultivation and processing program.

Complete an assessment limiting areas allowing cannabis. Specifically consider eliminating the cultivation of cannabis in proximity to the residential neighborhoods identified through this CEQA process. Complete a project description and analysis that provides the information necessary to contrast the limiting of cannabis designations with the full development potential stated in the above paragraph and develop an alternative project description.

- Make project determinations based on the Mandatory Findings of Significance, which protects adjacent property owner's rights to health, safety and the peaceful enjoyment of their properties.

In addition to CEQA, ensure compliance of applications with California state regulations, including:

- Prop 64: CalCannabis regulations implemented by the CA Department of Food and Agriculture, which requires site-specific CEQA evaluation for each project prior to permitting and cumulative impact analyses;
- Fire Safe Roads, evacuation and public safety requirements as implemented by the Board of Forestry
- Water availability, water demand, wastewater disposal and water quality protections as regulated by the State Water Resources Control Board and the Department of Water Resources
- Setbacks and protections for biotic resources, riparian habitats and special status species as regulated by the CA Department of Fish and Wildlife.

Conditional Use Permit Ordinance: After the EIR defines fact-based siting criteria, and in alignment with clearly identified State permit requirements, including project-specific environmental review, determine areas suitable for cannabis operations based on evaluation of:

- water availability, including groundwater impacts,
- proximity to sensitive receptors: residential homes, schools/children, parks/recreation, class I bike trails
- waste stream impacts from excess wastewater and plastic hoop houses,
- protect conservation easements, open space designated land, identified scenic resources, community separators,
- access roads, wildfire danger and other hazards,
- endangered or sensitive species, wildlife corridors, riparian corridors, wetlands,
- historic/archeological/cultural resource sites and
- accessibility by police and fire public services.

Curtail Ministerial Permitting: Projects resulting in fencing, 24-hour security, nuisance lighting and odor emissions are by definition changing their surrounding environment and thus triggering project-specific CEQA requirements. Eliminate the practice of issuing multiple ministerial permits to separate growers on the same or adjacent parcels, and upon permit renewal, complete the required cumulative analyses. This loophole leads to unstudied parcel-specific impacts, obfuscates liability for violations, and does not comply with project-specific CEQA review as required by State law and CalCannabis guidelines.

Public Comment Template: This template is prepared to organize public comments made at Sonoma County forums under the most relevant CEQA categories.

The format is as follows: The main category headings are listed in Roman Numerals and capitalized. The specific facts/findings, criteria or standards that the EIR must address for the main category follow and answer the question: “Does the project have a substantial adverse impact on?”
Those relevant to the siting criteria or comments are **in bold**. Other County Ordinances or State requirements relevant to the CEQA criteria are noted above the siting criteria and comments sections.

The Siting Criteria and comments are identified by the initial of the main category and numbered.

COMMENTS are shown in bold

I. AESTHETICS

Does the project have a substantial adverse impact on:
a) **Scenic vista** (Open Space Element scenic corridors, scenic landscape units, Community Separators, parks etc.)
b) damage scenic resources or historic buildings w/in **state scenic highway**
c) degrade visual character (In nonurbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings)
d) create a new source of light or glare that affect nighttime views

The Open Space & Resource Conservation Element contains Objectives and policies “to provide guidelines so future land uses, development and roadway construction are compatible with the preservation of scenic values along designated scenic corridors.”

The Open Space and Resource Conservation Element specifically addresses night lighting: “Preserve and maintain view of the night time skies and visual character of urban, rural and natural areas, while allowing for nighttime lighting levels appropriate to the use and location. Lighting levels are recommended at the minimum necessary to preserve nighttime skies and the nighttime character of urban, rural and natural areas. There is a prohibition of continuous all night exterior lighting in rural areas, unless it is demonstrated to the decision-making body that such lighting is necessary.”

Siting Criteria – Aesthetics

C**OMMENTS:**

SC-A1. Commercial cannabis cultivation operations must not be visible in designated scenic Corridors or scenic landscape units. Siting of operations and/or screening must not degrade the existing visual character or quality of public views and its surroundings and/or have a substantial adverse effect on a scenic vista.

SC-A2. Prohibit cannabis hoop house use in any location that can be seen from a Scenic Corridor, *a public park or a public right of way.*

SC-A3. Prohibit commercial cannabis cultivation in any scenic vistas or residential area where light or glare would impact a day or nighttime view in an area.

SC-4. Prohibit all cannabis cultivation in voter-passed Community Separator parcels.

ADDITIONAL COMMENTS:

1. Specifically require the provisions of the County's Open Space & Resource Conservation Elements are applicable to Commercial Cannabis Cultivation.

2. To ensure site cleanup when operations cease, require posting of $50,000 mitigation bond upon issuance of each permit.

3. Require that no light escape structures from dusk to dawn, and that security lights are aimed downward and away from residential areas

4. Require fencing between cannabis and residential areas be aesthetically consistent with the rural landscape and view sheds residents enjoy. High opaque industrial fencing is not consistent with agriculture or residential uses. Prohibit Cannabis operations requiring high chain-link fences and prison like operations in proximity to residential uses.

11. AGRICULTURE AND FORESTRY RESOURCES

a) convert prime farmland to non-ag use
b) conflict with ag zoning or a Williamson Act contract
c) other changes which may convert farmland to non-ag use
General Plan – Ag Resources Element – visitor serving uses

COMMENTS:

1. Do not open agricultural or resource lands to cannabis events. Follow CalCannabis rules for events in commercial and industrial areas.
2. Limit tree removal, especially removal of oak trees by cannabis cultivation.

III. AIR QUALITY – Odor Abatement

a) conflict with implementation of air quality plan (Note: NSCAPCD has no plan)
b) violate or significantly contribute to the violation of an air quality standard (example NOx)
c) contribute to Greenhouse Gas emissions
d) expose sensitive receptors to substantial pollutant concentrations
e) create objectionable odors affecting a substantial # of people

Air Quality – Technical Studies

COMMENTS:

1. For Outdoor cultivation, require the applicant to submit the results of air quality modeling that show terpene emission levels under a series of typical weather conditions during the growing and harvesting season at the cultivation location *for the size of grow proposed*.(DAE) The modeling shall include all current and proposed sources of terpene emissions within one mile of the cultivation location, and the County may require setbacks deeper that 1,000 feet to mitigate offsite odor from outdoor and hoop house cultivation. (DL)
2. Require modeling for NOx concentrations and potential for ozone production (DAE)

3. Require that no odor will cross the property line for all indoor cultivation and processing and outdoor in the vicinity of residential uses.

IV. BIOLOGICAL

COMMENTS:

1. Identify and map Biological Resources and develop Siting Criteria and Riparian Setbacks for identified Biological resources. Include movement corridors, current and historic.

Bloomfield has Badger setts on residential and adjoining agricultural properties. The Bloomfield area is part of a series of Badger setts from Petaluma to the Coast identified by a Petaluma Badger expert and naturalist. Badgers have been designated a species of special concern by California Fish and Game.

2. Identify and map Springs with the habitat type to support Red-Legged Frogs. Red-legged Frog habitat has been identified in the Bloomfield area. Red-Legged Frogs are Federally listed as threatened. Develop Siting Criteria and Riparian Setbacks for identified Biological Resources

3. Identify and map sensitive aquatic biological resources, including federally and state-listed endangered salmon. Erosion resulting from cultivation activities both

from the change in use and from associated construction of cannabis production facilities may lead to increased sedimentation of creeks and tributaries in impaired watersheds in critical habitat areas. Mitigate or exclude cannabis cultivation on lands with impaired watershed.

V. CULTURAL RESOURCES

COMMENT:

1. Determine and map the location of cultural resources on designated Agricultural lands to be used for cannabis production. Contact the appropriate agency to report any finding of cultural remains on property
prior to disturbance.

2. There are only two main existing commercial businesses in Bloomfield, Stormy's and Olympia House Rehab, along with certain dairy businesses that have lent to the rural sanctuary aspect of the location of Olympia House Rehab. If potential clients and families of such clients and professional doctors helping said clients, find out that the small town of Bloomfield is also home to a large scale commercial growing operation, could that cause them to not consider Olympia House Rehab as a safe and secure rural setting for an addict to receive treatment.

VI. ENERGY

VII. GEOLOGY AND SOILS

VIII. GREENHOUSE GAS EMMISSIONS

IX. HAZARDS AND HAZARDOUS MATERIAL

X. HYDROLOGY AND WATER QUALITY

a) violate water quality standards or waste discharge requirements
b) substantially deplete groundwater supplies
c/d) alter existing drainage patterns on site or in area through alteration of the course of a stream or river –
i) result in substantial erosion
ii) increase the rate or amount of surface runoff – flooding
e) runoff water that exceeds storm water drainage systems
f) otherwise degrade water quality

Water Availability Siting Criteria

COMMENTS:

HSC1: Prohibit all cannabis cultivation in Sonoma County's Class 3 and 4 groundwater areas for all ministerial permits and the County should assess water availability in a water zones as recommended by CDFW before issuing new conditional use permits.

HSC2: Site cannabis operations along wastewater pipelines only. Prohibit trucking of water or recycled wastewater under all circumstances.

ADDITIONAL COMMENTS:

1. Limit permit approvals during a drought as declared by the State of California, to applicants that grow cannabis only using dry farming techniques with strict monitoring by the County.
2. Develop specific requirements that cannabis operation do not pollute ground water and endanger the watershed of other well water users. Develop conditions of approval for cannabis operations to require ground water monitoring and cleanup provisions if there is a danger to a watershed or nearby wells.

3. Identify Springs and watercourses that will be impacted by cannabis operations. In Bloomfield, spring water and ephemeral streams flow to Bloomfield Creek to the Estero Americano and ultimately the Pacific Ocean. Alteration or pollution of these springs and watercourses not only impact local water users but also the Estero Americano and the Pacific Ocean.

5. Consider an Estero Americano special zoning designation from the high water and tide line to recognize and protect this important watercourse along its flow to the Pacific Ocean

4. Prohibit cannabis operators from allowing workers to live on-site absent approved housing and zoning regulations and in a way that results in fouling on-site and off-site water resources.

XI. LAND USE AND PLANNING

COMMENTS:

General Plan

1. Sonoma County's General Plan and its environmental document are over 20 years old, out of date and inadequate for County Wide Planning Purposes. The

General Plan must be updated to provide countywide review of commercial cannabis cultivation and its relevance and associated impacts to all General Plan Elements.

2. GP Ag Resource Element: Prevent Detrimental Concentration of commercial and visitor serving uses in Ag Zones

   2a: Prohibit commercial cannabis cultivation in proximity of rural residential neighborhoods and towns *and ensure adequate setbacks to protect Health and Safety including nuisance from odor, noise, dust, traffic and crime to all property lines of residences and businesses.*
   2b: Limit acreage of any 10-mile square zone to prevent over-concentration of any one area. Determine general environmental constraints and issues within each 10-mile square zone and develop a plan depicting the acres within zones not open to cannabis operations.

   2c: Develop a minimum parcel size requirement for cannabis in proximity to Residential neighborhoods

3. Support City-centered growth by providing incentives for cannabis cultivation in industrial zoned areas and processing in commercial or industrial zones.

4. Comply with State regulations that classify cannabis as an agricultural product, not an agricultural crop, and therefore not subject to right-to-farm law.

Land Use – Zoning Code Setbacks:

1.Setbacks must be a minimum of 1000 feet from cultivation sites to residential property lines and be further increased due to local conditions to protect rural residents from potential health effects and adverse quality of life impacts. The negative effects of unanalyzed and unmitigated environmental impacts can have an irreversible impact on the character of rural communities.

2. Children spend a larger percentage of their time at home than they do at school so residential setbacks must be set at least 1000 feet from residential property lines as are setbacks from schools and other sensitive receptors.

3. Processing plants must be sited in Commercial/Industrial Zone Districts due to the significant impacts on residential uses by operating hours of 7 days a week, 24 hours a day, the influx of seasonal employees, deliveries on site from 8-5, commercial traffic on rural communities' substandard streets, storage of hazardous material, security fencing and/or sensor night lights, audible alarms and security guards

4. Measure Setbacks to Property Line, not buildings: In the current cannabis

ordinance, the use of adjacent residential property owners private land as a setback to buffer commercial cannabis cultivation impacts without property owner consent is an infringement on private property owners rights and use of their property and must be dropped.

5. Commercial Cannabis outdoor and hoop house cultivation must be sited from rural residential property lines by at least 1000 feet or further to address noise, odor and other impacts including the following:

> *reducing the existing air quality with noxious odor. No odor should cross residential property lines.
>
> *significantly increasing water use endangering adjoining residential water sources. There are at least 67 residential wells in Bloomfield.
>
> *chemical drift to residential uses and fog odor neutralizing aerosols that contain oxidizing agents that have not been subject to long-term studies,
>
> *night lighting impacts that ruin the adjoining residents' enjoyment of night skies and significantly impact wildlife.

6. Indoor cannabis cultivation is industrial in nature and not in keeping visually with the rural character of Sonoma County. Industrial-scale, commercial developments in rural residential neighborhoods, permanently alters the rural character, creates significant visual impacts and degrades the existing visual character of rural communities. This must not be allowed in the interests of recreational cannabis use and financial gains.

7. Create a "Rural Residential Exclusion Zone option for neighbors to pursue, which would be a simple and speedy (less than six months) mechanism to exclude commercial cannabis production from certain locations based on potential harm to watersheds, including wells serving residential homes, endangered species, neighborhoods with multiple homes, poor access roads and/or other site-specific constraints

8. Prohibit cultivation and processing in areas without fire safe roads, which are narrow and often dead-end roads. This is another reason all processing should be done in our central corridor and not in our rural areas.

9. State explicitly that cannabis is an agricultural product, not an agricultural crop, and therefore not the same as conventional agriculture and not subject to right-to-farm law.

10. The EIR must include an analysis of potential cannabis facilities locating in close proximity to rural residential development and how potential fire in different scenarios might spread under different weather, fuel, wind and ignition point scenarios exposing people and/or structures to a significant risk of loss, injury or death involving wildland fires. This is especially critical for rural residential developments downwind of

potential cannabis facilities and/or in an area with inadequate roads and evacuation route, forested or heavy brush areas and locations remote from fire protection services regardless of 1000 feet or greater setbacks.

The community of Bloomfield is downwind of the Estero Americano, also known as the Petaluma Wind Gap and meets the criteria developed above. The entire community is downwind (East) of the Estero wind and vulnerable to a potential fire conflagration should wind borne fire reach the wooden structures comprising the community. In addition, rural communities fire services may be remote from their locations. Evacuating residents and fire trucks coming to fight a fire could not pass on the 12-20 foot wide streets in the Bloomfield community and other similar rural communities.

11. Commercial Cannabis Cultivation proposed in proximity to rural residential uses is a project that must be subject to environmental evaluation and public hearings based on the unique conditions and setting of the location and the potential for significant impacts on residents quality of life and use of property. Ministerial permitting in these circumstances does not meet the intent of CEQA to study impacts that could include, odor and air quality, groundwater supply, aesthetics, wildfire, emergency response and evacuation, traffic and vehicle miles traffic, energy and utilities, greenhouse gasses, noise, loss of farmland, among others.

12. Use of existing permanent structures for indoor cultivation in proximity to rural residential uses must not be allowed. Indoor cannabis cultivation is industrial in nature and not in keeping visually with the rural character of Sonoma County even if outside a 1000 foot setback. Industrial-scale, commercial developments in rural residential neighborhoods, permanently alters their character, creates significant visual impacts and degrades the existing visual character of rural communities.

13. Security requirements for commercial cannabis cultivation and processing requiring night lightning are a new source of substantial light when allowed close to rural residences. The night lighting adversely affects the character of residential neighborhoods *and individual residences* creating a nuisance and inserting a commercial/industrial type character into a residential enclave. It further erodes the enjoyment of night skies and significantly negatively impacts wildlife.

14. We recommend **not** implementing a zone change allowing cottage-sized cultivation in the AR and RR zone Districts as shown as a policy option in the County Summary Report of the Cannabis Program Update Study Session dated 9/28/21. We instead recommend developing policies to protect rural residential properties from the intrusion of cannabis operations in AR and RR and all residential zone Districts and instead focus on providing extensive setbacks and other provisions to protect residential properties from the many identified negative impact of cannabis in close proximity to residential neighborhoods and towns.

15. The Bloomfield Community is within easy walking distance of the Olympia House Rehab Drug and Alcohol Treatment Facility. Consider the cumulative nature of a community and treatment facility within close proximity to each other and develop the

option of a buffer zone encompassing these types of uses that are totally incompatible with cannabis operations. Cannabis must be located a greater distance than 1000 feet from communities and Treatment facilities.

XII. MINERAL RESOURCES

XIII. NOISE

XIV. POPULATION AND HOUSING

XV. PUBLIC SERVICES

Cannabis introduces the need for the County to develop criteria and regulation that has not been yet been developed. The cart has been before the horse. The County is tasked with identifying Public Service Impacts of the proposed cannabis Ordinance as part of the Environmental Impact Report.

The cannabis program impacts most Sonoma County Departments as follows:

Administration and legal services are heavily involved in cannabis issues. The County has already shelved an inadequate ordinance and environmental review and is spending more resources on developing an environmental framework to use in creating an ordinance based on documented and properly studied information.

Permit Sonoma is tasked with preparing an EIR and subsequent regulations for Cannabis and how it relates to the other land use issues in the County. Unfortunately, the General Plan is out of date and as such does not provide a current framework for how cannabis can be viewed in the context of all the General Plan Elements. The County must still consider the purpose of all the General Plan Elements in preparing the EIR. Code Enforcement and abatement problems exist currently and will need ongoing and more robust attention as cannabis proliferates.

Health and Human Services will have to gear up for cannabis related health issues. This may include the need to develop or determine the potency of various cannabis products and to develop public information on how this drug can be used safely. Cannabis is considered a gateway drug. There will be increased service impacts for addiction treatment in addition to what now exists.

Depending on what provisions the County adopts, the Agricultural Department will continue to be involved.

The County Sheriff office will need to analyze the impact of cannabis on driving under the influence of cannabis and determine how to measure the degree of intoxication and the degree of impairment and what the penalties will be. This is a major public Safety issue. The County Sheriff's office will also have to respond to crime problems created by cannabis. There are already many documented crimes committed involving cannabis. Residential neighborhoods have given substantial testimony to the concern of criminal activity around residential neighborhoods.

The cannabis program was initially presented as major revenue producing land use for the County and the program implementation would be cost recovery. Cannabis is no longer in that realm and Sonoma County has consistently lowered taxes and standards to accommodate the cannabis industry. The County staff must ensure that cannabis project processing is cost recovery and pays for staff and consultants needed to process applications. **The Board of Supervisors can facilitate reducing the regulatory burden of cannabis projects by designating locations for cannabis a great distance from residential neighborhoods thereby reducing conflict.**

The EIR must include the impact on all the County Services shown above and any other services that may not be shown here but are identified during the environmental review. Each "Project Alternative" must include an identification and evaluation of the impacts on PUBLIC SERVICES and the subsequent impact on environmental resources.

COMMENTS:

1. When identifying Environmental Impacts, consider Sonoma County Services needed as a part of the analysis to mitigate environmental impacts.

2. Require Sonoma County Departments to provide their overall assessment of the Cannabis Program potential impacts to their department as part of the Environmental Impact Report so the information can be evaluated and used in determining significant impacts and their mitigation.

Following are examples;

(a. There may be land designated for cannabis use that is beyond the County Sheriff's ability to reach in 20 minutes, so a sub-station would need to be created or the land use designation dropped as not feasible.

(b. The dramatic increase of cannabis production and products directly results in profound public health concerns. The Behavioral Health services currently in place reflect the reality that cannabis is a drug that results in addiction and impacts children and youth. Some of the programs currently in place include:

Drug Abuse Alternative Center (DAAC) provides services to adults and youth for drug abuse and addiction; Drug free babies; Treatment and Accountability for Safer Communities (TASC); Women's Recovery Services (WRS); Turning Point; and Dependency Drug Court (DDC) for mothers in Child Protective Services (CPS) cases. Notably that program specifically excludes mothers who possess or intend to utilize a medical recommendation for medicinal marijuana.

Compounding these concerns is the need to develop means by which to determine the potency of various cannabis products and to develop public information on how this drug impacts users and the public. These current substance abuse programs underscore the negative impact of marijuana and cannabis on the public health of Sonoma County. The supersonic escalation of cannabis production and use in the County clearly will require a commensurate expansion by Behavioral Health and Human Services to combat the addictive and negative social impacts of cannabis both in terms of expanded hiring and programs.

The NOP does not mention Health and Human Services however the agency may have to hire additional staff to provide information and services within the Behavioral Health area such as Child Protective Services (CPS). Even hiring additional staff, greatly understates the impact and needs in this area. These issues are reflective of the potential negative impact of cannabis that must be considered in deciding a comprehensive cannabis Ordinance.

We recommend the County not proceed as demonstrated by the failed environmental document and ordinance by facilitating the ubiquitous profusion of cannabis in every Agricultural zone District even next to rural neighborhoods. Conversely, we recommend the County proceed with a balanced approach considering cannabis as a drug, as designated by the Federal Government, and develop an ordinance providing precautions and limitations that will protect the health, safety and welfare of all residents of Sonoma County.

(c. Permit Sonoma may have to hire additional code enforcement officers to respond to complaints and enforce Project conditions of approval. Permit Sonoma will need to contract with and manage experts in numerous fields to ensure cannabis operators are properly managing the impacts of their operations.

3. Develop a fiscal analysis on the impact of the cannabis program on a Department-by-Department basis to determine the overall fiscal impact of the cannabis program on Sonoma County. Include County staffing needs across departments to address County residents concerns about the need for the required additional policing, code enforcement, permit and building Department operations, Health and Human services needs to respond to drug abuse and addiction services, public noticing and other impacts identified through public comments and County staff input.

Criteria: SAFETY
COMMENTS:

1. Potential criminal activity endangering the safety of adjoining neighbors due to cultivation of a product that is desirable to criminals and transactions that are known to be cash only. Rural residents know from experience there is a lack of expedient public safety services such as fire and law enforcement for rural

emergencies. A detailed study of these services to protect public safety must be completed to consider response time, adequate personnel and staffing needs, managing complaints and enforcement follow-through.

2. Evaluate the safety of rural residential communities with substandard roads that would be shared with Commercial Cannabis Cultivation. Wildfire and evacuation congestion on substandard roads do not meet fire safe road standards, which require vehicles and emergency equipment to pass concurrently. Develop criteria and standards to preclude new proposed heavy uses on substandard, non-fire safe roads where this condition exists

3. Temporary plastic hoop house electrical use creates additional fire hazards especially if located downwind of residential communities.

XVI. RECREATION

COMMENTS:

1. Add RECREATION to the Sonoma County Comprehensive Cannabis Program update and Notice of Preparation.

2. Bloomfield Residents own and manage a local Park and the Bloomfield Cemetery. The Cemetery is on a high promontory above Bloomfield and is surrounded by a walking path. Both the Park and Cemetery are community-gathering places involving children. Study the impacts of cannabis operations in the vicinity of community oriented recreational activities and require mitigation measures such as distance that limit the impact of cannabis operations including visual, noise, smell, traffic and any other identified impacts on family recreation locations

XVII. TRANSPORTATION

XVIII. TRIBAL CULTURAL RESOURCES

XIX. UTILITIES AND SERVICE SYSTEMS

XX. WILDFIRE

COMMENTS:

1. Evaluate the safety of rural residential communities with substandard roads that would be shared with Commercial Cannabis Cultivation. Wildfire and evacuation

congestion on substandard roads do not meet fire safe road standards, which require vehicles and emergency equipment to pass concurrently. Consider the factor of wind driven fires and identify and study those area that are impacted by winds, such as in the Estero Americano also known as the Petaluma Wind Gap and higher elevation hill and mountainous areas.

2. Temporary plastic hoop house electrical use creates additional fire hazards especially if located downwind of residential communities.

XXI. MANDATORY FINDINGS OF SIGNIFICANCE (see Vision on Page 1)

From: Dave palmgren
To: Crystal Acker
Cc: Cannabis
Subject: Request for Rancho Madrone - Glen Ellen area south of Eldridge to be an Exclusion Zone for Cannabis
Date: Wednesday, March 8, 2023 1:38:59 PM

Dear Crystal,

I am requesting to include our neighborhood as an Exclusion Zone for Cannabis Cultivation per the upcoming proposed changes to the Cannabis cultivation ordinance. This neighborhood has more than 300 signatures of concerned citizens that these changes would have negative consequences in this highly dense residential and family community.

The properties in our neighborhood reside on all of the streets south of the Eldridge campus (begins at Martin St), to Sobre Vista Road and west of Sonoma Creek to the top residential properties on Sonoma Mountain (includes the old Spreckles Ranch). This includes the properties on both sides of Arnold Drive, Morningside Mountain Drive, Oso Trail, Vigilante Road, Martin St, Lorna Dr, Cecelia Dr, Burbank Dr, Marty St, Sonoma Glen Circle, Cressy Dr, Murray Dr, Thomas St, Jane Ct, Madrone Rd, Glenwood Dr, Woodside Ct, Maplewood Dr, Brookview Dr, Caton Ct, Oakwood Dr, Heaven Hill Rd, Pipeline Rd, Sobre Vista Rd and Sobre Vista Ct.

Thank you for your attention to this matter where the removal of setbacks and 10 acre minimum would have a major change in our highly dense residential neighborhood, and that Cannabis should be grown in large agricultural areas outside of family neighborhoods.

Please confirm receipt.

Thank you,

Dave Palmgren

964 Glenwood Drive
Sonoma, CA 95476

707-319-2050 cell
dave.palmgren1@gmail.com

From: dorie k
To: Cannabis
Subject: Cannabis comment
Date: Wednesday, March 8, 2023 7:24:21 PM

EXTERNAL

Dear County,

I am a county resident and property owner. I also have been a drug and alcohol policy researcher since the 1970s with a doctorate in criminology from UC Berkeley; I have taught at UCs and Cal States and have done research for federal NIH and state agencies.

While marijuana is usually a less harmful substance than alcohol from a health viewpoint, the details depend on how a substance is used, how it is grown, and how it is legally managed.

Frankly, the US has done a poor job preventing alcohol problems, and California’s and Sonoma County’s powerful wine industry has made it even more difficult in this state and region to do effective problem prevention.

Since marijuana is still illegal from a federal viewpoint, its use is hard to regulate. But if the wine and alcohol model dating from the 1930s is used by Sonoma County in its decision making, the road ahead will be paved with widespread underage use, driving under the influence-related crashes, and health problems due to unregulated products.

Please remember that cannabis, like wine grapes, are drugs, not fruits, nuts or vegetables.

D. Klein, D.Crim.

From:	Erich Pearson
To:	Cannabis; Crystal Acker; McCall Miller
Subject:	Cannabis EIR Scooping Comments
Date:	Wednesday, March 8, 2023 5:30:15 PM

EXTERNAL

Hello,

Thank you for the opportunity to add comments here. Generally speaking, I think it is imperative to study any and all potential cannabis uses in all zoning areas.

Here is a list of thoughts:

Distribution by Farmers - in order to make this as-of-right, associated with a cultivation license, we may study limiting the distribution in ways that allows a farmer to self-distribute, while not allowing for a distribution hub for packaged products on Ag-zoned land. This should be studied for Processors too.

Some state license types that we want to be as-of-right, may need to be restricted (as the example above). This takes a thoughtful conversation with the cannabis community to make sure these are workable.

Farmers would like to be able to sell direct to consumers (with limitations similar to how wineries work). Onsite tours, tastings/consumption (with designated driver requirements), and events should be studied while looking at the way we regulate these activities as wineries.

Manufacturing and other activities within already permitted structures should be studied to consider allowing this as-of-right.

Conventional plastic greenhouses who's construction is allowed for traditional farmers under Ag-exempt rules should be studied. Allowing outdoor licensed cannabis farmers to "light dep/pull plastic" should be studied. For example, Processor-licensed buildings with a Manufacturing license should be able to infuse joints. A manufacturing license is necessary for the simple addition of hash to a joint. Onsite extraction requires a manufacturing license too, and should be allowed a Processing facility as well.

Defining cannabis as "Agriculture" should be considered. Using a VESCO model to regulate cannabis cultivation should be studied.

Current water restrictions should be studied, and aligning water use by cannabis to that of other crops should be a goal.

Cannabis Use Permits have a lot of ridiculous requirements that should be studied for elimination. Some are well-intentioned, and others are out-dated. For example, very few people have theft issues related to outdoor cultivation anymore due to the low value of the product.

Alignment with State law wherever possible, whether it be definitions or regulations related to specific license types.

Consider setting up an Ad-Hoc that serves as a liaison between the County and the cultivation community. We recognize that one size does not fit all, and as a County we want to allow certain license types in certain zoning, while still creating community-specific restrictions. In order to do this, it is critical that Staff understand operator's needs so that these restrictions can work for both the Community and the Operators.

Study temporary events, and what it takes to allow the temporary sale and consumption of cannabis at other locations.

Thank you - erich

Erich Pearson | CEO
975 Corporate Center Parkway, Ste. 115, Santa Rosa, CA, 95407

From:	McCall Miller
To:	Cannabis; Crystal Acker
Subject:	Fwd:
Date:	Wednesday, March 8, 2023 10:30:58 PM
Attachments:	DTC POT GLENTUCKY FAMILY FARM POT .pdf

McCall
707-565-7099

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From: Susan Gorin <Susan.Gorin@sonoma-county.org>
Sent: Wednesday, March 8, 2023 8:20:05 PM
To: McCall Miller <McCall.Miller@sonoma-county.org>
Subject:

Add to comments for EIR analysis.

Susan Gorin | 1st District Sonoma County Supervisor
575 Administration Drive, Room 100A
Santa Rosa, CA. 95403
Office 707-565-2241 | Cell 707-321-2788

GLENTUCKY FAMILY FARM
SONOMA MOUNTAIN

Dear Susan,
I am writing this letter to let you know as a small farmer how critical it is to be able to sell the cannabis we grow on site. The term is direct to consumer sales. As a small farmer when we were planning our business model back when cannabis was a medical crop we were able to get a decent price per pound, supply was somewhat in balance and we were able to squeak by financially. For once there was some light at the end of the tunnel. Then very soon after it went recreational the supply quickly grew out of balance with a major reason (not the only) being the small number of dispensaries open to the public.

This was double troubling to small independent growers because not only did dispensaries not need another gram of marijuana but many dispensaries also grew their own. In 2022 prices crashed. And on top of that many dispensaries had room for only a handful of independent growers, who were second in line after they sold and promoted their own stuff.

As we learned in the wine business direct sales did not compete against the dispensaries and hurt sales, but it actually help sales because now the consumer was educated about the small growers products and the industry in general and then sought them out on their next trip to the store, which are located closer to the public.

Direct Sales also had another positive impact on the wine industry and one I also see for cannabis in that it made the grower and producers open to the public more conscious about their practices and how their property was perceived by the public. In presenting themselves to the public they want to talk about and showoff their "best practices" and quality initiatives. I don't know a better way to encourage and keep producers responsible and environmentally sensitive.
Showcasing best practices and environmental stewardship is great marketing for all including Sonoma County.
It's hard to exaggerate how important this is to small farmers, we can barely squeak by selling vegetables at farmers markets and direct to the public, when cannabis became available to us it was a god-send. Very quickly that advantage disappeared as the market for cannabis

collapsed. Allowing us to meet our customers, and show and tell them personally about the effort that goes into farming will not only be great for the farmer it will be great for the reputation of Sonoma County and it's agricultural heritage.

Thank you,

mike Benziger

Glentucky Family Farm

UPC17-0012

From:	Lauren Mendelsohn
To:	Cannabis
Cc:	BOS; Omar Figueroa
Subject:	Letter from the Law Offices of Omar Figueroa for 3/8/23 Cannabis EIR Public Scoping Meeting
Date:	Wednesday, March 8, 2023 4:30:50 PM
Attachments:	LOOF Letter for EIR Scoping Meeting 3-8-23.pdf

EXTERNAL

Good afternoon:

Attached please find a comment letter from the Law Offices of Omar Figueroa regarding scoping of the Cannabis EIR.

Thank you.

****

Lauren A. Mendelsohn, Esq.
Senior Associate Attorney
Law Offices of Omar Figueroa
lauren@omarfigueroa.com
www.omarfigueroa.com

California Office
7770 Healdsburg Avenue
Sebastopol, CA 95472-3352
Tel: (707) 829-0215
Fax: (707) 827-8538

New York Office
159 20th Street, #1B-12
Brooklyn, NY 11232-1254
Tel: (212) 931-0420

Join Cal NORML and help fight for our rights!

0215 and delete and destroy all copies in your computer and/or network. Thank you for your anticipated cooperation.

Permit Sonoma
ATTN: Crystal Acker
cannabis@sonoma-county.org

CC: Sonoma County Board of Supervisors
bos@sonoma-county.org

March 8, 2023

Re: Scoping of Cannabis EIR

Dear County Staff and Supervisors,

The Law Offices of Omar Figueroa is a Sonoma County-based law firm serving a wide range of clients in the cannabis and hemp industries including applicants, operators, land owners, investors, and organizations spanning all types of licensed activities across California. Our founder and principal attorney, Omar Figueroa, served on the Sonoma County Cannabis Advisory Group (CAG) that met during the early days of the current ordinance, and we have been engaged with the County regarding its cannabis policies since then. Currently, Mr. Figueroa sits on the Board of Directors of the Sebastopol Center for the Arts as well as the Board of Directors National Cannabis Industry Association. Our Senior Associate Lauren Mendelsohn is on the Board of Directors of California NORML as well as the Board of Directors of the Sonoma County Cannabis Alliance. Additionally, Mr. Figueroa and Ms. Mendelsohn both served on the Board of Directors of the International Cannabis Bar Association.

We support scoping the EIR broadly to consider permitting all uses allowed under state law in a way that encourages and supports small and locally-owned businesses, as well as equity businesses and businesses with sustainable practices. We encourage the County to take into consideration the comments provided by other industry experts, and will dedicate the remainder of this letter to what we believe are novel considerations.

Page 6 of the NOP for the EIR states:

> "The Cannabis Ordinance Update is not anticipated to result in significant impacts to population and housing or recreation because it would not involve the generation of substantial new employment or a need for housing that could generate additional demand on recreation resources."

We think the County should study the possibility of significant impacts to housing and recreation as a result of this comprehensive policy update. If regulated appropriately, the cannabis industry could generate a significant amount of new employment. This job creation will stimulate the local economy and may also have an impact on housing, in particular farmworker housing. However, the impact on housing overall might not be as significant as a completely new industry would have, since many people who find a job at a Sonoma County cannabis business will already live here. Additionally, with regards to recreation, the impact of cannabis tourism, cannabis events, and consumption lounges should be taken into consideration as part of the EIR, as these would alleviate the burden on the County's other recreational resources.

The potential impact of federal legalization and interstate cannabis commerce should also be considered, as should the potential impact of appellations of origin for cannabis being established within Sonoma County, and the potential impact of merger of the cannabis and hemp supply chains.

As the County moves forward with this process, it is important to remember that according to the 2021 Sonoma County Crop Report and the 2021 Cannabis and Hemp Production Addendum, only 50 acres of cannabis countywide is currently creating $122 million in value each year. Cannabis is the third most valuable crop in Sonoma County, and is the most valuable thing grown on Sonoma County farms on a per-acre basis, far surpassing wine grapes, dairy, and other agricultural outputs on the list. Whether or not this valuable industry can continue to survive in Sonoma County hinges on the outcome of the EIR process.

In sum, please think big. Think of a successful cannabis industry that is anticipated to generate substantial new employment, which is what will happen under a scenario of federal legalization and interstate cannabis commerce.

Please let us know if you have any questions. We look forward to working with you throughout this process.

Regards,

Lauren Mendelsohn
Lauren Mendelsohn, Esq.
lauren@omarfigueroa.com

Omar Figueroa
Omar Figueroa, Esq.
omar@omarfigueroa.com

From: Paul Morrison
To: Cannabis; Crystal Acker
Subject: Request for the Rancho Madrone/Glen Ellen area south of Eldridge to be an Exclusion Zone for Cannabis
Date: Wednesday, March 8, 2023 8:30:09 AM

EXTERNAL

Ms. Acker,

Please take this email as an official request to include our neighborhood as an Exclusion Zone for Cannabis Cultivation per the upcoming proposed changes to the Cannabis cultivation ordinance. This neighborhood has more than 300 signatures of concerned citizens that these changes would have negative consequences in this highly dense residential and family community.

The properties in our neighborhood reside on all of the streets south of the Eldridge campus (begins at Martin St), to Sobre Vista Road and west of Sonoma Creek to the top residential properties on Sonoma Mountain (includes the old Spreckles Ranch). This includes the properties on both sides of Arnold Drive, Morningside Mountain Drive, Oso Trail, Vigilante Road, Martin St, Lorna Dr, Cecelia Dr, Burbank Dr, Marty St, Sonoma Glen Circle, Cressy Dr, Murray Dr, Thomas St, Jane Ct, Madrone Rd, Glenwood Dr, Woodside Ct, Maplewood Dr, Brookview Dr, Caton Ct, Oakwood Dr, Heaven Hill Rd, Pipeline Rd, Sobre Vista Rd and Sobre Vista Ct.

Thank you for your attention to this matter where the removal of setbacks and 10 acre minimum would have a major change in our highly dense residential neighborhood, and that Cannabis should be grown in large agricultural areas outside of family neighborhoods.

Please confirm receipt of this email.

Thank you,

Paul Morrison
President - Protect Our Sonoma Valley Family Neighborhoods
976 Glenwood Dr
Sonoma, CA

From:	Ricardo Capretta
To:	Cannabis; Crystal Acker
Subject:	Request for the Glen Ellen Morningside Mountain / Oso Trail / Vigilante Road Community to be an Exclusion Zone for Cannabis
Date:	Wednesday, March 8, 2023 6:51:16 AM
Importance:	High

EXTERNAL

Ms. Acker,

Please take this email as an official request for Sonoma County to include our 604 acre neighborhood as an Exclusion Zone for Cannabis. In addition to our neighborhood being a one way in and one way out neighborhood, our community is served by a non-complying road with dangerous curves, inadequate road widths in some locations, and no emergency turnouts for emergency vehicles. In addition, our neighborhood is primarily zoned as an oak tree habitat and because we have so many native oak trees, our neighborhood has a much higher risk of fire. Increased activity due to cannabis activities would be detrimental to our neighborhood. A few years back, our neighborhood was granted an Exclusion Zone for short term vacation rentals for similar reasons.

The properties in our neighborhood are as follows:

PROPERTY ADDRESS - Glen Ellen, CA 94544	**Acres**	**ASSESSOR PARCEL #**
1000 Morningside Mountain Dr.	11.80	054-400-018
No Address. Vacant Land	4.13	054-400-017
1200 Morningside Mountain Dr.	10.00	054-120-047
No Address. Vacant Land	15.11	054-120-048
No Address. Vacant Land	10.42	054-120-049
No Address. Vacant Land	10.00	054-120-050
No Address. Vacant Land	4.00	054-120-036
1400 Morningside Mountain Dr.	8.28	054-120-017
1407 Morningside Mountain Dr.	4.05	054-120-035
1500 Morningside Mountain Dr.	8.87	054-120-016
No Address. Vacant Land	12.23	054-120-039
1741 Morningside Mountain Dr.	27.32	054-120-042
No Address. Vacant Land	12.20	054-120-045
No Address. Vacant Land	12.11	054-120-046
1700 Morningside Mountain Dr.	8.24	054-120-025
1750 Morningside Mountain Dr.	8.66	054-120-029
1877 Morningside Mountain Dr.	6.96	054-120-030
1900 Morningside Mountain Dr.	4.50	054-120-028
2000 Morningside Mountain Dr.	6.14	054-120-027
2010 Morningside Mountain Dr.	4.15	054-120-018
55 Oso Trail	10.16	054-110-039
77 Oso Trail	10.87	054-110-046
100 Oso Trail	19.28	054-110-045
2100 Morningside Mountain Dr.	4.58	054-120-025
2205 & 2207 Morningside Mntn Dr.	6.23	054-110-038

2500 MMD Dr. & 3600 Vigilante	55.52	054-110-042
2600 Morningside Mountain Dr.	9.51	054-110-031
2700 Morningside Mountain Dr.	23.72	054-110-001
No Address. Vacant Land	222.75	054-100-012
3275 Vigilante Road	8.06	054-100-003
3350 Vigilante Road	9.31	054-100-049
3380 & 3388 Vigilante Road	10.00	054-100-047
3475 Vigilante Road	5.33	054-110-050
3577 Vigilante Road	4.83	054-110-011
3585 Vigilante Road	4.86	054-110-016
	604.26	

Please confirm receipt of this email. Thank You.

CAPRETTA
ARCHITECTURE
+
PLANNING
+
BUILDING

Ricardo Capretta

415-489-1703 (Office - Sonoma)
415-383-8242 (Office – Mill Valley)
415-203-7700 (Mobile)

From:	Ron Judy Smalley
To:	Crystal Acker
Subject:	Request for the Rancho Madrone/Glen Ellen area south of Eldridge to be an Exclusion Zone for Cannabis
Date:	Wednesday, March 8, 2023 9:21:07 AM

EXTERNAL

Ms. Acker,

Please take this email as an official request to include our neighborhood as an Exclusion Zone for Cannabis Cultivation per the upcoming proposed changes to the Cannabis cultivation ordinance. This neighborhood has more than 300 signatures of concerned citizens that these changes would have negative consequences in this highly dense residential and family community.

The properties in our neighborhood reside on all of the streets south of the Eldridge campus (begins at Martin St), to Sobre Vista Road and west of Sonoma Creek to the top residential properties on Sonoma Mountain (includes the old Spreckles Ranch). This includes the properties on both sides of Arnold Drive, Morningside Mountain Drive, Oso Trail, Vigilante Road, Martin St, Lorna Dr, Cecelia Dr, Burbank Dr, Marty St, Sonoma Glen Circle, Cressy Dr, Murray Dr, Thomas St, Jane Ct, Madrone Rd, Glenwood Dr, Woodside Ct, Maplewood Dr, Brookview Dr, Caton Ct, Oakwood Dr, Heaven Hill Rd, Pipeline Rd, Sobre Vista Rd and Sobre Vista Ct.

Thank you for your attention to this matter where the removal of setbacks and 10 acre minimum would have a major change in our highly dense residential neighborhood, and that Cannabis should be grown in large agricultural areas outside of family neighborhoods.

Please confirm receipt of this email.

Thank you,

Ron & Judy Smalley
15232 Arnold Dr.
Glen Ellen, CA 95442

Sent from my iPhone

From: Sonoma County Cannabis Alliance
To: Cannabis
Cc: BOS
Subject: Cannabis EIR & Ordinance Update - Public Scoping Comments from the Sonoma County Cannabis Alliance
Date: Wednesday, March 8, 2023 11:13:08 AM
Attachments: Sonoma County Cannabis Alliance_Letter for EIR Public Scoping Meeting_March 8, 2023.pdf

EXTERNAL

Good morning:

Attached please find a comment letter from the Sonoma County Cannabis Alliance for tonight's public scoping meeting regarding the cannabis ordinance update & EIR process.

Thank you.

Sonoma County Cannabis Alliance
info@scgalliance.com
Facebook | Twitter | Instagram
www.scgalliance.com

March 8, 2023

Permit Sonoma
Attn: Crystal Acker
2550 Ventura Avenue
Santa Rosa, CA 95403
Cannabis@sonoma-county.org

CC: bos@sonoma-county.org

Re: Comment for EIR Public Scoping Meeting

Dear Permit Sonoma,

The Sonoma County Cannabis Alliance (formerly the Sonoma County Growers Alliance) respectfully submits the following comments for today's public scoping meeting regarding the EIR for the County's comprehensive cannabis program update.

The Sonoma County Cannabis Alliance is a grassroots, non-profit organization founded in 2015 to support and advocate on behalf of the local cannabis industry. Since then, we've called for sensible regulations that allow Sonoma County operators, in particular small businesses, to survive and succeed in the competitive cannabis marketplace. Despite our efforts and input, we've watched the County's approach at regulation nearly decimate the local industry. However, many current and potential operators are still here, and we are hopeful that the EIR process can help get the program back on track.

Below is a list of key aspects we would like studied in the EIR, but we also urge you to look back at the numerous comments that we've submitted on this topic over the years, as well as the recording from the community group meeting that the County held with us in 2021. We also encourage you to review the recommendations from the now-defunct Cannabis Advisory Group, who put many hours into coming up with recommendations that were largely ignored at the time.

- **The EIR should be scoped broadly.** Consider as many impacts as possible to avoid having to conduct further environmental review related to this update in the near future. This should include currently allowed uses as well as uses proposed below and other reasonable extensions of these uses. We also want to note that the County's original Negative Declaration for the current cannabis ordinance considers 170 to 200 acres of commercial cultivation that could be permitted with ministerial Zoning Permits, which is

Sonoma County Cannabis Alliance
321 S. Main Street, #524, Sebastopol, CA, 95472
www.scgalliance.com | info@scgalliance.com

far more than is currently permitted via ministerial and discretionary permits combined. The consultants conducting the EIR should review the historical record carefully and take this into account.

- **Revisit restrictive zoning rules.** In particular, the County's decision early on to eliminate AR and RR as eligible zoning districts for any kind of commercial cannabis permit led to many operators having to sell their properties (which in many cases is where they and their families lived) to find an eligible site, and in some cases they were forced to move out of the County entirely. We ask that the EIR study the impact of commercial cannabis permits, including those of "cottage" size, being allowed in all zoning districts, with the recognition that mitigation measures might be needed in some cases. Consider the impacts of developing a variance or similar process for non-conforming parcels that would otherwise be appropriate for cannabis cultivation.
- **All license types allowed at the State level should be allowed by the County.** See point #1 above. The County can choose to place reasonable restrictions on certain types of licenses, but should not hold back local operators from having a type of business that is allowed under State law. Some additional license types not currently available in the County despite being available elsewhere in California include: Type 7 (volatile) Manufacturing, Type N (infusion) Manufacturing, Type P (packaging & labeling) Manufacturing, Type S (shared kitchen) Manufacturing,, Type 9 (non-storefront) Retail, Cannabis Event Organizer, and Temporary Cannabis Events.
- **County definitions should match definitions in State law.** For example, the County's definition of "mixed light" cultivation in Chapter 35-4 and Chapter 26-04-020 should be amended to reflect recent changes in State regulations, which now allow outdoor cultivation licensees to utilize light deprivation. Furthermore, the EIR should take into consideration that various cannabis-related definitions in State laws and regulations may be updated periodically, and when this happens the cannabis ordinance should be easy to revise accordingly without requiring a lengthy process and new environmental review.
- **Consider the impact of allowing consumption lounges, cannabis events and cannabis tourism.** These uses are all allowed by the State and could bolster the local economy. With regards to cannabis tourism and events, these activities are already happening here and in the surrounding areas, yet the County is not capitalizing on this or providing a pathway for cannabis events and cannabis tourism to legally exist in the unincorporated areas. With regards to consumption lounges, such would provide a safe and legal space for visitors to consume the cannabis they purchase but can't consume in their hotel or vacation rental, as well as a safe and legal space for residents of multi-tenant housing to consume their cannabis; thus, lounges promote public health and equity in addition to tourism.

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- **Revisit the minimum parcel sizes allowed for cultivation.** Cannabis cultivation of any type (outdoor, mixed-light, or indoor) should be allowed on parcels smaller than 10 acres depending on landscaping, topography, and other factors. Stringent parcel size and setback rules make it less likely that small farmers and persons from disadvantaged communities will be able to participate in the local industry due to the high cost of local real estate.
- **Consider the impact of multiple smaller cannabis operators on a single parcel.** The multi-tenant zoning permits initially issued by the County under the current ordinance provided a pathway for operators who couldn't afford to rent or purchase an entire parcel; however, the County placed a moratorium on this. We urge the County to study the impacts of multi-tenant cultivation as a way to support small and equity businesses.
- **Consider direct-to-consumer sales and tasting rooms.** Such could take place on the farm or at a manufacturing facility, for example, similar to wineries.
- **Allow microbusiness in zones where cultivation is allowed.** Doing so would support the creation of cottage industries, so that operators can produce, process, manufacture, distribute, and/or sell from the same property.
- **Consider the impact of defining cannabis as "agriculture."** Cannabis is a plant. It's planted, tended to, and harvested like other crops. Hemp, which is botanically identical to cannabis with the exception of THC content (which can change within either a cannabis plant or a hemp plant single plant during its lifetime), is regulated as agriculture. The distinction is arbitrary. We encourage the County to study the impacts of treating cannabis akin to other agricultural crops.
- **Ensure a Transitional Pathway for Current Applicants and Permitholders.** The County has pulled the rug out from operators many times over the past few years. These folks trusted the County, but were let down. It's critical that people in the current system are not disadvantaged by the new regulatory framework and that they get to keep their place in line and enjoy the benefits that came with (or which they expect to come with) the permit they've obtained or been working hard towards. This could be done via "grandfathering in" existing applicants and permit-holders as legal nonconforming uses. A less ideal alternative is a phase-out period for these existing permit-holders and applicants, but if this option is chosen then plenty of time should be allowed for the transition – we suggest no less than 10 years.
- **Review cannabis-related code enforcement rules and practices.** Our members and supporters have experienced intimidation, extortion, and violations of their civil and constitutional rights at the hands of Sonoma County Code Enforcement. Furthermore, we wonder how much effort is being dedicated to enforcing against unpermitted operators versus operators who are trying to do the right thing. We ask for parity between how cannabis violations and other commercial violations are treated.

Sonoma County Cannabis Alliance
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www.scgalliance.com | info@scgalliance.com

Furthermore, we ask that the County respect the rights of medical cannabis patients and adults to grow and share cannabis from their own personal garden, which should not be defined by a numerical plant count or plot area but rather by the lack of any commercial activity (i.e. sales) associated with that cannabis.

- **Consider the impacts of reducing unnecessary restrictions on farmers.** For example, the County should make it easier to process on-site and remove arbitrary limits on immature plant area canopy.
- **Take equity into consideration.** We applaud Sonoma County for recently being awarded $687,561.00 in "Type 2" California GoBiz grant funding which is earmarked for equity applicants/licensees as part of a local cannabis equity program. Whatever updates to the cannabis ordinance are made must take equity-related issues into account. That being said, there is no reason to wait until the finalization of the EIR process and new ordinance development to begin further work on Sonoma County's cannabis equity program. We look forward to being part of this conversation moving forward.

In addition to the EIR scoping notes above, encourage you to consider the comments submitted by the Hessel Farmers Grange, which also represents local cannabis operators, as well as the comments submitted by other groups and individuals who have first-hand experience working in or alongside this industry. Furthermore, we reiterate our request for a dedicated Cannabis Program Manager and a Board of Supervisors Committee dedicated to cannabis.

Thank you,

Sonoma County Cannabis Alliance
Board of Directors & Policy Committee

Sonoma County Cannabis Alliance
321 S. Main Street, #524, Sebastopol, CA, 95472
www.scgalliance.com | info@scgalliance.com

From: Kim Roberts-Gutzman
To: Cannabis
Subject: Living with cannabis producers
Date: Thursday, March 9, 2023 7:44:51 AM

EXTERNAL

County Cannabis Regulators

I live next to a cannabis producer. My private dead-end easement road has double the vehicles from this property. Mack trucks and other large vehicles along with speeding cars in the middle of the night. The property has 4 ugly cargo containers with some kind of noisy equipment making a constant noise. The smell of cannabis is horrible at times. I have to leave my property to get away from it. We need larger setbacks from a product that stinks this bad. We have young men parking on our property at night walking down the easement road to the cannabis property. Luckily we own animals that sound an alarm waking us. Where we drive on the road to notify them that the police are on the way. This cannabis property has guns of all caliber and have been shooting for hours since May. People in a 2 mile radius have been calling 911 to no avail. Gun shots are terrorizing the neighborhood. Children are hiding under their beds thinking someone is coming to kill them.
Changes need to be made!
Kim Roberts
1750 Barlow Lane
Sebastopol, CA. 95472
707 974-2226

From:	Richard Navarro
To:	Cannabis
Subject:	Cannabis comments
Date:	Thursday, March 9, 2023 8:07:30 PM

EXTERNAL

I am opposed to allowing cannabis to be planted in neighborhood areas. Don't want the extra water usage, the smell, the extra traffic created, the removal of agriculture land usage, the intrusion of cannabis industry into family areas. There should be no permits given that favor the introduction of cannabis agriculture into our family community.
Please oppose any attempts to bring cannabis into our community.

Richard Navarro
Sebastopol

Sent from my iPad

From:	craigspencerharrison@gmail.com
To:	Cannabis
Cc:	Crystal Acker
Subject:	Scoping-- Exclusion Zone Policy Paper (December 2021)
Date:	Friday, March 10, 2023 2:20:17 PM
Attachments:	Exhibit A Exclusion-Criteria-Recommendation-2018 04-25.pdf Exhibit B CAG-Inclusion-Exclusion-Recommendations.pdf Exhibit C Exclusion-combining-zone-notice-public-staff-report-20160524.pdf Exhibit D Exclusion Zones to be studied.pdf Exhibit E 1000 ft buffer.pdf Exhibit E Exclusion Zone- Bloomfield 12-2021.pdf Exhibit E Exclusion Zone- Bloomfield 12-2021.pdf Exhibit H Inclusion Zones to be studied.pdf Exclusion Zones. final Dec 2021.docx

Please file these under scoping, if they aren't already there.

Craig S. Harrison

In the “County of Sonoma 2017 Cannabis Ad Hoc Committee Charter/Scope of Work” document the following direction was given:

“Inclusion and Exclusion Zones – In December 2016, the board gave direction to staff to develop inclusion and exclusion combining zones for future consideration. The Ad Hoc will work on the development of combining zones that would allow the Board to carve out specific areas or properties on which to include or exclude certain cannabis land uses separately from what is allowed pursuant to the base zoning district.”

Below is a list of possible criteria that could be used in reviewing/assessing applications for creation of exclusion zones that would be received from interested parties. We currently envision that an exclusion zone would exclude all cultivation, but it may be possible to exclude outdoor and mixed light (for example) while continuing to permit indoor cultivation.

Due to strong interest, we suggest the exclusion concept be **fast tracked**. It is a relatively straight forward process to produce; and solves the problem of uncertainty for the cannabis grow applicant who will not be wasting time or money filing an application on a parcel which could end up in an exclusion zone. It is suggested that all ministerial applications be held until this process is finalized.

Allow for a process that lets future exclusion zone applications be submitted prior to a final ordinance adoption. This would allow the county to alert potential cannabis grow applicants that the area they are interested in will be having an exclusion zone application in process as soon as the ordinance is in place.

<u>List of exclusion zone criteria</u>:

1) **Inadequate access**
    a. narrow public road
    b. narrow private road
    c. easement across private property with no owner agreement for commercial use of road
2) **Water resource issues**
    a. inadequate water supply
    b. sensitive watershed
    c. interference with neighborhood wells and septic systems
3) **Residential character is to be preserved**
    a. current land use is residential
    b. neighborhood is clearly defined
    c. currently little or no commercial ag operations
    d. adjacent to residential area
4) **Sensitive flora or fauna habitat**
5) **Scenic corridor**
6) **Existing county study area**
    a. Inconsistent with area specific plan
7) **Area defined to decide by ballot?**

Progress Report for March 2018 CAG Meeting from Inclusion/Exclusion Sub-Group

The Sonoma County Board of Supervisors passed a set of ordinances to regulate the cultivation, manufacturing, sale, and taxation of medical cannabis in December 2016. At that time there was little experience in other counties within the State of California upon which to base the ordinance, and there was a lively public debate over many parts of the regulations. This is especially true regarding the decision over zoning: what cannabis cultivation permits would be available for parcels in what land use zones. Because the Supervisors recognized that their December 2016 decision on cannabis zoning would likely not be optimal in all cases, they adopted a provision that allowed inclusion and exclusion combining overlay zones, which would essentially allow for exceptions to their broad zoning decisions.

In early 2017, a new Supervisor ad hoc committee on cannabis was formed, and this ad hoc decided to convene a citizen’s advisory group as a source of ideas and input for issues surrounding the existing medicinal cannabis regulations and upcoming adult use cannabis regulations. This advisory group was selected from volunteers who applied to be in the group…mostly interested parties who were active in the process of creating the regulations in 2015-2016. This group, the Cannabis Advisory Group (CAG), was convened not as a decision-making body, but as a body that could provide input and ideas to the Supervisors (through the county cannabis staff and ad hoc) from a variety of perspectives. It was decided early that this group would not vote on ideas to pass on, because that would limit the breadth of ideas being developed/offered and be subject to the group’s specific demographics. Instead the group was encouraged to work on ideas that met the goals of as many of the county’s citizens as possible, and where priorities of different group members diverged, offer a variety of ideas and possible solutions that the Supervisors might consider.

In early 2018 a working sub-group of the CAG was formed to evaluate the use of inclusion and exclusion zones to see if they could be used to help the existing cannabis regulations better meet the needs and desires of Sonoma County citizens. This working group consists of seven members which is less than a CAG quorum, enabling the team to have private working meetings to develop its initial ideas. These initial ideas would then be brought back to the entire CAG in a public forum, where additional input could be gathered from both CAG members and from the public. Because of the varied points-of-view and priorities of the CAG and the working sub-group, we expect that a consensus recommendation regarding inclusion and exclusion zones will not be reached, but instead a range of options will be forwarded to county staff for further analysis and possible presentation to the Board of Supervisors. Thus the idea will not be to present a single recommendation, but instead to provide a wide range of possible solutions to zoning-related problems perceived by county residents both within and outside the cannabis industry. The Board of Supervisors will then decide what its own priorities are and what issues it in fact wants to address using inclusion and exclusion zones, and then it will vote to choose one or more solutions to those issues.

The objective of the use of inclusion and exclusion zones is to better meet the needs of Sonoma county residents relative to the existing December 2016 zoning regulations. Thus the first job of the working sub-group was to evaluate what groups are not being well-served under the zoning regulations as they currently exist. Overwhelmingly two issues were identified which are causing significant consternation to different county residents. First, small-scale cannabis growers (that are purported to number in the thousands) who have for the past number of years raised their crops on small residential plots have found that they have very limited options to join the new legal California cannabis market. These growers have little capital, and most of what they do have is invested in their home and land. When the 2016 regulations did not allow for commercial cannabis cultivation in RR and AR parcels, their path to the legal market became the lease or purchase of a second (likely larger) parcel of land zoned DA, LIA, or LEA. With the rush to the more limited supply of agricultural-zoned properties by these small-scale growers as well as outside businesses looking to join the market in Sonoma County, land prices have escalated and the local growers have felt crowded out of the market. That is, crowded out of both the land market and the legal cannabis market.

The second issue identified is that of the resistance to commercial cannabis cultivation by rural county residents who live in areas that have become primarily residential over the years despite being zoned agricultural. These are mostly owners of DA parcels, and mostly of parcels less than 10 acres in proximity to RR neighborhoods, but also include owners of larger parcels in more spread-out tracts. These residents feel that movement of commercial cannabis grow operations into their areas will impact the quality of life in their neighborhoods through visual impacts, odors, the risk of violent crime, and the general bustle of commercial activities around their homes. They are also wary about the impacts of cannabis on their roads, soil, and water supplies; some of these areas are quite environmentally sensitive. They feel that they live in rural residential neighborhoods despite the inherited agricultural zoning of their land, and as such deserve the same isolation from commercial activity as RR and AR zones.

Having recognized these two issues brought about by current zoning regulations, we have tried to identify possible solutions that may resolve or at least ease them. We recognize that the Board of Supervisors may not feel that one or either of these issues are high on their list of priorities, but these are the issues that up to now this working group has felt justified to provide input on.

In discussing these issues it became clear that the idea of inclusion zones was not going to be as simple to implement as exclusion zones. Exclusion zones are areas where normally by zoning regulation the cultivation of cannabis would be allowed, but where instead it is prohibited (or at least restricted) by virtue of exclusion zone status. In this case the “benefit” of exclusion zone status is shared equally by all landowners who don’t want cannabis cultivation allowed in the area. This evenly shared “benefit” makes for a relatively simple process of agreement and banding together among like-minded landowners to share political and financial costs to request exclusion zone status. The “benefits” of inclusion zone status, in contrast, would generally not be shared evenly by all landowners within the zone, but only by those who are actually cultivating cannabis. This would lead to a group of landowners within the zone that is split between those who benefit and those who are at best indifferent to inclusion zone status. It would be difficult to drum up widespread support for creation of an inclusion zone, and would likely result in few large inclusion zones being created unless there happened to be a very dense concentration of growers. It is more likely that very small inclusion zones (or even individual inclusion parcels) would be applied for and created, where the “benefits” of inclusion zone status would be more universally appreciated by the smaller group of landowners. This processing of tiny inclusion zones or inclusion parcels would result in a logjam within the county zoning process and be an additional financial burden on inclusion zone applicants, in large part defeating the original purpose of the inclusion zones (attempting to make it easier for small-scale growers to enter the regulated market). For this reason the discussion of small-scale growers below strays from a strict discussion of inclusion zones and considers other alternatives as well.

Small-Scale Growers
A range of possible solutions to this problem have been discussed, trying to make more land available to bring small-scale growers into the regulated market. Some of these potential solutions involve inclusion zones and other options do not. These options include: allowing permits to multiple individual growers on large agricultural and/or industrial sites so that many small-scale growers can share the costs and infrastructure of a single large property (this may take the form of either co-operatives or private leasing arrangements); allowing non-flowering cannabis propagation and cultivation (nurseries) in RR/AR; allowing cottage-scale cultivation in larger RR/AR parcels through limited inclusion zones; and allowing countywide cottage-scale cultivation in larger RR/AR parcels by incorporating Staff's suggestions from November 2016.. These various options would not all have an equal impact on improving access of small-scale growers to the regulated market, and they would obviously have varying impacts on rural residents who are not growers.

Multiple Leases on Large Parcels
With small parcels generally unavailable to small-scale growers because of the prohibition of cultivation in RR/AR and the minimum lot sizes for agricultural parcels, we see a possible solution in the use of large agricultural (or industrial, for indoor cultivation) properties by multiple individuals. As examples, a 20-acre agricultural property might be used by 6-8 growers at the cottage or specialty level, or a 100 acre property might be used by a dozen growers at the small or medium level. In these cases, each of the individual growers would have her own permit to cultivate on this shared land. These growers would be able to share the cost of the studies needed in the permit process, to share noise-, odor-, traffic-, and waste disposal plans, to share water and security infrastructure, and still have a relatively low development density on the property. Particularly attractive land for this approach might be the large parcels that are currently used for disposal of treated county wastewater. While this approach wouldn't give the growers the convenience of growing at home, it could be a way to lower the cost of entry into the market for small-scale growers and allow them to continue intensive small-scale farming.

This approach is not possible under current county regulations because the regulations limit permits on a single property to a cumulative one acre. This limit was enacted in 2016 because of an anticipated one acre limit in California law. However, California has lifted that restriction, and the county could do so also if it is interested in this approach to aiding small-scale growers.

Nurseries in RR/AR
Two of the largest impacts of cannabis cultivation on neighbors in rural residential settings are the odor and the security risk around harvest time from having significant quantities of high-value flowering crop on location. In cannabis nurseries only a few plants are allowed to flower, and the vast majority of the material on site is in the propagation and juvenile plant stage. This material does not emit much odor and is not typically the target of thieves. Cannabis nurseries can be the locations where the valuable, creative process of development of new useful medicinal strains occurs, and this has been an important part of the cannabis industry in Sonoma County. Perhaps cannabis nurseries would be acceptable on certain RR/AR properties without the odor and security risks associated with the cultivation of mature plants. This could provide additional opportunities for small-scale growers on RR/AR properties within the county.

Cottage-Scale Cultivation in RR/AR
Another way of making land easier to acquire for small-scale growers in the county is opening up some RR/AR parcels to cottage-scale cannabis cultivation. Of course, the primary land use

in RR/AR is residential, and so this would only apply to growers who live on the land they are cultivating. This could be done in two ways:

1. By creating inclusion zones in certain areas where cannabis is more readily accepted, or where RR/AR land is used more agriculturally than residentially. Within the inclusion zones, the restrictions and minimum lot sizes that are used to govern DA could be adopted, or even more stringent lot size and setback requirements could be used. As discussed earlier, developing support for large inclusion zones may be difficult, as only a minority of landowners are likely to apply for cultivation permits. Also, it may be challenging to get cultivators currently working in the unregulated market to come forth to apply for an inclusion zone they may not, in the end, qualify for.

2. By allowing cultivation on select RR/AR parcels countywide by adopting the November 2016 recommendation of Staff to allow cannabis cultivation on parcels larger than 2 acres. This would open up approximately 9000 parcels in the county to cultivation. If a larger minimum parcel size were chosen, fewer parcels would be available (for example, with a 10-acre minimum, about 1000 parcels would become available). In this scenario, the November 2016 Staff recommendations that RR/AR cultivation must not be detectable by neighbors could be adopted - nothing seen, smelled, or heard. This additional requirement would potentially increase the required setbacks from neighboring residences and would also remove most impact on neighbors. It would also further limit the number of parcels eligible for outdoor and mixed light cultivation in these zones.

In general, the smaller the size of RR/AR parcels that are opened to cultivation and the more that are opened, the easier it would be for small-scale growers to join the regulated market. The trade-off to this would be the additional impact on surrounding residences as cultivation is more widely distributed.

Rural Landowners

Many rural landowners are upset with the influx of cannabis operations and permit applications in their neighborhoods. They are upset for a variety of reasons: environmental concerns, access concerns, concerns about odor, crime, aesthetics, and the onset of commercial activity in a serene rural residential setting. Exclusion zones can be an effective solution to these issues, separating these residential areas from cultivation facilities. They would, however, decrease the number of parcels available in the county to small-scale growers. In order to address these issues, a suggestion for exclusion zone criteria might include the following:

> Allow creation of exclusion zones in areas that are not suitable for commercial cultivation of cannabis because of any the following:
> 1) There is inadequate access, water, or electrical service
> 2) Cannabis cultivation would be incompatible with the biotic character of the area
> 3) There is a significant fire hazard due to topography, vegetation, and/or accessibility
> 4) The residential character of the area would be significantly compromised by the installation of a commercial cannabis cultivation operation.

Proposed exclusion zones should be contiguous with relatively uniform current land usage, but all parcels need not all have the same zoning. Another potential exclusion criterion that was discussed relates to existing study areas: parts of the county with area-specific development plans. These areas could be considered for exclusion zone status if commercial cannabis cultivation is seen as inconsistent with the area-specific plans.

County of Sonoma Agenda Item Summary Report

Clerk of the Board
575 Administration Drive
Santa Rosa, CA 95403

Agenda Item Number:
(This Section for use by Clerk of the Board Only.)

To:	Board of Supervisors
Board Agenda Date:	May 24, 2016
Vote Requirement:	Majority
Department or Agency Name(s):	Permit and Resource Management Department
Staff Name and Phone Number:	Jane Riley 565-1833
Supervisorial District(s):	First and Fourth
Title:	Zone Change to add the Vacation Rental Exclusion (X) Combining Zone; County of Sonoma. PRMD File No. ZCE16-0003.

Recommended Actions:

Hold a public hearing and adopt an Ordinance rezoning various parcels to add the Vacation Rental Exclusion (X) Combining Zone to certain residential areas within the Sonoma Valley and the north county. APNs: Various; see attached list.

Executive Summary:

On January 26, 2016, the Board of Supervisors considered a package of vacation rental code amendments designed to reduce neighborhood impacts and protect housing stock, including a recommendation from the Planning Commission to prohibit the establishment of new vacation rentals within the Low Density Residential (R1) Zone. Rather than adopt an outright ban on these properties countywide, the Board directed that the Vacation Rental Exclusion (X) Combining Zone be used to specify the areas in which vacation rentals will not be allowed.

On March 15, 2016, the Board of Supervisors adopted Resolution of Intention 16-0085 directing staff to initiate rezoning procedures to consider application of the Vacation Rental Exclusion (X) Combining Zone to certain areas identified by the Board. While the Board chose not to adopt a ban on vacation rentals in all low density single family zones, there are some areas of the County that have been identified as having certain characteristics that necessitate vacation rental exclusions, such as low housing availability and poor neighborhood compatibility. The Resolution of Intention directed staff to consider adding the Vacation Rental Exclusion (X) Combining Zone in the following areas:

a) All R1 Low Density Single Family Residential and RR Rural Residential zoned properties within the communities of Boyes Hot Springs, Fetters Hot Springs, El Verano, Agua Caliente, Glen Ellen and Kenwood;
b) All of the parcels within the private residential communities of Diamond A, Foothill Ranch, Agua Caliente Knolls, Sobre Vista, Palomino Lakes, and the Vineyards subdivision;

c) The residential properties in the Nut Tree/Apple Tree neighborhood and those bordering Winter Creek Road in the Sonoma Valley; and
d) The Fitch Mountain area, bordered by Healdsburg city limits on the west and by the Russian River on the north, east and south.

Following adoption of the Resolution of Intention, PRMD staff identified all affected parcels and provided legal notification of the proposed rezoning to add the Vacation Rental Exclusion (X) Combining Zone Exclusion Combining Zone. Affected property owners and other interested parties were able to comment on the proposal at hearings before the Planning Commission held on April 14, 2016 and April 21, 2016.

Effect of the Vacation Rental Exclusion (X) Combining Zone
In areas where the Vacation Rental Exclusion (X) Combining Zone would be adopted, no new applications would be accepted for vacation rentals. Existing, fully permitted vacation rentals would be able to continue to operate, but their permits would expire upon sale or transfer of the property. All uses permitted in the respective base zone with which the X district would be combined would still be permitted, except for vacation rentals. Existing Combining Zones would not be affected by the Vacation Rental Exclusion (X) Combining Zone. Hosted rentals would continue to be allowed within the Vacation Rental Exclusion (X) Combining Zone.

Criteria for Placement
The Vacation Rental Exclusion (X) Combining Zone would be placed on parcels where one or more of the following criteria are met:

a) There is inadequate road access or off-street parking;
b) The prevalence of vacation rentals is detrimental to the residential character of neighborhoods;
c) The housing stock should be protected from conversion to visitor-serving uses;
d) There is a significant fire hazard due to topography, access or vegetation;
e) The residential character is to be preserved or preferred; and
f) Other areas where the Board of Supervisors determines that it is in the public interest to prohibit the establishment and operation of vacation rentals.

Each of the 7,810 parcels named in the Board's Resolution of Intention 16-0085 for consideration for inclusion within the Vacation Rental Exclusion (X) Combining Zone met one or more of the above criteria. Within each of the named areas, concern had been expressed related to one or more of the above issues, including high fire danger, limited road access, inadequate off-street parking, the loss of housing stock and the prevalence of vacation rentals eroding the residential character of neighborhoods.

Existing Permitted Vacation Rentals in the Vacation Rental Exclusion (X) Combining Zone
On and after the effective date of the rezonings to add the Vacation Rental Exclusion (X) Combining Zone to the parcels designated herein, no application would be accepted for establishment or operation of a vacation rental on any property with the X designation. Existing, fully permitted vacation rentals would be allowed to continue until sale or transfer of the property, at which time the vacation rental permit would expire automatically. A vacation rental permit could also be revoked for repeated

violations of the vacation rental performance standards, as set forth in the Vacation Rental Ordinance (26-88-120), and would not be able to resume as a vacation rental.

Pipeline Provision

The Board of Supervisors may establish a pipeline provision for new applications for vacation rentals that are going through the approval process during these proceedings. Typically, new complete applications submitted prior to the effective date of an ordinance would continue to be processed as usual. Staff has included this provision in the draft ordinance and recommends its adoption.

Future Requests for the Vacation Rental Exclusion (X) Combining Zone

Since the Board's March adoption of the package of zoning code amendments for vacation rentals, including provisions for the Vacation Rental Exclusion (X) Combining Zone, staff have received inquiries from neighborhoods that were not listed within the Resolution of Intention inquiring as to how to initiate the Vacation Rental Exclusion (X) Combining Zone rezone in their areas. Pursuant to 96-010 of Chapter 26 (Zoning) of the Sonoma County Code, requests for changes to zoning may be made by petition (application) of one or more residents of the area affected by the proposed zoning. They may also be initiated by the Board of Supervisors through adoption of a Resolution of Intention. In the future, residents of areas that meet the designation criteria of the Vacation Rental Exclusion (X) Combining Zone and wish to be considered for application of the Vacation Rental Exclusion (X) Combining Zone would need to file an application for a Zone Change with the Permit and Resource Management Department (PRMD). Neighbors in a single geographical area or neighborhood may file together as a single application, thereby reducing their costs, even if not all residents of the area agree about rezoning the neighborhood. All property owners would receive notice by mail of the request unless the number of properties affected exceeds 1000, in which case the law requires placement of a 1/8 page advertisement in a local newspaper. The Planning Commission and the Board of Supervisors would both hold public hearings to consider the rezoning requests. The current cost to apply for a Rezoning is about $8,400.

Planning Commission Actions and Recommendations

After receiving public input at their April 14 and April 21, 2016 public hearings, the Planning Commission reviewed each of the below areas included in Resolution of Intention 16-0085 and made their findings and recommendations on a 3-0-0-2 vote. While 7,810 parcels were originally included in the Resolution of Intention, the Commission recommended 6,204 parcels to move forward for the Board's consideration for the Vacation Rental Exclusion (X) Combining Zone.

Palomino Lakes (4th District)

Palomino Lakes is a private residential community outside of Cloverdale. The Planning Commission recommended this area for the Vacation Rental Exclusion (X) Combining Zone due to its narrow private roads and high fire danger.

The Vineyards (4th District)

The Vineyards is a private residential community outside of Geyserville. This community has recently reached a settlement agreement with some property owners that will allow vacation rental use for up to 14 days per year. This use would not be consistent with the Vacation Rental Exclusion (X) Combining Zone, which prohibits all vacation rental uses. The Planning Commission did not recommend this area for the Combining Zone.

Fitch Mountain (4th District)
Fitch Mountain consists of a mixture of permanent residential uses and vacation rental uses. Access is limited and roads are narrow with inadequate off-street parking. Fire danger is very high. The Planning Commission recommended the residential parcels of Fitch Mountain for the Vacation Rental Exclusion (X) Combining Zone due to extreme fire danger, inadequate access and parking, and the need to preserve residential character.

Kenwood (1st District)
All residentially-zoned parcels in Kenwood were included in the Resolution of Intention. The Commission recommended that only the R1 urban residential parcels be included in the Vacation Rental Exclusion (X) Combining Zone, citing the need to preserve permanent housing stock and the preservation of residential character. The RR parcels in the Kenwood Community were not recommended for the Vacation Rental Exclusion (X) Combining Zone.

Glen Ellen/Hill Road (1st District)
Glen Ellen is a mix of urban residential and rural residential parcels, and includes some rural areas with limited access. All residentially-zone parcels in the Glen Ellen area were also included in the Resolution of Intention, similar to Kenwood, to allow full consideration of these areas. The Commission recommends the inclusion of all of the R1 urban residential parcels within Glen Ellen, and also the inclusion of some of the Rural Residential parcels on the west side of town. The Commission also recommended application of the Vacation Rental Exclusion (X) Combining Zone to the entire Hill Road area, citing poor road access and fire danger.

The Foothills (1st District)
The entire private residential community of the Foothills was recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone due to limited road access and high fire danger.

Sobre Vista (1st District)
The entire private residential community of Sobre Vista was recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone due to limited road access and high fire danger.

Diamond A (1st District)
The entire private residential community of Diamond A was recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone due to limited road access, high fire danger, and the need to preserve the residential character of this community.

Agua Caliente Knolls (1st District)
Ague Caliente Knolls is a residential community composed mostly of smaller urban residential parcels, and there have been a number of neighborhood complaints related to vacation rentals here. This subdivision was recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone for reasons of neighborhood compatibility and preservation of residential character.

Nut Tree/Apple Tree Area (1st District)
This Rural Residential area has also generated many neighborhood complaints related to vacation rentals, and is recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone for the reasons of neighborhood compatibility and preservation of residential character.

Winter Creek Lane (1st District)
This subdivision is recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone for the reasons of poor access and parking, and the need to preserve the residential character of the area.

Boyes Hot Springs (1st District)
The Springs area is also a mixture of rural and urban residential parcels, and the Planning Commission considered this area in two parts. Part one includes all of the urban residential (R1) parcels within the Springs, which are recommended for inclusion within the Vacation Rental Exclusion (X) Combining Zone for reasons of the preservation of permanent housing stock, neighborhood compatibility, and the preservation of neighborhood character. Part two of the Planning Commission's recommendation considered the rural residential areas. The Commission did not feel that the Vacation Rental Exclusion (X) Combining Zone should be applied to all of the rural residential areas shown in the Resolution of Intention, and recommended only that certain areas on the west side of Arnold Drive, generally with smaller parcel sizes, permanent housing stock necessitating preservation, and a history of complaints, should be included within the Vacation Rental Exclusion (X) Combining Zone.

Options for Board Action

The Board of Supervisors may include some, all, or none of the recommended parcels within the Vacation rental Exclusion (X) Combining Zone. The Board may request the removal of parcels or areas from the recommended Combining Zone. The Board may also request the addition of parcels or areas into the Combining Zone, but may only do so as a part of today's action if those areas were included in the public notice. Mapping services will be available at the Board hearing if needed.

Prior Board Actions:

03/15/2016: The Board adopted Ordinance No. 6145 making changes to the Vacation Rental Code, and adopted Resolution of Intention 16-0085 directing staff to consider application of the Vacation Rental Exclusion (X) Combining Zone to a variety of parcels in the 1st and 4th Districts. Ordinance No. 6145 became effective on April 14, 2016.

01/26/2016: The Board straw-voted changes to the Zoning Code for vacation rentals and identified areas for future application of the Vacation Rental Exclusion (X) Combining Zone Exclusion Combining Zone

11/04/2014: The Board adopted a Resolution of Intention directing staff to conduct a robust public outreach program and undertake amendments to the Vacation Rental Ordinance.

10/07/2014: The Board considered the Auditor's Report on Vacation Rentals and provided direction to PRMD staff on the Resolution of Intention to amend the Vacation Rental ordinance.

11/09/2010: The Board adopted the Vacation Rental Ordinance, effective January 1, 2011.

11/03/2009: The Board adopted a Resolution of Intention directing staff to amend the Zoning Code to include provisions for vacation rentals, as recommended by the Ad Hoc Committee.

04/21/2009: The Board considered the compatibility issues with the use of single family homes as transient rentals and considered a range of possible policy options. The Chair appointed two supervisors

to an Ad Hoc Committee to return with a recommendation.	
Strategic Plan Alignment	Goal 1: Safe, Healthy, and Caring Community
Application of the Vacation Rental Exclusion (X) Combining Zone to selected parcels will preserve existing housing stock, reduce fire danger, and improve neighborhood compatibility.	

Fiscal Summary - FY 15-16

Expenditures		**Funding Source(s)**	
Budgeted Amount	$		$
Add Appropriations Reqd.	$	State/Federal	$
	$	Fees/Other	$
	$	Use of Fund Balance	$
	$	Contingencies	$
	$		$
Total Expenditure	**$**	**Total Sources**	**$**

Narrative Explanation of Fiscal Impacts (If Required):

Vacation Rentals countywide generate an estimated $2000 in TOT per property, per year. There are currently 268 permitted vacation rentals located within areas recommended for the Vacation Rental Exclusion (X) Combining Zone. As properties with the X Zone designation begin to be sold and their permits expire, the County could see a decrease in TOT revenue over time. If residential turnover is 5% per year, the expected decrease in TOT revenues would be approximately $6000 per year, compounded annually.

Staffing Impacts

Position Title (Payroll Classification)	**Monthly Salary Range** (A – I Step)	**Additions** (Number)	**Deletions** (Number)

Narrative Explanation of Staffing Impacts (If Required):

None.

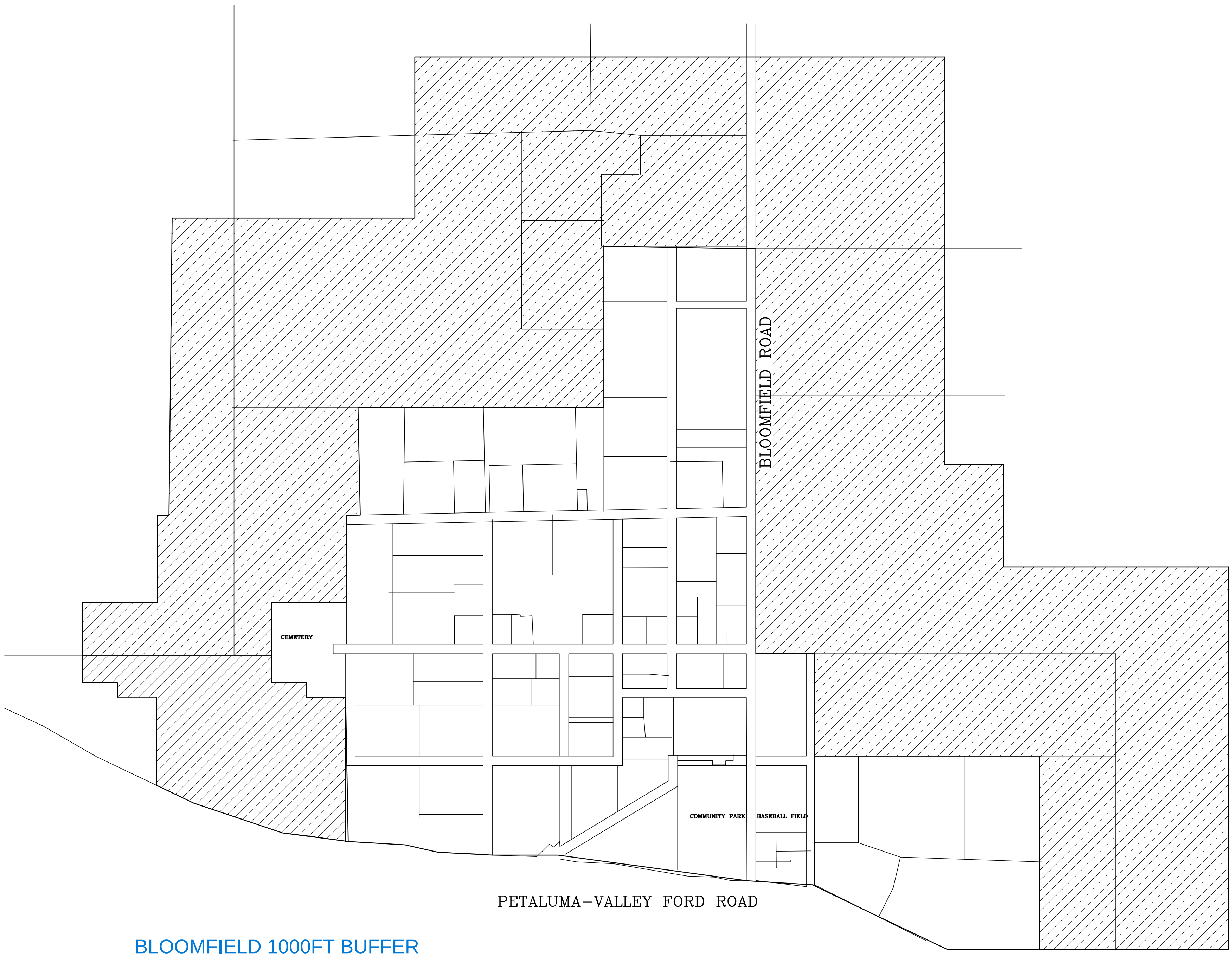
Attachments:

Exhibit A: Draft Ordinance with Attachment A (APN List) and Attachment B (Maps)
Exhibit B: Planning Commission Resolution No. 16-002, dated April 21, 2016
Exhibit C: Planning Commission Draft Minutes dated April 21, 2016
Exhibit D: Planning Commission Draft Minutes dated April 14, 2016
Exhibit E: Planning Commission Staff Report dated April 14, 2016
Exhibit F: Public Correspondence

Related Items "On File" with the Clerk of the Board:
None.

Exhibit D—Exclusion Zones to Be Studied

1. Bennett Valley (all parcels included in Bennett Valley Area Plan)
2. Bloomfield (parcels identified in Exhibit E)
3. Franz Valley. Parcels bordered by:
   West/NW: include all of Pepperwood Preserve
   East/NE: include the Joe Montana property (10500 Franz Valley Road), top of Oat Hill (ridge between Franz Valley and south edge of Knights Valley) to the Napa County line
   East/SE: Napa County line
   South/SW: Napa County line to Mountain Home Ranch Road to Porter Creek Road to Franz Valley Road (at Porter Creek Road/Mark West Springs Road.
4. Liberty Valley (to be defined later)
5. Coffee Lane, Sebastopol (all parcels; this may be subsumed in the Ragle Ranch Area)
6. Los Alamos Road and side roads accessed by Los Alamos Road (all parcels)
7. Palmer Creek Road (all parcels)
8. Mark West Springs Watershed (to be defined later)
9. Penngrove (to be defined later)
10. Ragle Ranch Area (parcels identified in Exhibit F)
11. Firestone/Gold Ridge Area (parcels identified in Exhibit G)
12. Voter-protected community separators (all parcels)



BLOOMFIELD 1000FT BUFFER

Scoping- Cannabis EIR- Exclusion Zone- Bloomfield-12/17/21

The subjects that can be covered under an EIR are as follow:

Aesthetics, Agricultural and Forest Resources, Air Quality, Biological Resources, Cultural Resources, Energy, Geology/Soils, Greenhouse Gas Emissions, Hazards and Hazardous Materials, Hydrology and Water Quality, Land use and Planning, Mineral Resources, Noise, Population and Housing, Public Services, Recreation, Transportation / Traffic, Tribal Resources, Utilities and Service Systems & Wildfire.

1. We advocate for only Conditional Use Permits – discretionary permits that require public hearing and environmental review, No more ministerial permits that can be approved without notice and environmental review in AG or RRD zones, especially those near residential enclaves.

2. Issues of concern:

a. Setbacks of sufficient size and able to be implemented to buffer residential enclaves from Odor, **noise, night lighting, safety of potential criminal incursion onto private property and inadequate Sheriff response time to our rural area, waste stream impacts from excess wastewater & environmental impacts of plastic hoop houses, endangered species or sensitive species-we have substantial wildlife activity including badger, wildlife corridors, wetlands, historic and cultural resources such as our cemetery, impairment of scenic vistas, water availability, including groundwater overdraft and reduced recharge impacting our wells-we have over 400 people in town and ranch families on the outskirts, County lack of enforcement on illegal grows without constant effort of neighbors and implementing conditions of approval on applications.**

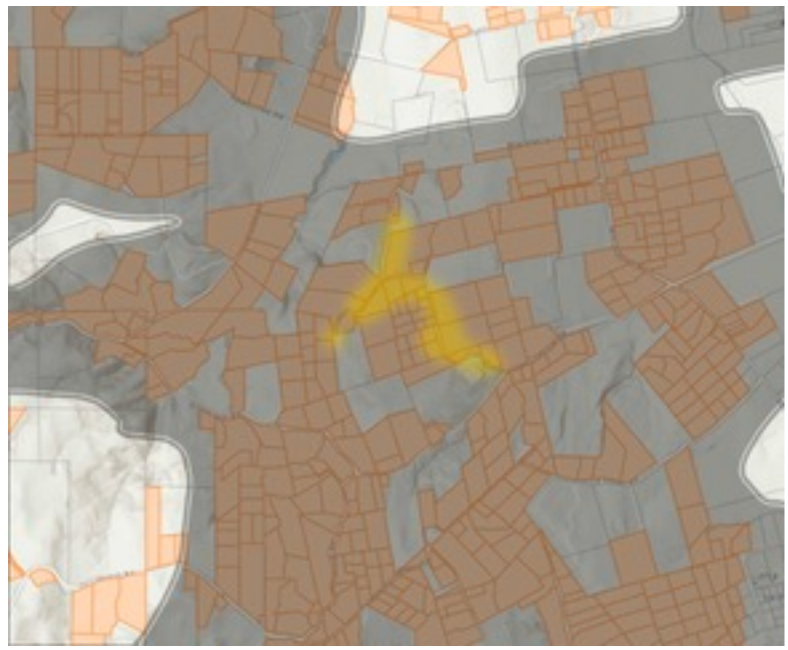
b. Study the impacts on processing plants located in close proximity to residences. We believe processing plants should be located in Commercial/Industrial zone districts due to their substantial negative impacts of: operating 24 hours, 7 days a week, deliveries on site from 8-5, commercial traffic on community substandard non-fire safe streets where two vehicles cannot pass concurrently, security fencing, and/or motion sensor night lights, audible alarms, security guards, significantly increased waste use endangering adjoining residential water source, chemical drift to residential uses, including agricultural chemicals and Fog odor neutralizing aerosols that contain oxidizing agents that have not been subject to long-term studies, increased noise at night when residents are home and sleeping at night, impacting residents enjoyment of night skies and significantly impacting wildlife, the 300 foot setback from residents homes using private property to buffer an industrial use and impact a homeowners use of private property without homeowner consent. Do not want to see cannabis tasting on site in a neighborhood setting and impaired drivers after evens on neighborhood street from events and parties

3. Studies we want to see to address environmental impacts

a. Air quality – technical studies, Comprehensive Water Availability Analysis, Adequate Analysis of environmental setting-by watershed, any environmental issues through which the **EIR technical analyses will develop siting criteria, setbacks and performance standards.**

4. Designate Exclusion and Inclusion zones as a means to achieve mitigation of Issues of concern above.

We are proposing a minimum 1000' buffer from the RR zoning around the town of Bloomfield (as shown in the maps below). From its inception in the 1850's Bloomfield had a core of smaller lots created in a typical grid pattern.The lots varied form .5 acres to 1.5 to 10 acres as a buffer to the adjacent larger agricultural site. The initial plan included a school site, community park and cemetery, which all exist today. When Sonoma County created zoning it respected this development pattern with RR zoning.
All lots were assumed to be large enough for residences and some smaller agricultural activity.
We are requesting a minimum1000' buffer to limit the impact of commercial cannabis on the adjoining residential community. Given the potential for larger scale grows in the future with hoop houses, 24hour security, commercial operations and the state requirements of closed fencing, the buffer would limit these impacts on our residents. The current dairy activities area have located their "intensive" operations in the center of their larger sites, naturally creating a buffer to the smaller residential uses. We would like this development pattern to continue.



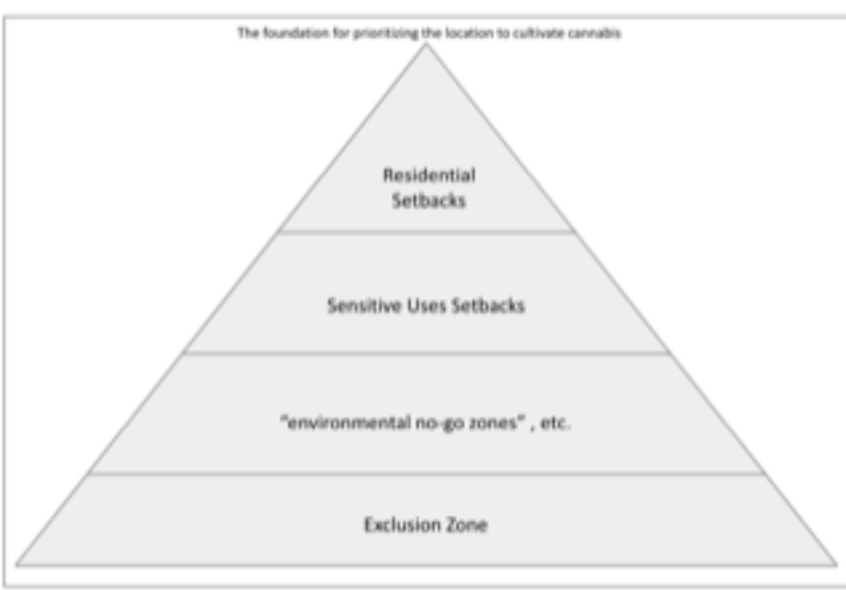


Exhibit H—Inclusion Zones to be Studied

1. All industrial-zoned parcels in Sonoma County, including those on Todd Road near U.S. 101 where many cannabis operations are already located (PRMD should consider beginning the rezoning process to increase the number of industrial-zoned parcels)

2. Parcels near Charles M. Schutz Airport (many of these are zoned industrial)

3. Parcels near wastewater treatment plants, including the following (finding a master list of such plants has been challenging, and there may be additional locations):

   a. Sonoma Valley Wastewater Treatment Plant, 22675 8th Street East Sonoma

   b. City of Santa Rosa Laguna Wastewater Treatment Plant, 4300 Llano Rd. Santa Rosa

   c. Russian River County Sanitation District Treatment Plant, 18400 Neeley Road, Guerneville

   d. Charles M. Schulz Airport Wastewater Treatment Plant (near Sanders Road)

Bennett Valley Residents for Safe Development

Scoping—Study Designating Exclusion and Inclusion Zones

December 17, 2021

An overall goal of the revised cannabis program should be to reduce the angst and simmering hostility between growers and rural neighborhood residents. After five years, it is evident that the needs and desires of these groups are incompatible. Identifying exclusion zones where cannabis cannot be commercially grown, processed, or sold is a first priority. There are many easily-identifiable areas where there is strong resistance to cultivation, and eliminating them from the permitting system would result in fewer complaints and fewer permit appeals. County staff could redirect its time and resources to processing applications outside of exclusion zones and to enforcement issues. Inclusion zones where permitting is expedited should also be identified. This will also save staff time.

Albert Einstein observed that "insanity is doing the same thing over and over again and expecting different results." Continuing to allow cannabis cultivation scattered all over the county in areas where there is strong local resistance is the worst possible policy, and would prolong the current program's manifest failures. Once exclusion zones are designated, many controversies will disappear.

Exclusion Zones Have Long Been an Option in the Cannabis Ordinance.

Exclusion zones were included in the drafts of the original ordinance, and the Planning Commission approved creating them in 2016. Bennett Valley and perhaps other communities requested to be declared exclusion zones in 2016. Ultimately the supervisors declined to establish exclusion zones in the December 2016 ordinance and elected to give the issue more thought. The Charter/Scope of Work for the 2017 Cannabis Ad Hoc Committee included the following direction: "develop inclusion and exclusion combining zones for future consideration. The Ad Hoc will work on the development of combining zones that would allow the Board to carve out specific areas or properties on which to include or exclude certain cannabis land uses separately from what is allowed pursuant to the base zoning district." See Exhibit A.

In March 2018, the Cannabis Advisory Group's Inclusion/Exclusion Sub-Group's report (Exhibit B, p. 4) suggested that exclusion zones be created in areas where any the following conditions exist:

- There is inadequate access, water, or electrical service.
- Cannabis cultivation would be incompatible with the biotic character of the area.
- There is a significant fire hazard due to topography, vegetation, and/or accessibility.
- The residential character of the area would be significantly compromised by the installation of a commercial cannabis cultivation operation.

The Inclusion/Exclusion Sub-Group also suggested that area-specific plans "could be considered for exclusion zone status if commercial cannabis cultivation is seen as inconsistent with the area-specific plans." Exhibit B, p. 4.

In 2018, the Cannabis Ad Hoc Committee (supervisors Gorin and Hopkins) recommended that exclusion zones would be appropriate for areas where:

- Commercial cannabis is detrimental to residential character.
- Residential character is to be preserved.
- Water supply is inadequate.

Exclusion zones have wide popular support. In 2018, Save Our Sonoma Neighborhoods' polling company found that 70% of county voters approve of exclusion zones. PRMD's August 2021 survey found that 74% approve of exclusion zones. Providing communities with the right to chart their own destinies with respect to commercial cannabis is especially compelling given that cultivation of cannabis was legalized by the initiative process. Many who voted for Proposition 64 do not want commercial cannabis activities in their neighborhoods. Why not let them decide this issue for their own communities? The Planning Commission again approved the creation of exclusion zones in 2018, but the supervisors declined to establish them in October 2018.

Mechanism to Create Exclusion Zones.

An ordinance provision to create exclusion zones (technically, "combining district overlay zones") that forbids the commercial cultivation, processing, or sale of cannabis could readily be crafted using elements from the X Vacation Rental Exclusion Combining District, § SCC 26, article 79. On May 24, 2016 the Board designated about 7,800 parcels in 15 neighborhoods or communities in the first and fourth supervisorial districts to be exclusion zones for vacation rentals. PRMD's Summary Report is attached (Exhibit C).

The environmental impact report (EIR) for the revised cannabis ordinance should study providing for the exclusion of commercial cultivation, processing, or sale of cannabis in neighborhoods where one or more of the following criteria are met:

(a) Areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time.
(b) Areas where water supply is inadequate, including water zones 3 and 4.

(c) Areas that are located in a high fire severity zone designated by the Board of Forestry or an Extreme Fire Hazard designated by the Public Utilities Commission.
(d) Areas where commercial cannabis activity is detrimental to the residential character of neighborhoods.
(e) Areas where the primary residential nature is to be preserved, especially where many contiguous parcels under 10 acres in size are grouped together.
(f) Areas where the scenic character is to be preserved.
(g) Areas where law enforcement is inadequate because average response times are more than 15 minutes.
(h) Areas where there is strong resistance to commercial cannabis activity.
(i) Areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

Exhibit D is a working list of such neighborhoods that are requesting to be an exclusion zone and that should be explicitly studied. Additional neighborhoods may be added to this list, and the boundaries that are proposed here might be revised. The EIR should study having a buffer zone (e.g., minimum 1,000 feet) around the parcels to be excluded.

Mechanism to Create Inclusion Zones.

The EIR should also study including in the revised cannabis ordinance designating as inclusion zones (technically "combining district overlay zones") areas where commercial cultivation, processing, or sale of cannabis have limited negative impacts on communities or the environment. In such areas, cultivation could be permitted on an expedited basis with a less stringent environmental review process. This would hopefully provide an incentive for potential growers to locate their projects in such areas and avoid unnecessary controversy. PRMD's August 2021 survey found that 51% approve of inclusion zones. Exhibit H is a working list of such areas that should be explicitly studied. Additional areas may be added to this list, and the boundaries that are proposed here might be revised.

Issues to be studied in the EIR.

It is important that the EIR study not only the concept of exclusion and inclusion zones, but also the specific areas identified in Exhibits D and H relative to the criteria listed above under Mechanism to Create Exclusion Zones and Mechanism to Create Inclusion Zones. Following the example of the vacation rental ordinance, this would provide the necessary environmental review to allow designation of specific parcels in the revised ordinance without additional Board of Zoning Adjustment or board of supervisor hearings. The ordinance should also study allowing areas to become exclusion or inclusion zones as a zoning change processed in accordance with the provisions of Chapter 26, Article 96 of the County Code. Designating a large number of parcels as exclusion and inclusion zones in the ordinance would avoid lengthy petitioning processes, save PRMD staff time, avoid BZA hearings, and avoid appeals to the Board. The petitioning process should be a backstop for areas that were not considered or identified during the ordinance process.

From:	Daniel J. Wilson
To:	Cannabis
Subject:	Attention Crystal Acker / Response to County"s Cannabis Policy EIR
Date:	Friday, March 10, 2023 12:49:42 PM
Attachments:	2023 03 09 D. Wilson Ltr to Permit Sonoma re EIR.PDF

EXTERNAL

Ms. Acker and Staff of Permit Sonoma:

On behalf of Franz Valley property owner Ken Parr, please see attached correspondence regarding the County's Comprehensive Cannabis Program Update and, specifically, its planned EIR.

Thank you.

Daniel Wilson, Esq.
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100 Stony Point Road ▪ Suite 200 ▪ Santa Rosa CA 95401
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JOHN M. SANFORD
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BRIAN G. LANCE
SARAH M. LEWERS
DANIEL J. WILSON
* *Retired*

Attorneys and Counselors at Law

March 9, 2023

VIA E-MAIL

Crystal Acker
cannabis@sonoma-county.org
Permit Sonoma
2550 Ventura Avenue
Santa Rosa, California 95403

Re: Sonoma County Comprehensive Cannabis Program Update

Ms. Acker and Permit Sonoma Staff:

My firm represents Ken Parr, the owner of the properties at 8410, 8420, 8430, and 8394 Franz Valley School Road, Calistoga 94515 (Sonoma County). He grows grapes.

I write regarding the planned Program Environmental Impact Report ("EIR"), which the County noticed in its February 6, 2023 Notice of Preparation and Program EIR (the "Notice"). The Notice solicits public input on the EIR. As the County acknowledges, changes to its cannabis policies implicate "significant" environmental and other concerns that need to be carefully evaluated and mitigated, including under CEQA. (Notice at 5.)

There are large numbers of serious environmental concerns, all of which should be investigated and comprehensively addressed in the EIR. We will not attempt to list them all here. This letter focuses on a few issues that are particularly salient for Mr. Parr and the other grape growers and residents in Franz Valley.

First, Cannabis produces copious amounts of terpenes. Studies indicate that these terpenes can significantly affect neighboring vineyards.[1] Experts continue to opine that this is a potentially serious concern. For example, Dr. Anita Oberholster of University of California, Davis, says that the terpenes can "change the character of the wine significantly. If one terpene or a combination of terpenes overpowers the wine, making it one-dimensional or imparting unpleasant characters to the wine, the wine may be considered tainted."[2]

Wine is the bedrock of the Sonoma County economy, and the source of livelihood for everyone in its largest industry. The County must thoroughly study any possible risk associated with the cannabis terpenes, including in a manner that accounts for all the potentially relevant variables (e.g. the proximity of the cannabis to the vineyard; the size and type of the cannabis grow; grape type; the length of exposure; etc.)

Second, cannabis cultivation causes noxious odors. These odors interfere with property owners' use and enjoyment of their land, as well spoil the experience of tourists and other visitors.

Third, cannabis cultivation is very water-intensive, far more so than wine grapes. Expanded cultivation threatens to exhaust the water supply that neighboring properties have relied upon for decades.

The above is far from exhaustive. In its EIR, the County should also study and address other issues such as: (a) pollution; (b) fire risk; (c) impact on wildlife; and (d) crime.

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[1] *See, e.g.*, Capone, D.L., Jefferey, D.W., & Sefton, M.A., *Vineyard and Fermentation Studies to Elucidate the Origin of 1,8-cineole in Australian Red Wine*, J. Agric. Food Chem. 60, 2281-2287 (2012) (finding that a type of terpene in eucalyptus trees, which also is present in cannabis, significantly affects terpene levels in grapes growing nearby).

[2] Quoted in https://www.independentnews.com/news/livermore_news/uc-davis-specialist-anita-oberholster-says-marijuana-odor-effect-on-wine-grapes-should-be-studied/article_60277538-3cb4-11ec-85f0-1b97ebc14294.html.

We appreciate the County's thoughtful consideration of these matters, and all others implicated by its cannabis policies, and urge caution in making changes that have any risk of harming those whose work has been the backbone of Sonoma County's economy and culture for decades or more.

ABBEY, WEITZENBERG, WARREN & EMERY P.C.

Dan Wilson

Daniel J. Wilson

From:	Deborah Eppstein
To:	Crystal Acker
Subject:	Fwd: Evacuation models from Dr. Cova
Date:	Friday, March 10, 2023 4:07:01 PM
Attachments:	Cova TJ Community Egress Concepts 2021 copy.pdf Cova Report pdf July 6 2020 Guenoc valley.pdf 2020-07-06 CBD comments Guenoc Valley Mixed Use Development FEIR copy.pdf Tom Cova DOI 2005 Should Fire-Prone Communities Have a Maximum Occupancy.pdf

EXTERNAL

Here are the attachments form Dr. Cova's work.

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Fwd: Evacuation models from Dr. Cova
Date: January 10, 2022 at 6:48:27 PM PST
To: Scott Orr <Scott.Orr@sonoma-county.org>, Crystal Acker <Crystal.Acker@sonoma-county.org>

Hi Scott and Crystal- can you please include these documents in the scoping evaluations for the cannabis EIR and draft cannabis ordinance? These are the documents I referred to in my December 16 email on wildfire safety.

Thanks- and here's to a really good 2022

Best,
Debby

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Evacuation models from Dr. Cova
Date: January 10, 2022 at 11:19:52 AM PST
To: Tennis Wick <Tennis.Wick@sonoma-county.org>

Dear Tennis,
In follow up, here is some useful information which should be and straightforward to implement on evacuation planning and modeling from Dr. Tom Cova, an evacuation planning expert from University of Utah.

The 1st attachment describes the model. I suggest starting here - it is readily understandable and should be applicable to development on all roads in the WUI in Sonoma County. This could form a basis for the evacuation planning for Sonoma County as well as determining safe levels of future development.

The 2nd attachment is Dr Cova's evacuation analysis that was convincing to the Lake County Judge in denying the EIR from the Guenoc Valley mixed use project proposal.

The 3rd attachment is the full document where analysis was included as Exhibit 1, and also contains Dr. Cova's full CV.
The 4th attachment is an earlier (2005) publication by Dr. Cova discussing concepts to consider to determine maximum development the WUI.

I look forward to herring your comments!

Thanks,
Debby
Deborah Eppstein
801-556-5004

Deborah Eppstein
deppstein@gmail.com

Public Safety in the Urban–Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?

Thomas J. Cova[1]

Abstract: Residential development in fire-prone wildlands is a growing problem for land-use and emergency planners. In many areas housing is increasing without commensurate improvement in the primary road network. This compromises public safety, as minimum evacuation times are climbing in tandem with vegetation and structural fuels. Current evacuation codes for fire-prone communities require a minimum number of exits regardless of the number of households. This is not as sophisticated as building egress codes which link the maximum occupancy in an enclosed space with the required number, capacity, and arrangement of exits. This paper applies concepts from building codes to fire-prone areas to highlight limitations in existing community egress systems. Preliminary recommendations for improved community evacuation codes are also presented.

DOI: 10.1061/(ASCE)1527-6988(2005)6:3(99)

CE Database subject headings: Fire hazards; Evacuation; Access roads; Traffic capacity; Transportation safety; Codes; Public safety; Transportation engineering.

Introduction

Residential development in fire-prone wildlands is a growing problem for land-use and emergency planners. Easy access to recreation, panoramic scenery, and lower property costs are enticing people to build homes in areas that would otherwise be considered wildlands. This development steadily increased in the United States from the mid 1940s, although local growth rates varied according to economic, demographic, and amenity factors (Davis 1990). At the same time, decades of fire suppression has resulted in a record abundance of fuel in and around many developments (Pyne 1997). This led the Forest Service to recently identify thousands of communities near federal lands as "at risk" to large conflagrations (U.S. Forest Service 2001).

The area where residential structures and fire-prone wildlands intermix is called the urban–wildland interface or wildland–urban interface (Cortner et al. 1990; Ewert 1993; Fried et al. 1999). In much of this area, homes are being added as the primary road network remains nearly unchanged. This is not surprising, as interface communities are often nestled in a topographic context that prohibits the construction of more than a few exiting roads. It is generally too expensive to build a road into a canyon, or onto a hillside, from every direction. Also, residents prefer less access because it reduces nonresident traffic. A common road-network addition is a culdesac that branches off an existing road to add more homes.

Incremental planning in fire-prone areas has a number of adverse impacts (e.g., wildfire effects, open space decline), but the focus in this paper is evacuation egress. "Egress" is defined as a means of exiting, and it can be viewed as accessibility out of an area in an evacuation. When a wildfire threatens a community, residents generally evacuate in a condensed time either voluntarily or by order. In past urban wildfires with short warning time, limited egress has proven to be a problem ("Charing cross bottleneck was a big killer" 1991; Office of Emergency Services 1992). Sheltering-in-place is a competitive protective action when there is not enough time to escape or a homeowner wishes to remain behind to protect property, but it is much less tested than evacuation in wildfires. However given increasing housing densities in fire-prone areas without commensurate improvements in the primary road network, the case for sheltering-in-place is gaining ground. This leads to an important question: "How many households is too many?" Or alternatively, "What is the maximum occupancy of a fire-prone community?"

Maximum occupancies are well defined and enforced in building safety, and it is common to see the maximum number of people allowed in an assembly hall posted clearly on the wall. This concept has not been applied to community development in fire-prone areas, although the broader terms of "access" and "egress" appear in contemporary codes (National Fire Protection Association 2002; International Fire Codes Institute 2003). Egress standards are currently defined in terms of minimum exit-road widths, or a minimum number of exits, without regard to how many people might rely on the exits. This is less sophisticated than building egress codes which link the maximum expected occupancy of an enclosed space with the required number, capacity, and arrangement of exits (Coté and Harrington 2003). Building egress codes have been hard earned over nearly a century of research, refinement, and loss of life (Richardson 2003).

The purpose of this paper is to apply egress concepts drawn from building fire safety to community egress in fire-prone areas. Although these concepts and codes were originally developed for

[1]Associate Professor, Dept. of Geography, Center for Natural and Technological Hazards, Univ. of Utah, 260 S. Central Campus Dr., Rm. 270, Salt Lake City, UT 84112-9155. E-mail: cova@geog.utah.edu

Note. Discussion open until January 1, 2006. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on October 7, 2004; approved on February 15, 2005. This paper is part of the ***Natural Hazards Review***, Vol. 6, No. 3, August 1, 2005. ©ASCE, ISSN 1527-6988/2005/3-99–108/$25.00.

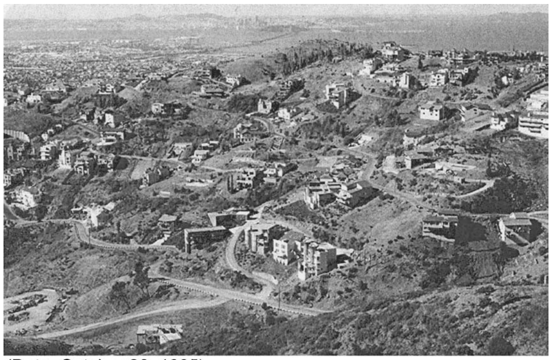

(Date: October 20, 1995)

Fig. 1. Looking west at narrow roads surrounding 1991 Oakland–Berkeley fire origin

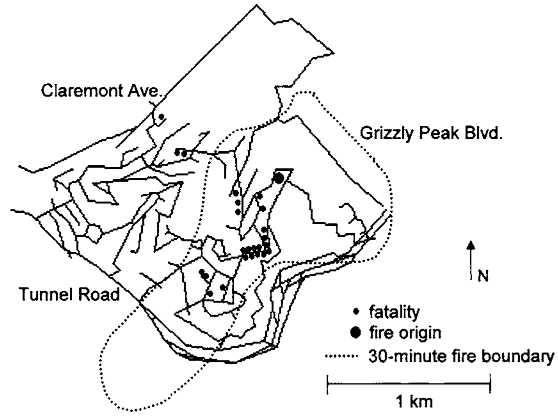


Fig. 2. Fatalities, fire origin, and approximate 30 min fire boundary in 1991 Oakland–Berkeley fire

small-scale, indoor spaces, they have potential utility in fire-prone communities. The first section reviews background on the growing urban–wildland egress problem. The next section reviews basic means-of-egress concepts defined in building codes. A method is presented to compare community egress systems based on concepts and standards from building safety that includes preliminary recommendations for new community egress codes. The paper concludes with a discussion of improvements that can be made to community egress systems.

Growing Urban–Wildland Egress Problem

Representative Communities

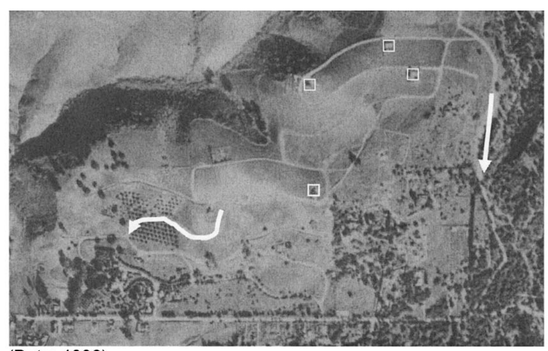
There are literally thousands of fire-prone communities in the West with a static road network and steadily increasing housing stock. This section briefly examines 2 representative examples. To date, the dominant focus of planners and residents in these communities has been structure protection with much less attention focused on egress issues. This may be due to the fact that property loss in wildfires is much more common than loss of life. Poor egress in interface communities is generally the result of narrow roads, irregular intersections, and few exits. In most of these areas the likelihood of an extreme fire is increasing in tandem with the vulnerability created by steadily climbing minimum evacuation times. Without fire to rejuvenate the ecological system, vegetation advances toward its fire recurrence interval as home construction adds additional fuel, residents, and vulnerability (Rodrigue 1993; Radke 1995; Cohen 2000; Cutter 2003).

Buckingham, Oakland, Calif.

Fig. 1 shows the neighborhood at the origin of the 1991 Oakland–Berkeley Fire 4 years after the fire. Without vegetation to obscure the view, it is clear that the road network is a maze of narrow streets. The photo was taken during the initial rebuilding process when hazard abatement procedures were being considered. At the time of the fire there were 337 homes in this neighborhood with four exits. The fire blocked the two primary exits in its first 1/2 h (Tunnel Road east and west), leaving the remaining residents two narrow, uphill exits. Most of these residents chose to leave on Charing Cross Road, a 13 ft wide afterthought that was not designed to handle this volume. Many of the fatalities (Fig. 2) were residents caught in or near their cars at the end of a traffic queue when the fire passed.

Mission Canyon, Santa Barbara, Calif.

Mission Canyon is a community just northwest of downtown Santa Barbara, Calif. that is adjacent to a chaparral ecosystem. The basic road network geometry was established in the 1930s and has changed little since (Fig. 3). In 1938 there were four households in the upper canyon using two exits (shown in white), but by 1990 there were more than 400 households relying on the same two exits. All households north the two exits (above) must use one of these two exits to leave, but households south of these exits (below) have more exiting options. The area was originally grasslands, but today it contains a significant amount of flammable, non-native vegetation (e.g., Eucalyptus) intermixed with wood structures. Prior evacuation studies have concluded that


(Date: 1938)

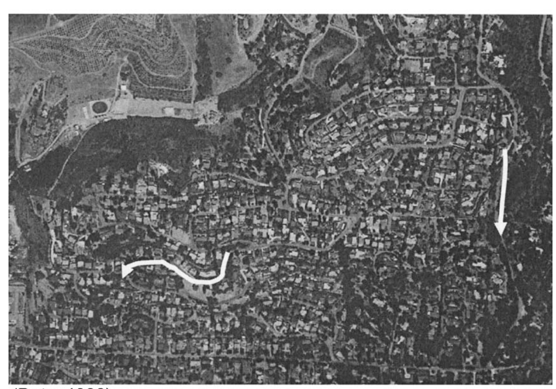

(Date: 1990)

Fig. 3. Mission Canyon in 1938 (4 homes, 2 exits in white) and 1990 (400+homes, same 2 exits in white)

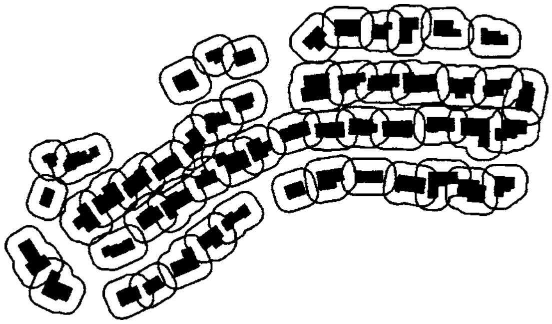


Fig. 4. Overlapping home ignition zones in fire-prone neighborhood (30 ft defensible-space buffer)

clearing upper Mission Canyon in the event of a wildfire would be relatively difficult (Cova and Church 1997; Law 1997; Church and Sexton 2002).

Protective Actions in Wildfires

Protective actions in a wildfire differ from a building fire in that sheltering-in-place in a structure, water body or safe zone (e.g., parking lot or golf course) is possible. This distinction is important because it means that evacuating a community may not be the best protective action in some cases (Krusel and Petris 1992). However, these cases can be difficult to assess during an event. Given more than enough time to evacuate, this is generally the best option for protecting life. If there is little to no time to evacuate, sheltering-in-place is likely the best option because evacuees risk being overcome by the fire in transit with much less protection than offered by a shelter. In the middle lies a gray area where evacuating may be the best option. As strongly as many experts feel about this issue (Wilson and Ferguson 1984; Decker 1995; Packman 1995; Oaks 2000), the uncertainty associated with a scenario can be too great to definitively state the best protective action. It depends on the quality of a shelter, road network geometry, fire intensity, wind speed and direction, visibility, travel demand, water availability and many other factors that are difficult to assess and synthesize under pressure.

A key hurdle in advising people to shelter-in-place in their homes is that not all structures are defensible. A defensible structure offers its occupants sufficient protection to withstand a passing wildfire. This is embodied in the concept of a "home ignition zone," or the area immediately surrounding a structure where ignition is feasible (Cohen 2000). Structures are not defensible if their ignition zones contain substantial fuel, adjacent ignition zones overlap, or both. If ignition zones overlap, then creating a defensible space would require homeowners to clear their neighbors' vegetation (Fig. 4). In other words, the wood structures in this figure are not defensible and an ignition chain reaction is possible. In cases where structures are sufficiently spaced, vegetation and other fuel within the home ignition zone can also render a structure indefensible. This is common because residents in these areas generally embrace trees and the amenities they provide. In dense, residential areas with wood structures, overlapping ignition zones and few viable shelters or safe zones, providing residents with sufficient egress is a critical issue.

Building Egress Codes

Early History

The concept of a maximum occupancy originated in an area of study called "means of egress." A means-of-egress is defined as, "… a continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three distinct parts: the exit access, exit, and exit discharge (Coté and Harrington 2003, p. 99)." Means-of-egress studies and associated codes incorporate all aspects of evacuating a building from stairway capacities and known crowd behavior under varying density to the proper illumination of exit signs. In setting standards for an enclosed space, an analyst can either examine the number, capacity, and arrangement of exits and calculate a maximum occupancy or, alternatively, examine the expected maximum occupancy and construct the required minimum egress. In either case, state-of-the-art egress standards and methods link occupancy to the number, capacity, and arrangement of exits.

Building egress standards can be traced to an occupancy–density study conducted by Rudolph Miller around 1910 in Manhattan (Nelson 2003). Miller's objective was to tabulate the density of workers per floor in 500 workshops and factories. This resulted in a wide range of densities from 19 to 500 ft^2 per person with the average for all floors at 107 ft^2 per person. In 1913 the National Fire Protection Association established the "Committee on Safety to Life" to study egress and formulate standards with a particular focus on advancing the principle of apportioning means-of-egress to the number of occupants in a building. One of the first egress standards was set by the New York Department of Labor in 1914 which limited the occupancy on each floor to 14 persons for every 22 in. of stair width. In 1935 the National Bureau of Standards published, "Design and construction of building exits," an important work in the history of building egress codes. One finding was that egress codes varied widely in regards to how many exits are needed, where they should be, and their required characteristics. Five different methods were discovered for determining required exits widths, and the report concluded with a new method that required stairwells have sufficient capacity to handle an evacuation of the most populated floor, the current method used in North American codes (Nelson 2003).

Modern Building Egress Codes

Contemporary methods for calculating a maximum occupancy for a building, floor, or meeting room are simple, but the number of possible building space uses and exit types is extensive (Coté and Harrington 2003). For example, the 2003 Life Safety Code© includes detailed exit-capacity adjustments (in persons) for stairways based on the presence, size and positioning of handrails, as well as ramp-capacity adjustments that incorporate ascending or descending slope (National Fire Protection Association 2003). In general, occupant load and building geometry determine the required number, location, and capacity of exits. An important aspect of a means-of-egress is that, "it is only as good as its most constricting component." Furthermore, a good design principle for an egress system is balance among exits because one or more might be lost in a fire.

A central concept in determining building egress is that of an occupant load factor. Occupant load factors are upper limits on density that vary with the use of the space. In other words, the nature of the use of a space determines its allowable density. For example, a "residential apartment building use" is allowed a gross

Table 1. Occupant Load Factors from Life Safety Code®[a]

Use	m^2 per person	ft^2 per person
Assembly use		
Concentrated, without fixed seating	0.65 net	7 net
Less concentrated, without fixed seating	1.4 net	15 net
Educational use		
Classrooms	1.9 net	20 net
Shops, laboratories, vocational rooms	4.6 net	50 net
Day Care use	3.3 net	35 net
Residential use		
Hotels and dorms	18.6 gross	200 gross
Apartment buildings	18.6 gross	200 gross
Industrial use		
General and high hazard	9.3 gross	100 gross

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density of 200 ft^2 per person while a "concentrated assembly (without fixed seating) use" allows a much higher net density of 7 ft^2 per person (Table 1). "Net" density refers to rooms, and "gross" density refers to floors or an entire building. Defining the maximum density for an indoor space based on its use is valuable because it bypasses the need to conduct an empirical occupancy study for every building. Occupant load factors derived from the table are then used in conjunction with the area of a meeting room or floor to design the means-of-egress system and also to trigger provisions like the need for a sprinkler system.

The required number, capacity, and arrangement of exits are determined using the occupancy load, the use of the space, and simple geometric rules. The required number of exits for each story is determined with a step function based on the use of the space and the occupancy load. Stories with less than 500 occupants require a minimum of two exits, those with between 500 and 1,000 require at least three exits, and more than 1,000 occupants requires at least four. A capacity-factor table specifies the minimum width for stairways and horizontal exits based on the use of the space. Most indoor activities require stairwells to have 0.3 in. of width for each person on the floor with the greatest number of occupants, but areas with hazardous contents require 0.7 in. per person, a much greater capacity (Table 2).

The linear relationship between the maximum number of occupants and exit widths was originally proposed by Pauls (1974) and widely adopted in North America. For example, a stairwell 44 in. wide has a capacity of (44 in./0.3 in. per person) = 147 persons for most floor uses (Table 2). If the occupancy of the floor is expected to exceed 147, then the stairwell capacity is insufficient and the maximum occupancy must be lowered or the stairwell egress capacity must be increased. The arrangement of the exits is determined using a simple geometric rule called the "one-half diagonal rule" that states that two exits shall not be located closer than one half the length of the maximum diagonal dimension of the area served (Fig. 5). This requires exits to be sufficiently remote so as to prevent a fire from blocking more than one. For example, if the maximum diagonal distance across a room with two exits is 60 ft., then the exits must be at least 30 ft. apart. Finally, an arbitrary distance cutoff is used to ensure that no building occupant is too far from an exit.

Table 2. Capacity Factors from Life Safety Code®[a]

	Stairwells (width per person)		Level components and ramps (width per person)	
Area	(mm)	(in.)	(mm)	(in.)
Board and care	10	0.4	5	0.2
Board and care, sprinklered	7.6	0.3	5	0.2
Health care, nonsprinklered	15	0.6	13	0.5
High hazard contents	18	0.7	10	0.4
All others	7.6	0.3	5	0.2

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Community Egress Codes

Despite the tremendous fire hazard in many interface communities, few studies have been done on residential densities in fire-prone areas (Theobald 2001; Schmidt et al. 2002; Cova et al. 2004). There is certainly nothing as complete as Nelson's (2003) longitudinal study of Washington D.C. federal building occupancy densities from 1927 to 1969. Second, there are no road-capacity studies for fire-prone communities on par with Pauls' (1974) extensive research on doorway and stairwell capacities. Roads in interface communities can be very narrow, intersect at odd angles, and vary in width. The capacity of this type of road network in dense smoke is difficult to quantify but would likely be very low. Third, existing egress codes for fire-prone communities are very general and do not provide the elegant methods for comparing and testing egress systems found in the building safety codes. The following codes serve as representative examples of contemporary community egress codes (National Fire Protection Association 2002):

1. 5.1.2 Roads shall be designed and constructed to allow evacuation simultaneously with emergency response vehicles.
2. 5.1.3 Roads shall be not less than 6.1 m (20 ft) of unobstructed width with a 4.1 m (13.5 ft) vertical clearance.

While the intent of the codes is clear, they do not link the occupant load with the required minimum number, capacity, and arrangement of exits. Current codes also tend to overlook the furthest distance a household is from its closest exit as well as vulnerability owed to dense fuel along the exits. In general, standards for interface community access focus more on maintaining fire-fighter ingress than resident egress (International Fire Code Institute 2003). Given that it is easy to find growing interface communities with miles of tangled narrow roads, many residents, and few exits, improved egress codes are a growing need.

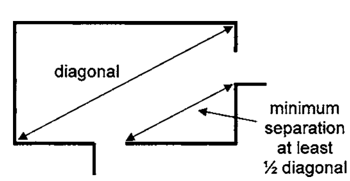

Fig. 5. One-half diagonal rule in building egress codes ensures that exits are sufficiently remote from one another

Differences in Community and Building Means-of-Egress Systems

Although there are many similarities between building and community egress systems, there are also significant differences. First, notification systems vary across communities (Sorensen 2000), whereas warning is generally issued with a siren, flashing lights, and a public address system in a building. For this reason, warning is nearly instantaneous and uniform in modern buildings, where it can take minutes to hours to warn all residents in a community, depending on the area, population density, and notification modes (e.g., reverse 911 or door to door). This has egress implications because the most constraining component in a community's egress system may simply be information, a vital yet scarce resource in most emergencies (Alexander 2002). However, slow notification can have benefits (if it is not too slow), as it can dampen household departure rates which reduces the likelihood of a traffic jam from a sudden burst of travel demand in a wildfire. Sudden bursts of travel demand are rare in evacuations but can lead to extreme stress when egress is constricted (Quarantelli et al. 1980; Chertkoff and Kushigian 1999), as in the case of the 1991 Oakland Fire.

Emergency manager behavior, population mobility, and human response are also important elements of an egress system. Emergency manager behavior is important because an incident commander generally decides who should evacuate and when they should leave (Lindell and Perry 1992). Mobility in a community context refers to the proportion of available drivers and vehicles in a population, whereas building evacuees are generally on foot or in a wheelchair. A glaring example of this constricting factor exists in many developing countries where mobility can be so low as to render regional evacuation infeasible (e.g., cyclones in Bangladesh). However, mobility can also cause problems if a highly mobile population leaves in a condensed amount of time and overloads an egress system.

Human response is also important, and evacuee behavior can be very different in wildfires than buildings. In building fires, occupants generally proceed directly out of the building or facility given sufficient egress, knowledge of the floor plan, and clear directions. In wildfires, there are family members, pets, horses, and livestock to evacuate, property to protect, and sheltering-in-place is always an option. These factors can dampen sudden spikes in egress demand but are more often a drawback in clearing an area quickly. In a building evacuation, the "walk, don't run" rule is used to dampen demand spikes and to reduce the likelihood of panic. Unfortunately, there are very few studies on wildfire evacuation behavior, but analogies can be drawn to evacuation behavior in other hazards that have been studied in greater depth (Perry 1985; Mileti and Sorensen 1990; Zelinsky and Kosinski 1991; Vogt and Sorensen 1992; Drabek 1996; Dow and Cutter 2002).

Perhaps the most obvious difference between building and community egress systems is the engineered components. Buildings have stairways, elevators, escalators, ramps, doors, handrails, and hallways, where communities have driveways, roads, intersections, stop signs, and traffic signals. Although these differences are significant, general concepts drawn from building codes may have value in a community context. One approach is to modify and extend building egress codes to achieve codes of comparable quality for communities.

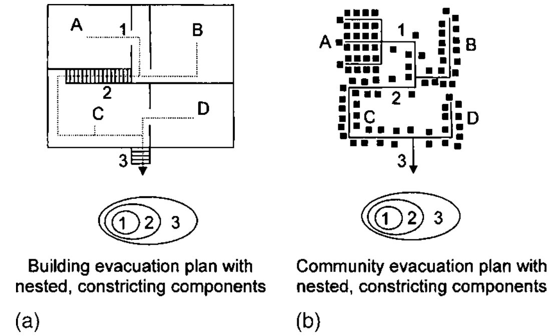

Fig. 6. Comparing nested, constricting components in building egress system with similar ones in community

What is a Community "Exit"?

An initial geographic problem in designing codes for communities might be deemed "the community exit problem." In a building context, exits have a component referred to as the discharge that leads people to a public way outside the building. In other words, safety is defined as "outside" the room or building. Inside and outside are ambiguous concepts in a community context and difficult to specify. If a predefined emergency planning zone (EPZ) is centered on a known hazard like a nuclear power plant or chemical stockpile site (Sorensen et al. 1992), then safety can be defined as outside the EPZ. In wildfires the zone to evacuate is defined on-the-fly at the time of the event and may expand in any direction as the fire progresses. For this reason, setting egress codes in advance that relate occupancy load to exit capacities requires searching the set of all potential evacuation zones.

An insight drawn from building studies can aid in addressing this problem. As noted, "A means of egress is only as good as its most constricting component." In a road-network context, this is referred to as a "bottleneck." A bottleneck can be used to define the inside and outside of a community, as traversing one is similar to clearing an exit discharge in a building (Cova and Church 1997). In other words, once a vehicle has successfully traversed a bottleneck, it is no longer a constraint on travel. This means that the community exit problem can be viewed as a search for potential roadway bottlenecks. In a sense, this is the approach adopted by interface codes that require at least two exits, as this precipitates a search for communities with only one exit, a potential bottleneck.

One problem with requiring that communities have more than one exit is that a bottleneck can still exist. In short, more than one exit does not ensure that an egress system is sufficient. It depends on the number of occupants, the arrangement and capacity of the exits, and the concentration of travel demand in space and time. Adding to this problem, bottlenecks can be nested in communities as they can in buildings. Fig. 6 compares nested constricting components in a building egress system with similar constricting components in a community context. Neighborhood A is nested within bottlenecks 1, 2, and 3. A building's outer wall is the point at which nested constraining components terminate, but in a community context, components nest from a street segment to a neighborhood, city, region, and so on. This can be addressed by terminating the search for egress bottlenecks when the area constrained is larger than that likely to be evacuated in a wildfire.

Table 3. Proposed Load Factors for Interface Communities

Use	Road length per household (m)	Road length per vehicle (m)
Residential[a]		
Low wildfire hazard	12.5	6.3
Moderate wildfire hazard	16.7	8.3
High+ wildfire hazard	20.0	10.0
Residential and tourism[b]		
Low wildfire hazard	12.5	4.2
Moderate wildfire hazard	16.7	5.6
High+ wildfire hazard	20.0	6.7

[a]2 vehicles per household.

[b]3 vehicles per household.

Table 5. Proposed Capacity Factors for Interface Communities

Use	Minimum total exit capacity (vph per household)	Minimum evacuation time (h)
Residential[a]		
Low wildfire hazard	1	2
Medium wildfire hazard	2	1
High+wildfire hazard	4	0.5
Residential and tourism[b]		
Low wildfire hazard	1.5	2
Medium wildfire hazard	3	1
High+wildfire hazard	6	0.5

[a]2 vehicles per household.

[b]3 vehicles per household.

Improving Community Egress Codes

Methods

The focus in a community context is therefore on identifying constricting components in a means-of-egress system. Furthermore, to achieve a comprehensive code and associated methods, the most constricting component should be defined in terms of the expected maximum occupancy as well as the number, capacity, and arrangement of exits. This is accomplished in a building context with look-up tables and simple geometric rules like the one-half-diagonal rule. In this section, preliminary analogues for interface communities are proposed. Agreed-upon community egress tables and codes will take significant cooperation among planners, and this represents a more formidable hurdle in terms of code development and compliance than the technical concepts discussed here (Burby et al. 1998).

Tables 3–5 represent community look-up tables for residential loading factors and the minimum number and capacity of exits. Table 3 depicts preliminary recommendations for community-based load factors expressed in road length per household, where communities with a greater fire hazard are required to have a lower density. In other words, as fire hazard increases the maximum allowable household density along roads should decline (Fig. 7). This is analogous to building codes which require a lower occupant density for buildings that contain hazardous materials (Table 1). To avoid delimiting a community's boundary, which is very subjective, "density" was defined as the average length of road (e.g., street centerline) per household in kilometers. This can be viewed as the average number of driveways per unit length of road. This calculation requires two easily acquired inputs that can be objectively measured: the number of households and total road length in the community.

Table 4 represents the minimum number of exits required for a community, which is a step function of the number of households. Allowing communities with only one exit to have up to 50 households avoids classifying all culdesacs as noncompliant with a two-exit minimum code. Table 5 represents the required minimum (total) exit capacity expressed in vehicles per hour (vph) per household. This is analogous to the linear relationship between persons and stairwell width in North American building egress codes (Table 2). The basis for the minimum required vph per household is a desired minimum evacuation time. For example, if a community has a high fire hazard (or greater), then the minimum evacuation time should be at most 30 min (0.5 h). Assuming two registered drivers per household, this requires that the exits have a minimum capacity of 4 vph per household. So a community with 100 households would need a total exit capacity of at least 400 vph to allow the estimated 200 vehicles to leave in 1/2 h (200 vehicles/0.5 h=400 vph). This coarse approach to estimating minimum evacuation time can be better tested for a given community with a traffic simulation model (Cova and Johnson 2002).

In most fire-prone communities, the "use" of the space is residential, but in larger communities there may be businesses, schools, churches, community centers, and tourist attractions (e.g., lakes, botanical gardens, hiking trails). Facilities and attractions above and beyond residences are important because community occupancy may vary significantly when tourists and tran-

Table 4. Proposed Minimum-Exits Table for Interface Communities

Number of households	Minimum number of exiting roads	Maximum households per exit
1–50	1	50
51–300	2	150
301–600	3	200
601+	4	

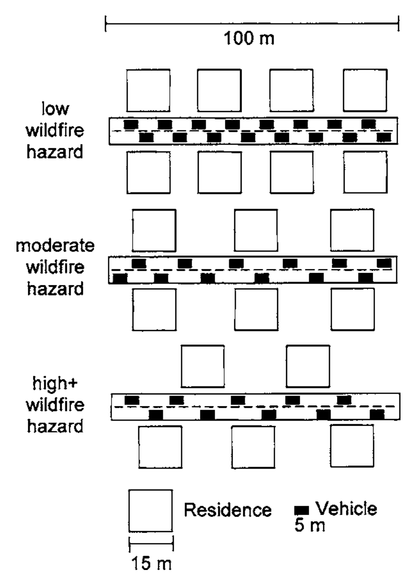

Fig. 7. Visual depiction of loading factor table for "residential use" assuming average of 2 registered drivers per home

sients are drawn (Drabek 1996). Furthermore, transient knowledge of the environment (e.g., evacuation routes) can be very poor. A community with a high degree of transients is analogous to an "assembly use" in building egress codes because occupants are generally unfamiliar with their environment. Table 5 requires a minimum capacity of 6 vph per household for high fire-hazard communities with tourism. So a community with 100 households and tourists would need a total exit capacity of at least 600 vph to allow the estimated 300 vehicles to leave in 1/2 h (300 vehicles/0.5 h = 600 vph). The assumed mean number of vehicles per household can be adjusted, but standards should be set using the maximum probable occupancy in an area rather than the residents (and thus vehicles) recorded by the census.

Using Tables 3–5 in conjunction with a diagonal rule, a maximum-distance threshold and an exit-vulnerability rule, it is relatively straightforward to develop preliminary codes and compare community egress systems. For example:

1. Occupant load factor (density). The density of homes along the roads in any fire-prone community or portion thereof should not exceed that specified in Table 3.
2. Number of exits. The number of means-of-egress from any fire-prone community or portion thereof shall meet the minimum specified in Table 4.
3. Exit capacity. The total egress capacity from a fire-prone community or portion thereof shall meet the factors specified in Table 5.
4. Exit arrangement. The closest distance between any two points along any of the *n* exits from a fire-prone community must be at least $1/n$ the maximum diagonal distance across the community. The maximum diagonal of a community is defined as the greatest Euclidean distance between any two households that rely on the same exit set, and the minimum distance between exits is defined as the shortest Euclidean distance between any two points along two exiting roads.
5. Maximum exit distance. No household in a fire-prone community shall be further than 3 km by road from its closest exit. The maximum exit distance for a community is defined as the household with the greatest shortest-path distance on the road network to an exit discharge in the most constraining bottleneck set (i.e., the end of one of the exiting roads from the community).
6. Exit vulnerability (distance to fuel). Exits in a fire-prone community shall have a 30 ft buffer on each side that is clear of fuel.

An important aspect of this approach is that each recommended code is an independent test. This means that a community can meet or fail any subset of the codes. For example, a community might meet the density and minimum-number-of-exits codes but fall short of the exit-capacity code. The advantage of independent tests is that distinct limitations in a community's egress system can be highlighted separately. Fig. 8 depicts the proposed characteristics measured for Mission Canyon.

Table 5 provides the important link between expected maximum occupancy and required minimum exit capacity. An interesting aspect of this table is that it can be applied in reverse to calculate a community's maximum occupancy. For example, if a high-fire-hazard residential community (i.e., minimum evacuation time no greater than 30 min) has a total exit capacity of 1,000 vph in the most constraining bottleneck set, then from Table 5 the maximum occupancy would be (1,000 vph/4 vph *per household*) = 250 households.

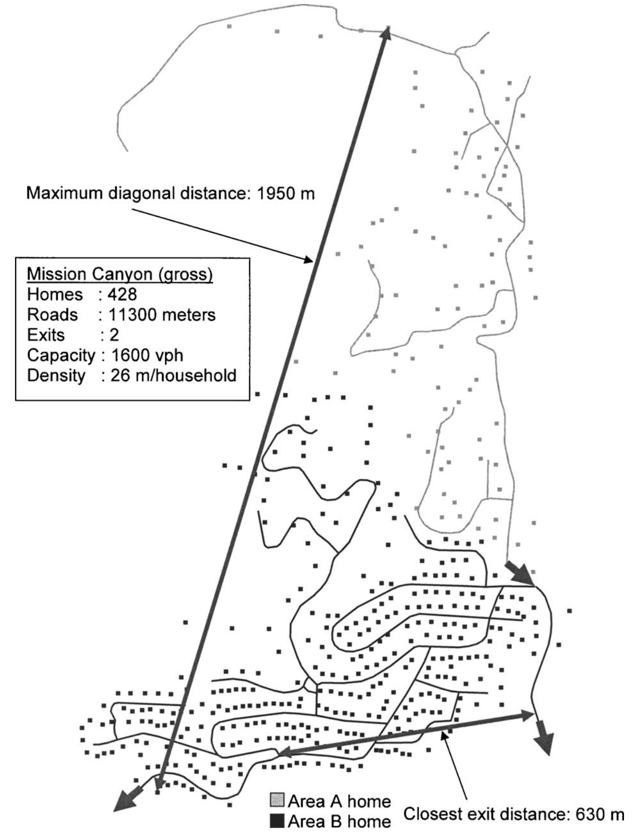

Fig. 8. Example (gross) egress calculations for Mission Canyon

Comparing Interface Communities

This section applies the proposed method to sample interface communities with high wildfire hazard, relatively low egress, and residential land use. A community with residential land use simplifies the estimation of occupant load by eliminating commercial, educational, and tourism activities. The inside (and outside) of each community is defined by the most constraining road-network bottleneck set. For example, if a community's most constraining bottleneck set is two exits, the calculations are for the households that would need to traverse one of these exits in an evacuation.

Perhaps the most involved calculation is for road capacity. This was crudely estimated using Eq. 8-3 in the *1997 highway capacity manual* (Transportation Research Board 1997):

$$\mathrm{SF}i = 2{,}800(v/c)_i f_d f_w f_g f_{\mathrm{HV}} \tag{1}$$

This equation states that a road's service flow rate (SF_i) in vehicles per hour (vph) is the product of the volume-to-capacity ratio for level-of-service i $(v/c)_i$ and a set of adjustment factors for directional traffic distribution f_d, lane and shoulder width f_w, grade f_g, and the presence of heavy vehicles f_{HV}. A narrow, mountainous road operating at level-of-service E (0.78) (maximum capacity) is assumed (for this analysis) with 100% of the traffic in one direction (0.71) on a 9 ft wide lane and 2 ft shoulder (0.70) heading downhill (1) with the possible 3% presence of large recreational vehicles (0.75) for an estimate of capacity per exit in clear visibility conditions with moderate demand rates of 814 vph (rounded to 800). In communities with uphill exits, wider roads or no recreational vehicles, this can be adjusted. Concentrated demand could greatly degrade this flow rate to level of service *F* where capacity can no longer be reliably estimated. Also, it should be noted that this number is very optimistic be-

Table 6. Data for Comparing Interface Community Egress Systems

Community	Homes	Exits	Road length (m)	Density (m per home)	Exit capacity (vph)	Max. diam. (m)	Exit separ. (m)	Max. dist. (m)	Exit fuel buffer
Buckingham[a]	337	4	5,293	16	3,200	1,040	85	430	No
Emigration Oaks	250	2	11,820	47	1,600	3,212	1,589	2,550	No
Summit Park	446	2	18,960	43	1,600	2,230	395	4,700	No
Mission Canyon	428	2	11,300	26	1,600	1,950	630	2,300	No
Area A (net)	60	1	4,576	76	800	1,520	NA[b]	1,750	No
Area B (net)	368	3	6,724	18	2,400	1,250	630	1,900	No

[a]1991 data.
[b]Not applicable.

cause it does not consider driveways along a road or other merge points that may create flow turbulence.

Table 6 shows the raw data for the communities in the comparison which all have "high+" wildfire hazard during the fire season. Community fire hazard was grossly assigned based on the predominant vegetation and residential construction type. A community of wood structures intermixed with a combination of highly flammable vegetation (e.g., Gambel Oak or Eucalyptus) was assigned a "high+" wildfire hazard. Table 7 is derived from Table 6 and the recommended codes presented in the prior section by determining which aspects of each community are "compliant" (C) or "noncompliant" (N).

An interesting result of this comparison is that the neighborhood at the origin of the 1991 Oakland–Berkeley fire is compliant for three of the six egress tests. The number and total capacity of the exits, as well as the furthest distance from any home to its nearest exit were reasonable. The problem appears to have been the relatively high residential density, the close proximity of exits 1 and 3 (Fig. 9), and the tremendous amount of fuel along the exits. The neighborhood had been built to urban density with only 16 m of road per household (i.e., street centerline length), the most densely developed neighborhood in the comparison (Table 6). This means that in 1991 the neighborhood had a driveway, on average, every 16 m. This is very dense development for an area with extremely high fire hazard. The arrangement of the exits was also not ideal, as exits 1 and 3 were closer than 1/4 the maximum diagonal distance between the furthest two households relying on the exits. In 1991, exits 1 and 2 were blocked by the fire in its first 1/2 h, and most of the remaining residents chose exit 3 (Charing Cross Road). However, from the point of view of a wildfire, exits 1 and 3 are too close to one another to be considered genuinely separate means-of-egress, so a fire that blocks exit 1 is almost certain to block exit 3 which is just uphill, and this is what happened in 1991. Finally, there was a substantial amount of fuel along the exits, and this is what led exits 1 and 2 to be blocked by the fire so early in the event. However, all told, if this neighborhood had less than four exits the number of fatalities would likely have been much higher.

In regards to the other neighborhoods in comparison, it is easy to identify canyon and hillside neighborhoods in the West with relatively poor egress systems to varying degrees. Emigration Oaks is a neighborhood just East of Salt Lake City, Utah that has a reasonably good egress system, but it is an elongated community and the two exits are less than 1/2 its maximum diagonal distance (Cova and Johnson 2002). This resulted in the community being noncompliant in regards to exit arrangement. The community also has a substantial amount of highly flammable Gambel Oak lining the exit-road shoulders. Summit Park is a community on the Wasatch Mountain ridgeline between Salt Lake City and Park City. This neighborhood did very poorly, as it currently has 446 homes relying on two proximal exits that are lined with conifers. Mission Canyon in Santa Barbara, Calf. also scored poorly for the same reasons. To provide one example of "net" egress calculations for a community, Mission Canyon is divided into areas A (upper canyon) and B (lower canyon). Area A is not compliant in regards to the number of exits because it has 60 homes and only one exit, where Area B is too dense and does not

Table 7. Comparing Interface Communities Against Egress Standards[a]

Community	Density	Number of exits	Exit capacity	Exit arrange	Maximum exit distance	Exit fuel buffer
Buckingham, Oakland, Calif.[b]	N	C	C	N	C	N
Emigration Oaks, Utah	C	C	C	N	C	N
Summit Park, Utah	C	C	N	N	N	N
Mission Canyon, Calif.	C	N	N	N	N	N
Area A (net)	C	N	N	N	N	N
Area B (net)	N	C	N	C	N	N

[a]C=compliant, N=noncompliant.
[b]1991 data.

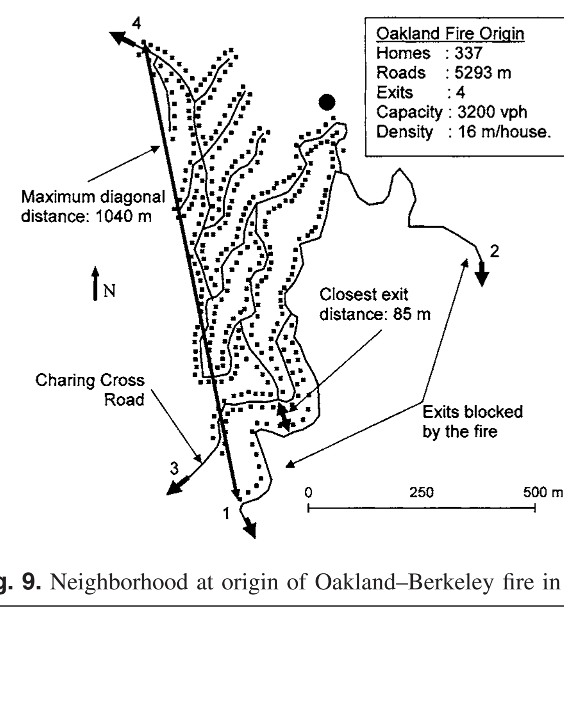

Fig. 9. Neighborhood at origin of Oakland–Berkeley fire in 1991

have sufficient exit capacity to serve its households. The main point with Tables 6 and 7 is simply that it is easy to identify neighborhoods with equal or greater fire hazard than the 1991 Oakland–Berkeley fire case and a more constrained egress system.

Urban and Emergency Planning Implications

The primary implication of developing a method comparable to building egress codes is that it is easy to identify fire-prone communities with relatively poor egress. The focus for urban and emergency planners should then turn to implementing new codes and improving egress systems. The proposed codes in the prior section can serve as a starting point and would need to be adjusted (or expanded) to work for a given locality. Also, despite the obvious limitations of the egress systems in the prior section, there are many actions that communities can take to improve their overall system (Plevel 1997). If a community has relatively poor egress, there are both demand-side and supply-side improvements (or adjustments) that can be implemented with varying cost (Burton et al. 1993). The focus in demand-side adjustments is reducing the concentration of vehicles in an evacuation in space and time to alleviate the need for egress capacity (e.g., supply). Example demand-side options include limiting the construction of new homes or businesses, limiting renters, constructing wildfire shelters, and identifying internal safe zones. Another demand-side adjustment is to require that structures be defensible so that residents can shelter-in-place. If a community can demonstrate that enough structures are defensible or there is sufficient public wildfire shelter or safe areas provided within the community, then the loading and capacity calculations could be adjusted to recognize that all not all residents will need to evacuate in a wildfire. This means that the following statement might be appended to each of the prior preliminary recommended codes:

"… unless a sufficient number and capacity of defensible structures, public shelters, or safe areas exist in the community for residents to shelter-in-place during a wildfire."

Supply-side adjustments to improve a community's egress system are also an option. This includes detailed evacuation route planning (i.e., Who will go where?) as well as reversing lanes and restricting turns at intersections to improve exit capacities (Wolshon 2001; Cova and Johnson 2003). Communities should also maintain their egress system. On-street parking restrictions can prevent low-capacity roads from becoming even lower, and clearing vegetation and other fuel along evacuation routes can minimize the loss of important exits during a wildfire. In cases where the egress system is severely substandard, widening roads or building new roads may be needed if more households are to be added.

Conclusion

Residential development in fire-prone areas is continuing without commensurate improvements to community-based transportation egress systems. This is only a small part of a much larger policy problem in fire-prone areas (Busenberg 2004), but it is an important one in protecting life. The codes presented in this paper would need to be integrated into a community's comprehensive hazard mitigation plan (Burby et al. 2000; Prater and Lindell 2000). However, the methods presented in this paper should help an analyst or planner in comparing community egress systems and possibly formulating codes. This may lead to improved community egress codes comparable to the higher-quality ones already in place for buildings. Limiting residential construction in low-egress, fire-prone areas with a "maximum occupancy" is not currently practiced but may be needed in some communities. If very few homes in a low-egress community are defensible and there is no safe zone or other public shelter, then limiting occupancy is one approach to maintaining public safety.

Economic pressure is strongly toward developing fire-prone communities to a density beyond which the egress system can safely handle in an urgent wildfire evacuation. The beneficiaries of new home development include new residents, developers, construction companies, and property tax collectors among many others. The parties that stand to lose include the residents who may perish in a wildfire, insurance companies, and the emergency managers challenged with the increasingly difficult task of protecting life and property in these rapidly growing areas. Thus, for political and economic reasons the methods presented in this paper may only find application in evacuation planning and comparing community egress systems. In the longer term, it is up to engineers and planners to ensure public safety in the urban–wildland interface by providing sufficient egress (or shelter) and educating residents on protective actions.

Acknowledgments

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7/6/2020

Sent via email and UPS

County of Lake
Board of Supervisors
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Re: Guenoc Valley Mixed-Use Planned Development Project Final Environmental Impact Report, SCH No. 2019049134

Dear Supervisors:

These comments are submitted on behalf of the Center for Biological Diversity (the "Center") regarding the Guenoc Valley Mixed-Use Planned Development Project (the "Project"). These comments follow our April 21, 2020 comments on the Draft Environmental Impact Report ("DEIR") for the Project, in which we raised serious concerns that the Project would have significant environmental impacts and identified numerous deficiencies in the DEIR. Unfortunately, instead of taking the opportunity to conduct more rigorous environmental review or revise the Project to reduce its significant impacts, Lake County (the "County") has responded largely by downplaying, obscuring, or denying the deficiencies in its environmental review. Furthermore, in the County's rush to approve the Project, it has robbed the public of adequate time to review the expansive environmental documents associated with the Project. The County should not approve the Project or certify the FEIR until, at a minimum, the County has rectified these deficiencies; otherwise, the County will be in violation of the California Environmental Quality Act ("CEQA"), Public Resources Code § 21000 et seq., and California Code of Regulations, title 14, § 15000 et seq ("CEQA Guidelines").

The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 1.7 million members and online activists throughout California and the United States. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life for people of California, including Lake County.

I. The EIR's Analysis of and Mitigation for the Project's Impacts on Biological Resources is Inadequate

A. The FEIR Fails to Adequately Assess Impacts to Sensitive Habitats and Aquatic Resources and Relies on Insufficient Mitigation Ratios to Address Impacted Resources

The FEIR fails to adequately assess and mitigate impacts to aquatic resources and sensitive habitats and disregards the best available science. The FEIR states that "a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts" (FEIR at 3-48), yet the mitigation ratios and steps to ensure effective, ecologically functional mitigation are insufficient. MM 3.4-17 only requires a mitigation ratio of 2:1 for preservation/restoration/enhancement, while the mitigation ratio for created habitat is only 1:1 for aquatic resources. In addition, only lands selected for preservation are to be approved by the County, and for enhanced/restored/created mitigation, the "minimum success criteria" that "Mitigation shall be deemed complete once the qualified biologist has determined that the success of restoration or habitat creation activities meets or exceeds 80 percent" is vague and insufficient. There are no "defined success criteria" for aquatic resources mitigation as the FEIR states (FEIR at 3-48). Defined success criteria are only provided in MM 3.4-15, which also has a low mitigation ratio of 2:1 for preservation/restoration, stating that achieving 75% acreage with the "monitoring biologist [] consider[ing] percent cover, species composition, overall health of plantings, and other indicators when determining success of establishment" (FEIR at 3.4-97). This is only provided for some, not all, of the sensitive habitats, and it hardly constitutes as providing defined success criteria. What species will be included when determining species composition? Native/invasive plants? Vertebrates? Invertebrates? Will presence/absence surveys take into account breeding individuals vs. foraging individuals? How will such data be collected? Will survey protocols follow agency guidelines? What time of day or during what season will surveys be conducted? What are "other indicators" to be used? Will functional hydrology and soil health be considered? The proposed mitigation leaves the reader with more questions than answers regarding whether impacts due to the Project will be avoided, and if impacts are unavoidable, if they will be adequately minimized or mitigated to less than significant.

The FEIR states that "Simply requiring mitigation to occur at high ratios with no scientific basis would not serve to ensure mitigation. Rather, a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts." (FEIR at 3-48). This argument misses the point of the Center's comments, and disregards scientific studies that specifically speak to the need for higher mitigation ratios (along with long-term monitoring, identified and measurable success criteria, and adaptive management strategies) to improve chances of adequately mitigating impacts to habitats and species (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Stein et al. 2018). The FEIR needs to take into account that, due to the proposed Project, habitat loss and species displacement are immediate, while any gains from their mitigation is uncertain. Moilanen et al. (2009) found that "very high offset ratios may be needed to guarantee a robustly fair exchange" and that "considerations of uncertainty, correlated success/failure, and time discounting should be included in the determination of the offset ratio to avoid a significant risk that the exchange is unfavorable for conservation in the long run." The FEIR fails to consider the best available science and adequately assess and mitigate impacts to aquatic resources and other sensitive habitats.

Given the importance of these heterogenous and varying aquatic resources to numerous native, rare, and special-status animals and plants, connectivity, and overall biodiversity, the FEIR should provide higher mitigation ratios that take the types of mitigation to be implemented into consideration, as not all mitigation is created equal. Preservation of existing habitat where sensitive and/or special-status species are known to occur through avoidance should be the primary focus, as restoration, enhancement, and creation of habitats can have limited success due to the challenges of establishing the appropriate hydrology (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Stein et al. 2018). For example, riparian/stream habitats are difficult to replace or create because of their complex hydrological, physical, and biotic structure, and it can take many years before an established riparian mitigation site might (or might not) become as ecologically functional as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Bronner et al. 2013). Adaptive management, collecting measurable performance standards based on habitat functions to determine mitigation success, and improved documentation strategies are necessary to increase the success rate mitigation for aquatic resources and sensitive habitat types, like riparian mitigation sites (Sudol and Ambrose 2002; Ambrose et al. 2006; Matthews and Endress 2008; Bronner et al. 2013).

Thus, if compensatory mitigation includes enhanced, restored, or created habitats, higher mitigation ratios coupled with extended years of effective monitoring and adaptive management strategies are needed to improve chances of establishing equivalent ecological function as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Bronner et al. 2013; Stein et al. 2018). Mitigation ratios of 2:1 for preservation or restoration/enhancement and 1:1 for created habitat with unspecified, measurable success criteria and no requirement to implement adaptive management strategies are insufficient and do not align with current scientific knowledge. Mitigation for aquatic resources (and other sensitive habitats) should be at least 3:1 with in-kind preservation, 5:1 with restoration/enhancement, and 10:1 with created habitat. All mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities) should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies, and protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. If higher mitigation ratios are not feasible, the FEIR must provide evidence and analysis supporting that conclusion. With one third of America's plant and animal species vulnerable to impacts from human activity and one fifth at risk of extinction (Stein et al 2018), it is crucial that strategies to prevent further degradation and loss of remaining aquatic resources, sensitive habitats, and biodiversity are explicit and scientifically sound. Again, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, and the proposed mitigation is not founded in the best available science.

B. The EIR's Setbacks are Insufficient to Effectively Mitigate Impacts to Aquatic Resources, Including Riparian Corridors (Streams and Associated Upland Habitat), Wetlands, Ponds, and Reservoirs

Riparian ecosystems have long been recognized as biodiversity hotspots performing important ecological functions in a transition zone between freshwater systems and upland habitats. As the Center previously commented, many species that rely on these aquatic habitats also rely on the adjacent upland habitats (*e.g.*, riparian areas along streams, and grassland habitat adjacent to wetlands). In fact, 60% of amphibian species, 16% of reptiles, 34% of birds and 12% of mammals in the Pacific Coast ecoregion (which includes Lake County) depend on riparian-stream systems for survival (Kelsey and West 1998). Many other species, including mountain lions and bobcats, often use riparian areas and natural ridgelines as migration corridors or foraging habitat (Dickson et al, 2005; Hilty & Merenlender, 2004; Jennings & Lewison, 2013; Jennings & Zeller, 2017). Additionally, fish rely on healthy upland areas to influence suitable spawning habitat (Lohse et al. 2008), and agricultural encroachment on these habitats and over-aggressive removal of riparian areas have been identified as a major driver of declines in freshwater and anadromous fish as well as California freshwater shrimp (*e.g.*, Stillwater Sciences 2002; Lohse et al. 2008; Moyle et al. 2011). Loss of biodiversity due to lack of habitat contributes to ecosystem degradation, which will diminish a multitude of ecosystem services in the long-term.

Yet the FEIR disregards the Center's previous comments that are supported by scientific literature, stating that "While the statements that the commenter makes may be true for a given species within a specific context, they generally do not apply within the context of the Proposed Project and Lake County on the whole." (FEIR at 3-49). This logic is flawed and unsupported. The Project is located in an area identified by scientists as having high terrestrial and riparian permeability and linkage potential (Gray et al. 2018) with heterogeneous habitats associated with aquatic resources (almost 200 acres of riparian stream habitat [if not more] as well as over 400 acres of emergent wetlands, over 650 acres of ponds and reservoirs, over 122 acres of jurisdictional wetlands, and over 10 acres of jurisdictional open waters in the Project area. Dismissing studies that clearly demonstrate that a wide variety of wildlife, including special-status species known or have the potential to occur in the Project area, require large areas of intact upland habitat connected to aquatic resources (*i.e.*, riparian habitat, emergent wetlands, vernal pools, etc.) to survive and sustain healthy populations and ecosystems highlights the FEIR's failure to adequately assess and mitigate impacts to biological resources in the Project area. Setbacks of 20-30 ft from aquatic resources are insufficient to support the entire life cycle and metapopulation dynamics of special-status species like western pond turtles (*Actinemys marmorata*) and foothill yellow-legged frogs (FYLF; *Rana boylii*), both known to occur in and adjacent to the Project area. The FEIR fails to use the best available science, and instead suggests that the numerous studies that report the importance of riparian habitats to biodiversity and the need for adequate connectivity between aquatic resources and upland habitat somehow do not apply to the Project area, even when the studies specifically look at special-status species known to occur in the Project area.

For example, several studies highlighted in the Center's previous comments discuss life history and migration patterns of western pond turtles and FYLF (Twitty et al. 1967; Holland 1994; Semlitsch and Bodie 2003; Bury and Germano 2008; Zaragoza et al. 2015). Western pond turtles are known to nest as far as 1,312 feet from aquatic habitat and can be found overwintering up to 1640 feet from aquatic habitat, as well as migrating over 3,280 feet (1 km) (Holland 1994; Zaragoza et al. 2015), and Bury and Germano (2008) found that "most individuals rapidly depart basking sites when disturbed by either visual or auditory stimuli of people (e.g., waving an arm, shouting) at distances of over 100 m [(328 feet)].” Adult FYLF have been observed in abandoned rodent burrows and under logs as far as 100 m (328 feet) from streams (Zeiner 1988) and juvenile FYLF have been found up to 600 feet upslope from their natal stream channel (Twitty et al. 1967). Yet the FEIR states that “western pond turtles and foothill yellow-legged frog (both of which are CDFW species of special concern) are more restricted in their ability to move far from streams because of a higher probability of desiccation and lower probability of finding adequate refuge relative to other parts of their range” because “the majority of the perennial and intermittent streams in the Area of Potential Effects have narrow riparian zones because of the well-drained soils and high prevalence of surface rock” (FEIR at 3-50) without providing any information to support their claim. This is conjecture and not founded on any science. Larger setbacks at aquatic resources that take into account connectivity with heterogeneous habitats, especially where special-status species are known to occur, have the potential to occur, or historically occurred, are needed to adequately minimize impacts to the species, populations, and ecosystems. The FEIR fails to adequately assess and mitigate impacts to aquatic resources and associated special-status species.

The FEIR misleadingly states that the federally threatened California red-legged frog (CRLF, *Rana draytonii*) “does not occur on the Guenoc Valley Site and is not documented to occur in Lake County” (FEIR at 3-49). Guenoc Valley and much of Lake County are within the current and historical range of CRLF. In fact, there are several recorded observations of CRLF in Lake County.[1] And although CRLF were not encountered in several potential locations in the Plan area, it is misleading to state that CRLF do not occur there. According to the USFWS 2005 CRLF survey protocol, “Multiple survey visits conducted throughout the survey-year (January through September) increases the likelihood of detecting the various life stages of the CRF. For example, adult frogs are most likely to be detected at night between January 1 and June 30, somewhere in the vicinity of a breeding location, whereas, sub-adults are most easily detected during the day from July 1 through September 30.” (USFWS 2005). But only targeted nighttime amphibian visual encounter surveys were conducted August 14-16, 2018 and May 14-15, 2019, which is insufficient to determine the presence or potential presence of CRLF in or adjacent to the Project area (Appendix BRA1 at 16). The USFWS recommends up to eight surveys within six weeks to detect CRLF, with two day surveys and four night surveys recommended during the breeding season (January 1 – June 30) and one day and one night survey during the non-breeding season, with each survey taking place at least seven days apart. (USFWS 2005). Surveys were not conducted following USFWS guidance and recommendations to optimize chances of CRLF detection. In addition, surveys were conducted at “selected habitats across the Property,” but the locations of the surveys are not provided in the appendix (Appendix BRA1 at 16). To conclude that CRLF “does not occur on the Guenoc Valley Site” (FEIR at 3-49) is an overstatement, as surveys were not optimal, and even if presence was not detected, it could be that they were present, but the surveyors did not see them. The FEIR fails to adequately describe, assess, and mitigate impacts to CRLF and other sensitive species that rely on aquatic resources and associated upland habitat.

[1] Data are available from the MVZ Herp Collection (Arctos) database, the Global Biodiversity Information Facility (GBIF; www.gbif.org), and Amphibiaweb (www.amphibiaweb.org).

Given that CRLF were historically present and are currently potentially present in the County and suitable habitat is present at the Project site, adequate setbacks and connectivity should be implemented. In a study that found radiotracked CRLFs moving up to 2.8 km (~1.7 mi) and a median distance of movement of 150 m (~492 ft) from breeding ponds, researchers aptly state that "maintaining populations of pond-breeding amphibians requires that all essential habitat components be protected; these include (1) breeding habitat, (2) nonbreeding habitat, and (3) migration corridors. In addition, a buffer is needed around all three areas to ensure that outside activities do not degrade any of the three habitat components."(Fellers and Kleeman 2007). Thus, at aquatic resources where CRLF are observed, potentially present, or were historically present, setbacks should at least 500 ft. Ideally, buffers should be even greater to accommodate the furthest dispersers, as larger buffers would allow for increased chances for establishment or re-establishment in unoccupied habitats, as often happens in metapopulation dynamics, or to increase resilience to climate change (Semlitsch and Bodie 2003; Cushman 2006). Again, the FEIR fails to consider the best available science to adequately assess and mitigate impacts to aquatic resources and the rare, sensitive, or special-status species that rely on the aquatic resources and connectivity with upland habitat.

These are just a few examples of how the FEIR inadequately assesses and mitigates impacts to aquatic resources, special-status species, and sensitive habitats. Note that this is not a comprehensive list of inadequacies that need to be addressed for the FEIR to comply with CEQA.

C. The FEIR Fails to Adequately Assess and Mitigate Impacts to Wildlife Movement and Habitat Connectivity

The FEIR states that while the site is "relatively large" and within the Pacific Flyway, "the Proposed Project does not propose modification of waterbodies in such a way that would make them significantly less useful as stopover points for migratory birds" (FEIR at 3-45). However, the FEIR fails to consider that if these heterogeneous habitats, like wetlands, streams, riparian habitats, grasslands, etc., are degraded in and around the Project site, they will no longer be able to support the numerous migratory birds that traverse the Pacific Flyway. As discussed previously, science has shown that 20- to 30-foot setbacks from aquatic resources is insufficient to protect the water quality and biodiversity of these systems. Without healthy ecosystems that support the vegetation and food resources (invertebrates, fish, herps, etc.) that many migratory birds rely on for rest, recovery, and nesting, the habitats in and adjacent to the Project area would no longer provide much needed connectivity for hundreds of millions of birds that traverse the Pacific Flyway throughout the year.

The FEIR goes on to state that designated open space, MM 3.4-17, and 20- to 30-foot setbacks from aquatic resources provide for regional movement while also providing habitat for less mobile species, like western pond turtles and FYLF (FEIR at 3-45). However, as discussed previously, the FEIR fails to consider the best available science, and the low mitigation ratios and minimal setbacks from aquatic resources are insufficient to support special-status animals and plants and overall biodiversity and ecosystem function in the Project area. And although the FEIR provides 1:1 mitigation of removed open space to preserved open space, the mitigation ratio should be higher, especially if the removed open space includes aquatic resources, sensitive habitats, or habitat that supports or may support special-status species and/or is important to connectivity. And, as mentioned previously, all mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities), in designated open space or otherwise, should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies. Mitigation lands should be protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. The proposed amendment to the Open Space Preservation Plan should include prioritization of preserving designated open space and avoiding removal, but if development occurs in designated open space then higher mitigation ratios that include long-term monitoring and adaptive management should be required.

The FEIR fails to adequately assess and mitigate impacts to functional connectivity. Although identifying designated open space with a minimum width of 475 ft and proposing 300-foot wide habitat and residential habitat easements to make up the FEIR's proposed wildlife paths through the Project area is a good start towards mitigating impacts to wildlife connectivity, it is insufficient and does not adequately consider the best available science. No movement studies were conducted in the area to determine that animals would actually move through the proposed wildlife paths, and the FEIR fails to consider edge effects of human activities on wildlife, wildlife movement, and habitat connectivity. As mentioned in the Center's previous comments, edge effects of development in and adjacent to open space will likely impact key, wide-ranging predators, such as mountain lions and bobcats (Crooks 2002; Riley et al. 2006; Delaney et al. 2010; Lee et al. 2012; Smith et al. 2015; Vickers et al. 2015; Smith et al. 2017; Wang et al. 2017), as well as smaller species with poor dispersal abilities, such as song birds, small mammals, and herpetofauna (Cushman 2006; Slabbekoorn and Ripmeester 2008; Benítez-López et al. 2010; Kociolek et al. 2011). Negative edge effects from human activity, such as traffic, lighting, noise, domestic pets, pollutants, invasive weeds, and increased fire frequency, have been found to be biologically significant up to 300 meters (~1000 feet) away from anthropogenic features in terrestrial systems (Environmental Law Institute 2003). In addition, the FEIR fails to consider, assess, or mitigate impacts to identified riparian and terrestrial least-cost pathways adjacent to the Project area (FEIR Habitat and Connectivity Assessment Appendix at 19-21). Thus, it is unclear if wildlife would move through the proposed wildlife paths; impacts due to the proposed Project would not be adequately mitigated in areas where the width of the designated open space is 475 ft wide or in 300-foot wide habitat or residential habitat easements, and the Project could have impacts to riparian and terrestrial permeability adjacent to the Project area. Although MM 3.4-19 requires wildlife-friendly fencing in some portions of the Project area and MM 3.4-21 was added to mitigate impacts of domestic cats (FEIR at 3.4-102), it is not enough to minimize impacts of human activities on wildlife movement and habitat connectivity.

The proposed development and roadways will increase traffic and further fragment the landscape, which could affect the diverse animals and plants in the area. For instance, field observations and controlled laboratory experiments have shown that traffic noise can significantly degrade habitat value for migrating songbirds (Ware et al. 2015). Subjects exposed to 55 and 61 dBA (simulated traffic noise) exhibited decreased feeding behavior and duration, as well as increased vigilance behavior (Ware et al. 2015). Such behavioral shifts increase the risk of starvation, thus decreasing survival rates. Another study also highlighted the detrimental impacts of siting development near areas protected for wildlife. The study noted that "Anthropogenic noise 3 and 10 dB above natural sound levels . . . has documented effects on wildlife species richness, abundance, reproductive success, behavior, and physiology" (Buxton et al. 2017). The study further noted that "there is evidence of impacts across a wide range of species [] regardless of hearing sensitivity, including direct effects on invertebrates that lack ears and indirect effects on plants and entire ecological communities (*e.g*., reduced seedling recruitment due to altered behavior of seed distributors)" (Buxton et al. 2017). Moreover, human transportation networks and development resulted in high noise exceedances in protected areas (Buxton et al. 2017).

In addition, preliminary results from studies underway by researchers at UC Davis and University of Southern California, as well as those by other researchers, suggest that the light, noise, and other aspects of roads can have negative impacts on wildlife numbers and diversity near the roadways (Shilling 2020; Vickers 2020). The researchers found a significant difference between species richness and species type, with lower richness and fewer species at along roadsides compared to background areas 1 km away from the roads (Shilling 2020). They also found that as traffic noises surpassed 60 dBC, the number of visits by small to large mammals decreased, and most of the species in their study avoid traffic noise (Shilling 2020). It is clear that different species have variable sensitivities to noise and light associated with development and transportation infrastructure; this can lead to changes in species distributions and population health and survival, which can have ecosystem-level impacts (*e.g*., Suraci et al. 2019). The FEIR fails to adequately assess and mitigate impacts of edge effects on functional connectivity.

Edge effects of human activities have also been documented specifically on mountain lions. One study found that mountain lions are so fearful of humans and noise generated by humans that they will abandon the carcass of a deer and forgo the feeding opportunity just to avoid humans (Smith et al. 2017).[2] The study concluded that even "non-consumptive forms of human disturbance may alter the ecological role of large carnivores by affecting the link between these top predators and their prey" (Smith et al. 2017). In addition, mountain lions have been found to respond fearfully upon hearing human vocalizations, avoiding the area and moving more cautiously when hearing humans (Smith et al. 2017; Suraci et al. 2019). Other studies have demonstrated that mountain lion behavior is impacted when exposed to other evidence of human presence, such as lighting or vehicles/traffic (Wilmers et al. 2013; Smith et al. 2015; Wang et al. 2017). Mountain lions are protected under Prop 117 as a "specially protected species," and although they do not receive California Endangered Species Act (CESA) protections in the Project area, mountain lions in Southern California and along the Central Coast are candidates for CESA listing. This highlights the importance of mountain lions in California ecosystems. As the last remaining wide-ranging top predator in the region, the ability to move through large swaths of interconnected habitat is vital for genetic connectivity and their long-term survival. Impacts to mountain lions in the region could have severe ecological consequences; loss of the ecosystem engineer could have ripple effects on other plant and animal species, potentially leading to a decrease in biodiversity and diminished overall ecosystem function. Many

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[2] *See also* Sean Greene, "How a fear of humans affects the lives of California's mountain lions," *Los Angeles Times* (June 27, 2017), available at http://beta.latimes.com/science/sciencenow/la-sci-sn-pumas-human-noise-20170627-story.html.

scavengers, including California condors, kit foxes, raptors, and numerous insects, would lose a reliable food source (Ruth and Elbroch 2014; Barry et al. 2019). Fish, birds, amphibians, reptiles, rare native plants, and butterflies would potentially diminish if this apex predator were lost (Ripple and Beschta 2006; Ripple and Beschta 2008; Ripple et al. 2014). Therefore, new development projects must carefully consider impacts to movement and connectivity for these and other wide-ranging carnivores. The FEIR fails to adequately assess and mitigate impacts to wildlife connectivity.

The FEIR fails to consider the need for corridor redundancy (*i.e*. the availability of alternative pathways for movement). Corridor redundancy is important in regional connectivity plans because it allows for improved functional connectivity and resilience. Compared to a single pathway, multiple connections between habitat patches increase the probability of movement across landscapes by a wider variety of species, and they provide more habitat for low-mobility species while still allowing for their dispersal (Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). In addition, corridor redundancy provides resilience to uncertainty, impacts of climate change, and extreme events, like flooding or wildfires, by providing alternate escape routes or refugia for animals seeking safety (Cushman et al., 2013; Mcrae et al., 2008; Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). Although the FEIR proposes 300-foot wide habitat and residential habitat easements for the proposed wildlife paths, they are insufficient to overcome edge effects for many species' movement, leaving only one constrained north-south pathway through the Project area via the designated open space while east-west movement is almost completely severed.

Corridor redundancy is critical when considering the impacts of climate change on wildlife movement and habitat connectivity. Climate change is increasing stress on species and ecosystems, causing changes in distribution, phenology, physiology, vital rates, genetics, ecosystem structure and processes, and increasing species extinction risk (Warren et al. 2011). A 2016 analysis found that climate-related local extinctions are already widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed (Wiens 2016). A separate study estimated that nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened birds may have already been negatively impacted by climate change in at least part of their distribution (Pacifici et al. 2017). A 2016 meta-analysis reported that climate change is already impacting 82 percent of key ecological processes that form the foundation of healthy ecosystems and on which humans depend for basic needs (Scheffers et al. 2016). Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to keep pace with suitable climate space, species are shifting their timing of breeding and migration, and entire ecosystems are under stress (Parmesan and Yohe 2003; Root et al. 2003; Parmesan 2006; Chen et al. 2011; Maclean and Wilson 2011; Warren et al. 2011; Cahill et al. 2012). Therefore, functional habitat connectivity is critical for many animals and plants to adapt to climate change. Again, the FEIR failed to use the best available science and adequately assess and mitigate impacts to wildlife movement and functional connectivity.

D. The FEIR Fails to Adequately Assess and Mitigate Impacts to the Western Bumble Bee (*bombus occidentalis occidentalis*), a Candidate Species Under the California Endangered Species Act

The FEIR fails to analyze the Project's potentially significant impacts on the Western bumble bee. The Western bumble bee (*Bombus occidentalis occidentalis*) was listed by the California Fish and Game Commission as a candidate species under CESA in June 2019. Accordingly, the species' status as a candidate requires that it be included among the species analyzed in the FEIR. (FEIR at 3.4-23; Fish & Game Code § 2068.) Yet the FEIR for the Project did not include any evaluation of the proposed Project's impacts on the western bumble bee. Although the species' historical distribution covers the area of the Project site (The Xerces Society for Invertebrate Conservation 2018), the FEIR is entirely silent on the species and fails to include it in the list of special status species considered in the FEIR (FEIR at 3.4-24). Habitat loss, degradation, and modification due to agricultural intensification and urban development and the use of chemical contaminants (*e.g.*, insecticides, herbicides, fungicides) pose a significant threat to the bee's ability to survive and reproduce (The Xerces Society for Invertebrate Conservation 2018), yet this special-status species is not mentioned in the FEIR. Thus, the FEIR fails to adequately describe, assess, and mitigate impacts to the western bumble bee, a candidate species under CESA.

II. The EIR's Analysis of and Mitigation for the Project's Greenhouse Gas Emissions Remains Inadequate

The FEIR's analysis of the proposed Project's GHG emissions fails to correct the numerous deficiencies we identified in our comments on the DEIR and remains inadequate. The FEIR confirms once more that the Project would result in significant amounts of GHG emissions during construction and operation of the Project. (See FEIR p. 3.7-11, Table 3.7-1A [total annual construction emissions of 22,509 MT; p. 3.7-15, Table 3.7-3 total Project operational emissions with mitigation of 30,846 MT annually].) Yet it does not properly analyze or fully mitigate all of the Project's significant GHG impacts. (See Pub. Res. Code § 21002; CEQA Guidelines § 15126.2.) In particular, the EIR makes no real effort to reign in the Project's astounding increase in Vehicle Miles Traveled ("VMT"), the largest contributor by far to the Project's overall GHG emissions. Additionally, its proposed mitigation for the Project's VMT and GHG emissions is vague, improperly deferred, and unenforceable and the EIR fails to consider all feasible mitigation and alternatives to reduce the Project's GHG emissions impacts to less than significant levels.

A. The EIR Fails to Provide Enough Information About its Emissions and Mitigation Calculations to Allow for Informed Decision-making

As we explained in our comments on the DEIR, the document fails to provide readers with information essential to understanding its analysis of the Project's GHG emissions; the County merely dismissed instead of correcting this shortcoming. Although the Response to Comments encourages readers to consult the 24 pages of tables in its Appendix AIR, these tables simply present readers with raw data and no means for interpreting or understanding it. (See DEIR Appendix AIR.) An EIR must "disclose the analytic route the agency traveled from evidence to action." (*California Clean Energy Committee v. City of Woodland* (2014) 225 Cal.App.4th 173, 205 [internal punctuation omitted].) The County's reliance on 24 pages of tables containing numeric inputs for the subsequent several hundred pages of tables that together constitute the GHG emissions analysis does not adequately apprise the public of how the County calculated the Project's GHG emissions.

Again, as we pointed out in our prior comments, EIR makes the same omission with respect to the purported effectiveness of its proposed mitigation measures. The EIR claims that the mitigation measures it proposes will result in FEIR p. 3.7-14 (Table 3.7-3 claiming that, with mitigation, total project emissions will be reduced by 30% to 30,846 MT annually, down from 44,162 MT annually without mitigation [Table 3.7-2]). Despite our prior concerns, the EIR still fails entirely to disclose how it arrived at these calculations for quantifying the mitigation measures' effectiveness in reducing or avoiding GHG emissions. Mitigation measures' effectiveness and enforceability must be supported by substantial evidence in the record. *Sacramento Old City Assn. v. City Council* (1991) 229 Cal.App.3d 1011, 1027. The County's response to our comments on this issue (the relevant Response to Comment 10-22) is wholly inadequate—it did not address or even acknowledge our concern regarding the lack of evidence to support the County's conclusions about the measures' estimated GHG reductions.

The EIR should be revised to include this information and recirculated so that the public can adequately review and comment on this crucial aspect of the DEIR's GHG analysis.

B. The EIR's Mitigation for the Project's GHG Emissions is Inadequate, Unenforceable, Vague, and/or Improperly Deferred

As we pointed out in our comments on the DEIR, the proposed mitigation for the Project's significant GHG impacts is badly lacking. The County's failure to reduce the Project's GHG emissions to less than significant undermines achievement of the statewide goals for GHG emissions reductions, including the following:

- Assembly Bill 32 (2006) requires statewide greenhouse gas reductions to 1990 levels by 2020 and continued reductions beyond 2020.
- Senate Bill 32 (2016) requires at least a 40 percent reduction in greenhouse gas emissions by 2030.
- Pursuant to Senate Bill 375 (2008), the California Air Resources Board establishes greenhouse gas reduction targets for metropolitan planning organizations (MPOs) to achieve based on land use patterns and transportation systems specified in Regional Transportation Plans and Sustainable Community Strategies. Current targets for the largest metropolitan planning organizations range from 13% to 16% reductions by 2035.
- Executive Order B-30-15 (2015) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.
- Executive Order S-3-05 (2005) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.
- Executive Order B-16-12 (2012) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.
- Senate Bill 391 requires the California Transportation Plan to support 80 percent reduction in GHGs below 1990 levels by 2050.

- The California Air Resources Board Mobile Source Strategy (2016) describes California's strategy for containing air pollutant emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.
- The California Air Resources Board's 2017 Climate Change Scoping Plan Update: The Strategy for Achieving California's 2030 Greenhouse Gas Target describes California's strategy for containing greenhouse gas emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.

As the Center explains below, the County should revise its mitigation for the Project's GHG impacts to ensure that it complies with CEQA, adopt additional feasible mitigation measures to reduce the Project's impacts to less than significant levels, and recirculate a revised EIR for public review and comment on the additional mitigation measures.

i. The EIR's Mitigation for the Project's Mobile Source Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The Project's remote location and residential/resort uses will result in a significant increase in mobile source emissions. The majority of trips generated by the project will originate far from the project thus giving rise to high total and per capita VMT. (See FEIR at 3.13-2 [showing that a majority of Project-generated trips will involve travel to or from areas located miles from the Project site, with 29% to/from Clearlake or North, and 19% south of Middletown].) Transportation-generated (i.e., "mobile") GHG emissions account for an astounding 24,585 $MTCO_2e$ annually—over 79% of the Project's total mitigated operational emissions of 30,846 $MTCO_2e$ annually. (FEIR at p. 3.7-15, Table 3.7-3) What's more, the FEIR acknowledges that "the Proposed Project would not meet the recommended OPR threshold of a 15 percent reduction in per capita VMT over existing conditions. This would be a significant impact." (FEIR at p. 13.3-28.) In fact, the Projects impacts are much worse—they result in an *increase* in per capita VMT in Lake County from existing conditions, in both the short and the long term. (FEIR at p. 3.13-28, Table 3.13-7.)

As the California Supreme Court has observed: "the Scoping Plan … assumes continued growth and depends on *increased efficiency* and conservation in land use and transportation from all Californians." (*Center for Biological Diversity v. Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 220.) More recently, the Fourth District Court of Appeal strongly affirmed the importance of reducing VMT in order to meet the state's GHG reduction targets, as described in the CARB Scoping Plan. The Court explained:

> [T]he 2017 CARB Scoping Plan . . . is the state's blueprint for meeting GHG emission reduction targets. (*Center for Biological Diversity, supra*, 62 Cal.4th at p. 220.) The Scoping Plan recognizes that in the past, "development patterns have led to sprawling suburban neighborhoods, a vast highway system, growth in automobile ownership, and under-prioritization of infrastructure for public transit and active transportation." The Scoping Plan states, "VMT reductions are necessary to achieve the 2030 target and must be part of any strategy evaluated in this Plan." (Italics added.) The Scoping Plan emphasizes that "California must

> reduce demand for driving" and "lower-VMT future development patterns are essential to achieving public health, equity, economic, and conservation goals."
>
> "Local land use decisions play a particularly critical role in reducing GHG emissions associated with the transportation sector . . . .
>
> "While the State can do more to accelerate and incentivize these local decisions, local actions that reduce VMT are also necessary to meet transportation sector-specific goals and achieve the 2030 target under [Sen. Bill No. 32.] Through developing the Scoping Plan, CARB staff is more convinced than ever that, in addition to achieving GHG reductions from cleaner fuels and vehicles, California must also reduce VMT." (Italics added.)
>
> VMT reduction is an integral part of California's strategy to reach 2030 and 2050 GHG emission reduction targets.

(*Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *117-118].)

The 11th annual California Green Innovation Index, which tracks the state's annual progress in reducing GHG emissions found in 2019 that

> [G]iven that transportation is by far the largest-emitting sector—and with most of the emissions coming from on-road light-duty passenger vehicles—the current upward trajectory of VMT and surface transportation GHG emissions [in California] cannot continue if the state is to meet its climate goals.

(Next 10 2019 at p. 31.)[3] As the OPR Technical Advisory states, meeting statewide targets for GHG reductions "will require substantial reductions in existing VMT per capita to curb greenhouse gases." (OPR Technical Advisory 2017, p. 7; see also CARB 2017, p. 75 [Scoping Plan stating that "VMT reductions are necessary to achieve the 2030 [GHG emissions] target."].)

Yet the Project completely disregards the need to *reduce* VMT in order to ensure that the state can meet its statewide GHG reduction targets. Instead it results in a sharp *increase* in daily per capita VMT in Lake County from existing conditions (FEIR at p. 3.13-28, Table 3.13-7), which it acknowledges as a significant impact (FEIR at p. 13.3-28). And the project does not commit to *any reductions in mobile source GHG emissions from mitigation measures.* (FEIR at pp. 3.7-14 to – [Tables 3.7-2 and 3.7-3 showing that "mitigated" and "unmitigated" mobile source GHG emissions *remain exactly the same*].) The County cannot simply abandon its obligation to reduce the Project's greenhouse gas emissions from mobile sources.

The EIR relies on GHG mitigation measure MM 3.7-1, which, with respect to the Project's mobile emissions states:

[3] As of 2011, The transportation sector was the largest single contributor to California GHG emissions, accounting for 37 percent of all emissions; passenger vehicles accounted for almost three quarters of this total. (PPIC 2011.)

Transportation Demand Management Measures
Implement Mitigation Measure 3.13-4 to develop and implement a transportation demand management plan to achieve a reduction in vehicle miles traveled as a result of the Proposed Project. At a minimum these measures will include:

- Dedicate on-site parking for shared vehicles (vanpools/carpools).
- Provide adequate, safe, convenient, and secure on-site bicycle parking and storage in the commercial portion of the project.
- Use of an electric fleet for internal transport vehicles (excluding trucks and other ranch vehicles for on-going agricultural and grazing activities) to the extent feasible (no less than 75 percent), including the golf course.

(FEIR at 3.7-16.) Measure 3.7-1 incorporates by reference traffic mitigation measure MM 3.13-4, which the FEIR claims "would also reduce project GHG emissions by reducing the overall mobile trips generated by the Proposed Project." (FEIR at 3.7-14.) While the County has made some minor wording changes to the text of MM 3.13-4 and included for the first time in the FEIR an administrative draft Transportation Demand Management plan ("TDM")[4], these changes do not remedy the concerns we raised in our DEIR comments that the proposed mitigation is vague, improperly deferred, unenforceable, and the EIR does not demonstrate that it will be effective.

At first blush, measures MM 3.7-1, MM 3.13-4 and the TDM may appear substantive, but a closer examination reveals the measures to be toothless and to fall short of CEQA's standards for mitigation. Examples of such shortcomings in MM 3.13-4 include, but are not limited to:

- *Provide Shuttle Service* – the provision notes that "There are currently no plans for Lake Transit to run buses along Butts Canyon Road near the project site and the nearest bus stops are about six miles away in Middletown. While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." Yet it does not commit to funding, expanding, or improving transit options that would connect the Project to Middletown and Clearlake. The provision states that "Alternatively, the project could potentially provide a frequent direct weekday shuttle service specifically for employees," but does not require it. Nor does the provision require *any* transit options for Project site residents (as opposed to guests or employees).

[4] In response to our comments on the DEIR, the County belatedly published an Appendix TDM to the FEIR. This document does not allay our prior concerns that the County is impermissibly deferring transportation demand management measures. We note that FEIR Appendix TDM is marked on its first page as a "Confidential Administrative Draft" and watermarked as "DRAFT" on every page—undermining any claim that it is final and binding on the Applicant. Moreover, the EIR's mitigation measures do not require County *approval* of the TDM—only that it be "submitted" by the Applicant, after which the County "shall verify compliance with the plan" though the County apparently has no ability to disapprove an inadequate plan. (FEIR at 3.13-36.) Finally, MM 3.13-4 lists "strategies shall be identified within the TDM plan" but stops conspicuously short of actually *requiring* implementation of those strategies.

- *TDM Coordinator* – The provision states that "Management shall designate a "TDM coordinator" to coordinate, monitor and publicize TDM activities. The effectiveness of providing a TDM Coordinator on auto mode share is uncertain but is generally seen as a supportive measure." While this idea behind this provision is laudable, there is no evidence of its effectiveness at contributing anything toward reducing the Project's GHG emissions.

Similarly, Appendix TDM describes 15 "strategies" to reduce VMT, but does not contain the requisite performance criteria. The language used to describe the other "strategies" is generally vague, aspirational, and lacking in specifics or actual enforceable requirements.

Nor does the administrative draft TDM contain any quantitative target or performance criteria for ensuring that a certain number of VMT reductions are actually achieved. Although the TDM purports to implement a monitoring and reporting program, in the absence of such standards or performance criteria, any such activities are meaningless. The administrative draft TDM states, "The Project sponsor shall adjust the TDM plan based on the monitoring results if they demonstrate that measures in the TDM plan are not achieving the reduction goal." But crucially, *there is no reduction goal*. This vague language is no substitute for concrete performance standards. Furthermore, taken together, MM 3.7-1, 3.13-4, and the administrative draft TDM allow the project applicant in the future to determine the extent it believes it is "feasible" to reduce VMT, with little or no oversight by the County and without standards by which to determine feasibility. This approach violates CEQA's standards for mitigation measures. (*See Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *73-*75.)

Feasible mitigation measures for reducing VMT-associated GHG emissions exist that were not considered or evaluated in the EIR. These include, but are not limited to:

- Committing to Transit options. (See OPR Technical Advisory 2017 at 22.) Although MM 3.13-4 states that the Project "could potentially provide a frequent direct weekday shuttle service specifically for employees" it makes no commitment to providing any such service. (FEIR at 3.13-37). The Project should commit to running daily shuttle services to Middletown (and Clearlake) that are available to members of the public, not just employees. The FEIR similarly states that "While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." (Id.) The Project should commit to funding a Lake Transit stop and service along Butts Canyon Road to serve project employees and residents.
- Committing to a hard limit on the total number of available parking spots on site and committing a fixed minimum ratio (for example, at least one third) of those sites to being restricted to use by rideshare/carpool/EV vehicles. (See OPR Technical Advisory 2017, p. 23; see also CAPCOA 2010 p. 207 [measure 3.3.1 Limit Parking Supply].)
- Committing to other mitigation measures from the OPR Technical Manual (OPR Technical Manual 2017, pp. 22-23), including but not limited to:
    - Incorporating affordable housing into the project, and providing increased onsite workforce housing to reduce employee commuting. (See also CAPCOA 2010 p.

176 [measure 3.1.6 Integrate Affordable and Below Market Rate Housing].) The administrative draft TDM's proposed measure 1.3.1 ("Workforce Housing") is non-committal, stating only that the Project "will provide up to 35 housing units on-site" and "up to 50 housing units offsite."

    - Increasing the diversity of non-residential and commercial uses on site to include uses such as grocery stores, daycare, etc., within walking distance from residences within the Project area, which can allow Project residents to find desired handle daily shopping and service needs without leaving the project area. (See CARB 2017 at 76, urging mitigation that uses "community design" to reduce VMT.)
- Offsets as a mitigation measure of last resort (see additional discussion below).

Although the EIR and administrative draft TDM give lip service to a handful of these measures—they do not actually develop them in any detail, impose performance standards, ensure that they are enforceable, or attempt to quantify or otherwise evaluate their effectiveness. The County therefore cannot and does not evaluate their feasibility. The EIR's failure to adopt all feasible mitigation measures to reduce the Project's significant VMT-related GHG emissions violates CEQA. (See Pub. Res. Code § 21002.)

ii. The EIR's Mitigation for the Project's Non-Mobile Source Operational GHG Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The text changes to MM 3. 7-1's provisions relating to the Project's non-mobile source operational GHG emissions do not remedy the deficiencies we identified in our comments on the DEIR.

Moreover, the Project fails to incorporate—and the EIR fails to consider—all feasible measures that could considerably reduce the Project's significant non mobile source GHG emissions. In particular, the County should consider the use of a legally adequate carbon offset program to offset the Project's unmitigated GHG emissions. Although any offset scheme must be carefully tailored to comply with CEQA's requirements (*see generally Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529]), carbon offsets should be considered as a last option for mitigation where no other options are available or feasible. The County appears not to have considered this option or determined whether it is feasible.

C. The Addition of a Transportation Demand Management Plan for the First Time After the Close of the Public Review Period for the Draft EIR Is Significant New Information Requiring Recirculation

The County included the administrative draft Transportation Demand Management Plan for the Project for the first time with its publication of the FEIR. It provided no reason or justification why this document was not disclosed earlier and made available for review with the DEIR so that the public could adequately comment on it. A lead agency is required to recirculate an EIR when significant new information is added to the EIR after the draft EIR is made available for public review. (CEQA Guidelines § 15088.5.) New information includes changes in the project or environmental setting as well as additional data or other information. (Id.) New information is significant where the EIR is changed in a way that deprives the public of a meaningful opportunity to comment. Here, the TDM is significant new information requiring recirculation and the opportunity for public comment. (*See Spring Valley Lake Association v. City of Victorville* (2016) 248 Cal.App.4th 91, 108 [recirculation required where stormwater management plan was redesigned and revisions analyzed the project's consistency with several general plan air quality policies and implementation measures].)

III. The FEIR Fails to Adequately Assess and Mitigate Impacts to Water Quality and Climate Change Resilience

As mentioned in the Center's previous comments, science has shown that implementing adequate buffers throughout the catchment or watershed in addition to around the reservoir(s) is an effective strategy to keep pollutants and sedimentation out of reservoirs (Norris 1993; Whipple Jr. 1993). Researchers suggest that to reduce sedimentation and pollution in drinking water supplies a minimum 300-foot buffer should be established around reservoirs, and larger buffer zones should be established around upstream channels and tributaries closer to pollution sources of sediment and other pollutants (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993). Yet the FEIR rejects this information because the Center's recommended setbacks, which are based on scientific studies, are "not based on local research near the Guenoc Valley Site or the wildlife species that may occur there" (FEIR at 3-50). This is dangerous and backwards logic that threatens safe drinking water for communities, basically assuming that the Project area is not similarly subject to physics, chemistry, or hydrogeomorphic processes that have shaped other riparian systems. Scientific evidence suggests that setbacks of 20 to 30 feet will not adequately protect water quality from degrading due to sediment, turbidity, and other types of pollution, such as excessive nutrients (nitrogen and phosphorous) and pesticides. Larger buffer zones at reservoirs and along streams and wetlands upstream of the reservoirs would provide more stream bank stabilization, water quality protection, groundwater recharge, and flood control both locally and throughout the watershed (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993; Sabater et al. 2000; Lovell and Sullivan 2006). They would also protect communities from impacts due to climate change by buffering them from storms, minimizing impacts of floods, and providing water storage during drought (Environmental Law Institute 2008). Thus, the FEIR should require a minimum 300-foot buffer around reservoirs with a minimum of 200-300-foot setbacks from streams and wetlands, depending on whether the habitat supports, has the potential to support, or historically supported special-status and/or sensitive species, or if it provides important habitat connectivity.

Other studies have shown that land use patterns at the watershed scale are correlated with water quality, carbon sequestration, and the level of species abundance and biodiversity (Pess et al. 2002; Opperman et al. 2005; Lohse et al. 2008; Padilla et al. 2010; Grantham et al. 2012). For example, higher levels of vineyard/agricultural conversion and exurban development within watersheds have been associated with increased fine sediment inputs to streams (Opperman et al. 2005; Lohse et al. 2008), reduced diversity of aquatic macroinvertebrates (Lawrence et al. 2011), reduced abundance and diversity of native fishes (Pess et al. 2002; Lohse et al. 2008), and reduced carbon sequestration (Padilla et al. 2010). Meanwhile, forest cover, which includes woodlands adjacent to aquatic resources, plays a critical role in maintaining important water resources for clean drinking water and agriculture. Reduced forest/woodland cover has been shown to result in increased runoff (*i.e*., pollutants such as pesticides and fertilizers flowing into groundwater and surface waterways), erosion, sedimentation, and water temperatures; changes in channel morphology; decreased soil retention and fertility; and decreased terrestrial and aquatic biodiversity (Brown and Krygier 1970; Pess et al. 2002; Dahlgren et al. 2003; Houlahan and Findlay 2004; Opperman et al. 2005; Lohse et al. 2008; Elliot 2010; Lawrence et al. 2011; Moyle et al. 2011; Zhang and Hiscock 2011; Jedlicka et al. 2014). In addition, forests and woodlands are an important carbon sink that can help moderate the impacts of climate change (Padilla et al. 2010; Pan et al. 2011), and some researchers argue that at a global scale, trees are linked to increased precipitation and water availability (Ellison et al., 2012). These studies indicate that land use planning needs to consider impacts at the watershed scale to implement effective environmental protections that actually safeguard important natural resources like water quality and erosion control. Again, by implementing insufficient setbacks of 20-30 ft for aquatic resources and providing insufficient mitigation for oak woodlands and other vegetation and natural communities that stabilize soils, maintain high water quality, and sequester carbon without considering the watershed-level impacts, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, water quality, and climate change resilience.

IV. The FEIR's Water Supply Analysis is Inadequate

The FEIR's water supply analysis fails to clearly demonstrate to the public and decision-makers that there will be sufficient long-term supplies to service the Project. The Project will use surface water rights previously granted for the Project site, but the FEIR and Water Supply Assessment ("WSA") are internally inconsistent in the quantities of surface water available. Furthermore, the FEIR and WSA fail to discuss the viability of long-term appropriations under existing permits in light of climate change's current and future impacts on regional surface water supplies in the Putah creek watershed.

A. The FEIR Fails to Properly Assess the Impacts of Climate Change on the Project's Surface Water Supply

The FEIR fails to adequately consider the impacts of climate change on the availability of increasingly scarce water resources in the western U.S. during the lifespan of the Project. California law requires agencies to discuss and disclose a proposed project's long-term future water supply. (See *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 430-432 (hereinafter "*Vineyard*"); Water Code § 10910.) The FEIR finds the Project will have less than a significant impact on water supply related to sufficiency of water supply. (FEIR at 3.14-15.) This finding is based on the WSA, which describes the surface water rights that will provide non-potable water to a significant portion of the Project site. (WSA at 22.) The WSA does not discuss how climate change will the attendant shifts in precipitation regimes will impact the amount of water ***actually available*** under the existing appropriative rights. This shortcoming undermines the accuracy of the water supply analysis, and the finding of no significant impact based thereon.

Significant for the State, as well as the Project area, is climate change's impact on water supply. The Intergovernmental Panel on Climate Change ("IPCC") specifically identified the

American West as vulnerable, warning, "Projected warming in the western mountains by the mid-21st century is very likely to cause large decreases in snowpack, earlier snow melt, more winter rain events, increased peak winter flows and flooding, and reduced summer flows . . . ." (IPCC 2007b.) Recently, researchers found that an increase in atmospheric greenhouse gases has contributed to a "coming crisis in water supply for the western United States. . . ." (Barnett 2008.) Using several climate models and comparing the results, the researchers found that "warmer temperatures accompany" decreases in snow pack and precipitation and the timing of runoff, impacting river flow and water levels. (Barnett 2008.) These researchers concluded with high confidence that up to 60 percent of the "climate related trends of river flow, winter air temperature and snow pack between 1950-1999" are human induced. (Barnett 2008.) This, the researchers wrote, is "not good news for those living in the western United States." (Barnett 2008.)

The California Center on Climate Change has also recognized the problem climate change presents to the state's water supply and predicts that if GHG emissions continue under the business-as-usual scenario, snowpack could decline up to 70-90 percent, affecting winter recreation, water supply and natural ecosystems. (Cayan 2007.) Climate change will affect snowpack and precipitation levels, and California will face significant impacts, as its ecosystems depend upon relatively constant precipitation levels and water resources are already under strain. (Cayan 2007.) The decrease in snowpack in the Sierra Nevada will lead to a decrease in California's already "over-stretched" water supplies. (Cayan 2007.) It could also potentially reduce hydropower and lead to the loss of winter recreation. (Cayan 2007.) All of this means "major changes" in water management and allocation will have to be made. (Cayan 2007.) Thus, climate change may directly affect the ability to supply clean, affordable water to the residents, or change how the Project will utilize water, and it may also impact other activities outside the Project area, such as agriculture or offsite residential use.

B. The FEIR Fails to Demonstrate How Much Surface Water Will Actually be Available at Full Build-out of the Project

The FEIR and WSA base the analysis of surface water supplies on the assumption that the maximum amount that can be appropriated under existing permits will be available throughout the 20-year planning horizon. The future water supplies identified in an EIR "must bear a likelihood of actually proving available; speculative sources and unrealistic allocations ('paper water') are insufficient bases for decision-making under CEQA." (*Vineyard*, 40 Cal.4th at 432.) The discussion of the impacts related to likely future supplies must include an analysis of the "circumstances affecting the likelihood of the water's availability." (*ibid*.) Here, the WSA states that 10,394.5 acre-feet per year ("AFY")[5] are authorized for diversion and storage (WSA at 51), and 7,360 AFY are available to be withdrawn from storage (WSA at 52) in a normal year under current permits. While the WSA contains projections for available non-potable surface supply within the place of use ("POU") in critical dry and multiple dry year scenarios, any decrease due to dry conditions is calculated based on the maximum permitted appropriation amount. (*id*.) The WSA does not clearly demonstrate the historic yearly diversions under the existing permits. Instead, the WSA provides a table accounting for usage and carryover storage

[5] This total amount also includes 560 AFY from riparian rights along Bucksnort creek.

from 2011 to 2018. (WSA at 37.) This table does not illustrate how much water was diverted from the Putah creek watershed in any of those years. Such information would demonstrate how much of the total appropriative rights are actually received, and how those amounts, and the resulting carryover storage, compare to projected demand for non-potable use within the POU. Without accurate accounting of likely future supplies, the supply-demand projections in the WSA (WSA at 57) are unverifiable, rendering the FEIR's conclusions about water supply unsupported by substantial evidence.

The FEIR's analysis of non-potable surface water supplies is further undermined by internal inconsistencies regarding how much water is lost from reservoirs each year due to seepage and evaporation. Factual inconsistencies render the FEIR inadequate as an informational document. (*Vineyard*, 40 Cal.4th at 439 ["Factual inconsistencies and lack of clarity in the FEIR leave the reader—and the decision makers—without substantial evidence for concluding that sufficient water is, in fact, likely to be available …"].) The WSA contains different data regarding how much water was lost from reservoir storage each year due to evaporation and seepage, then uses a projection that is significantly lower than observed rates of loss when calculating available supplies to be withdrawn each year during Project operation. (WSA a 37-39.) The WSA projects normal year supply of 7,360 AFY, which accounts for 1,770 AFY of evaporative losses. (WSA at 39.) But the WSA also notes that reservoir losses were observed to be 2,320 AFY from 2009-2013 and 2,700 AFY for 2014-2018. (WSA at 37.) Further muddying the waters, Table 4-5 demonstrates usage and carryover storage for Project site reservoirs between 2011 and 2018, and the average loss from evaporation and seepage during that period is approximately 2,827 AFY. (WSA at 38.) The WSA doesn't explain how the 1,770 AFY number was calculated, nor does it address how that number is significantly different from the actual losses observed for Project site reservoirs. This lack of clarity is significant, when considering the narrow supply and demand margins for non-potable surface water in the POU during single dry, and multiple dry water years. Specifically, the WSA assessment anticipates a non-potable surplus in the POU of 573 AF in a single dry year, and 973 AF in multiple dry years by 2040. (WSA at 58.) These surplus amounts vanish when accounting for how much evaporative/seepage loss actually occurred on the Project site between 2011 and 2018.[6] The inaccurate accounting of available non-potable surface supplies within the POU leads the WSA to report a surplus in drought years, when in fact, there would be a deficiency under those scenarios when using historic evaporative/seepage losses for reservoirs on the Project site. This undermines the conclusion that sufficient non-potable surface water exists to serve the Project's demand within the POU.

The shortcomings in the WSA's analysis of available non-potable surface supplies within the POU are not rectified by the potential availability of groundwater. As noted above, the EIR must demonstrate how it will supply the Project's water through the 20-year planning horizon, and if there is uncertainty about the availability of supply, alternatives must be discussed and the impacts of their provision disclosed. (See *Vineyard*, 40 Cal.4th at 432.) If the EIR plans to supplement non-potable demand within the POU with groundwater, that amount of groundwater must be quantified and disclosed to the public in the EIR. While the EIR concludes there is

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[6] Using actual average evaporative/seepage losses of 2,827 AFY, instead of the unsupported 1,770 AFY projection, the available supplies would be 1,057 AFY less than projected in all water year categories.

sufficient groundwater to the serve the Project's demands, specifically all potable demand and non-potable outside the POU (WSA at 54-55), the amount that will be used is critical in long-term regional supply analysis. As the EIR points out, Lake County is not required to have a Groundwater Sustainability Plan ("GSP") in place under the Sustainable Groundwater Management Act ("SGMA"). (FEIR at 3.9-19.) Nevertheless, the Lake County Groundwater Management Plan ("GMP") seeks to implement "County-wide initiatives to better understand and manage groundwater." (FEIR at 3.9-19.) The County's ability to coordinate groundwater management within the groundwater basin(s) necessitates a clear and accurate description of how much groundwater the Project will use. Unfortunately, the inadequate surface water supply analysis creates uncertainty in the Project's future supplies, and the potential availability of groundwater supplements was not quantified nor assessed in the EIR.

V. The EIR Lacks an Adequate Analysis of the Project's Impacts Relating to Wildfire and Emergency Evacuation

The Center's comments on the DEIR identified numerous inadequacies and shortcomings in the County's analysis of the Project's impacts relating to wildfire and wildfire emergency evacuation. Among other things, the DEIR failed to acknowledge the likelihood that the Project would increase the chance of wildfires while simultaneously impairing evacuation routes for existing residents. Unfortunately, the FEIR's response to comments and minor changes to the EIR and Wildfire Prevention Plan do nothing to remedy these deficiencies. Tellingly, the Planning Commission's staff report for the Project acknowledges (pp. 16-17) that "[i]n 2015, Lake County suffered three separate wildfires that burned approximately 171,000 acres of wild land, forest, and residential property, and resulted in the cumulative loss of 1,329 homes and damage of over 70 commercial properties." As we explained in our previous comments, the extremely high risk of wildfire in the area and the past history of large-scale repeated burnings at the Project site make it especially imperative that the County prepare an EIR that adequately discloses and analyzes the Project's wildfire impacts, and considers mitigation and alternatives to reduce these impacts.

A. The EIR Continues to Ignore and Obscure the Increase in Fire Risk Resulting from the Project

The FEIR remains deficient because it fails to acknowledge or adequately analyze the increased risk of wildfire that results from development and increasing the intensity of use in undeveloped areas subject to wildfire. Indeed, the FEIR continues to downplay or ignore this effect, claiming, once more and without support, that the Project would *reduce* wildfire risk on the Project site. (FEIR at 3.16-10.) This conclusion is patently defective. The County cannot continue to ignore the abundant evidence in the record that locating homes in the wildland urban interface increases the risk of wildfire ignition.

In its comments on the DEIR, the Center submitted extensive evidence to the County, including numerous published, peer-reviewed studies by the nation's preeminent experts on wildfires, of the scientific consensus that housing and human infrastructure in fire-prone wildlands are the main drivers of fire ignitions and structure loss. (See, e.g., Syphard, et al. 2019.) The FEIR's Response to Comments does not address, discuss, or even acknowledge any of this evidence. Instead, the FEIR's Response to Comments states merely, "The risk of human ignition of wildfires is considered in Impact 3.16-5 and addressed in the Wildfire Prevention Plan (Appendix FIRE of the Draft EIR)." (FEIR at 3-57 [Response O10-27].) But the County's response does not address the Center's comments. Instead of responding to the comment, or even addressing the effect of development in the Wildland Urban Interface on fire ignition risk, the County merely points to its Wildfire Prevention Plan. (FEIR at 3-57 [Response O10-28].) While a project-specific Wildfire Prevention Plan can conceivably reduce a project's wildfire impacts as compared to a hypothetical project without any wildfire prevention measures, the Wildfire Prevention Plan does not address—and the EIR does not disclose—the Project's potential to increase wildfire ignitions *as compared to existing conditions on the Project site*.

The County cannot ignore away the overwhelming evidence that that growth in the wildland-urban interface "often results in more wildfire ignitions, putting more lives and houses at risk." (Radeloff et al. 2018.) Developing housing in locations in California that currently have low or no density—such as the current Project site—dramatically *increases* the number of fires and the amount of area burned. *See* Keeley 2005; *see also* Syphard et al. 2013; Syphard et al. 2007 [stating that ninety-five percent of California's fires are caused by human activity].) Common anthropogenic causes of fire include arson/incendiary, equipment use, debris burning, smoking, vehicles, fireworks, electricity, and outdoor cooking. Additionally, structure fires can spread and initiate wildland fires.[7]

Drs. Alexandra Syphard and Jon Keeley, wildfire ecology experts who have been studying California wildfires and the relationship between wildfire and human activity for decades and have published hundreds of studies on the topic collectively, reiterate in an April 20, 2020 email that 95% of fires in California have been caused by humans, and when ignitions align with severe weather conditions, impacts are the most severe. (Syphard 2020.) They also state "as humans move farther east and into wildlands the likelihood of ignitions moving into those areas also increases." (Id.) There is insurmountable evidence from numerous studies which find that placing more sprawl development in fire-prone landscapes increases wildfire risk. The FEIR fails to consider the available science to adequately assess and mitigate the increase in wildfire risk due to the Project.

As one California court recently put it when finding the County of San Diego's EIR for a residential development project inadequate on these very grounds:

> [T]here is no discussion in the EIR of whether or how adding 1400 new residents into the area will affect the likelihood of wildfires. Adding this many residents into the Harmony Grove Project area is bound to affect the likelihood of fire given that, according to one report, 95% of modern wildfires in California are started by people. . . .The EIR should have addressed the issue. Although the EIR discusses

[7] In addition to the human-ignited 2015 Valley Fire, which we discussed in our comments on the DEIR, Lake County's 2016 Clayton Fire, which burned nearly 4,000 acres and destroyed 300 structures, was also human-ignited, according to Cal Fire. (CAL FIRE 2016.)

> what will be done to deal with wildfires, it does not address how adding new residents will affect the potential for wildfires to start.

(*Elfin Forest Harmony Grove Town Council v. County of San Diego* San Diego Sup. Ct. Case No. 37-2018-00042927-CU-TT-CTL, minute order dated Feb. 20, 2020 [included as reference].) Similarly here the EIR fails to address how adding up to 4,000 new residents to this demonstrably wildfire-prone location will affect the potential for wildfires to start.

Because it fails to acknowledge the significant wildfire impacts from increased risk of human ignition as a result of the Project, the EIR also fatally fails to mitigate them or consider alternatives to the Project that would reduce these impacts.

B. The EIR's Mitigation for the Project's Wildfire Impacts is Inadequate

As with the DEIR, the FEIR proposes only a single mitigation measure—MM 3.16-2—to reduce the Project's operational wildfire impacts (a single additional measure purports to mitigate all wildfire impacts from Project construction). (DEIR at 3.16-15 to -16.) As the Center previously commented:

> The [EIR] relies on MM 3.16-2 ("Post Wildfire Emergency Response") as the sole mitigation measure to reduce Impacts 3.16-4 and 3.16-5, which involve exposure of people and structures to wildfire. Yet, the measure is toothless and virtually meaningless; it defers preparation of the plan to an uncertain date, contains no standards to guide its preparation, is not enforceable, and does not include any concrete measures that can be shown to actually reduce wildfire impacts. In short, it fails to comply with *any* of CEQA's requirements for mitigation in an EIR.

The County did not respond to the Center's comments about the inadequacy of MM 3.16-2, or the untenability of relying on measure provides for the future preparation of a *post-wildfire* impacts study to reduce the risk of exposure from wildfires. Nor did the County make any attempt to defend MM 3.16-2's adequacy. Instead, the County apparently disclaims it, stating "No mitigation is identified because the Wildfire Prevention Plan adequately reduces the impact." (FEIR RTC, Response O10-30 [stating also, "Mitigation Measures 3.16-1 and 3.6-2 . . . alone would not be adequate, as the commenter notes."].) It then deflects to the Wildfire Prevention Plan (which, for the reasons described below is inadequate). The County cannot ignore the shortcomings in its mitigation measure MM 3.16-2—upon which the EIR relies to find that the Project's wildfire impacts would be less than significant—simply by pointing to *other* mitigation in the EIR.

i. The EIR Fails to Demonstrate That its Wildfire Prevention Plan Will "Reduce Wildfire Risks" to Less Than Significant

Like the DEIR, the FEIR continues to rely on a revised Wildfire Prevention Plan to "reduce risks in the area." (FEIR at 3.16-10.) The revised plan is included as the FEIR's Appendix FIRE. In our comments on the DEIR, we pointed out the Wildfire Prevention Plan's numerous flaws including a lack of evidence showing that its mitigation measures would be effective; its vague, ill-defined, or improperly deferred measures; and the fact that most of its measures are not enforceable. In response, the plan was revised such that its property boundary fire breaks around homes will ostensibly be required prior to home construction and to make external sprinklers a requirement for some structures.

While commendable, these changes do not remedy the Wildfire Protection Plan's shortcomings. For example, the irrigated vineyards and grazing that make up two of the Wildfire Prevention Plan's three wildfire "prevention strategies" remain vague, ill-defined, and lack enforcement mechanisms or meaningful performance criteria to evaluate their effectiveness. (FEIR Appendix FIRE at p. 15.) And there are still no assurances that many of the measures will actually be implemented. For example, a substantial portion of the plan's projected irrigated "fire breaks" which it relies on to "reduc[e] the spread of wildfires throughout the site" are only "potential" vineyards. (FEIR Appendix FIRE at pp. 19, 2 [identifying "potential irrigated vineyards fire breaks" that will be leased and managed by third parties].)

The Wildfire Prevention Plan is also vague and aspirational at the level of individual residential units. We identified this shortcoming in our DEIR comments, pointing out for example that the plan states only that: "If a wildfire occurs, it poses a considerable risk to residential homes and their occupants. Homeowners *will be advised* to implement various wildfire prevention strategies." (FEIR Appendix FIRE at p. 23 [unchanged from the draft included with the DEIR].) The document then goes on to suggest "various [landscaping] strategies [that] can reduce wildfire risk where establishing a new landscape design." (*Id.* at p. 25.) Finally, the document notes that "residential buildings will abide by" state building codes (*id.* at p. 28) and suggests "interior strategies," such as smoke detectors, for reducing fire risk (*id.* at p. 29). But as Syphard and Keely explain, new construction built to state building codes "is not a panacea" and "MANY of the houses destroyed [in wildfires in California between 2013 and 2018] were newly built." (Syphard 2020.)

In response to the Center's concerns about the enforceability of measures to reduce wildfire risk, the FEIR claims that the mitigation measures imposed in the Wildfire Prevention Plan are enforceable because "Implementation of the Wildfire Prevention Plan (Revised Appendix FIRE of the Final EIR) will be made a condition of project approval, and therefore will be enforceable by the County." (FEIR RTC at 3-57.) First, this appears to be incorrect; the draft Conditions of Approval document published as Exhibit 15 to the Planning Commission's Staff Report for the Project is entirely silent as to the Wildfire Prevention Plan. Second, even if the Conditions of Approval did require "implementation" of the Wildfire Prevention Plan, the plan's measures themselves are largely optional or advisory and use aspirational, not mandatory, language.[8] (See FEIR Appendix FIRE at p. 28 [listing a "selection of strategies to prevent fires" none of which, except for exterior sprinklers, are required to be implemented by homeowners].) The EIR's failure to include enforceable, concrete mitigation with measurable performance standards violates CEQA. (*City of Santee v. Cnty. of San Diego* (1989) 214 Cal.App.3d 1438, 1454-55.)

[8] As we mentioned in our comments on the DEIR, oversight of the [Wildfire Prevention Plan's] management, operations, and enforcement will be in the hands and at the discretion of the future Homeowner's Association; this remains true of the revised Wildfire Prevention Plan (FEIR Appendix FIRE at p. 3), and the FEIR's Response to Comments did not address this comment.

Moreover, as the Center explained in its comments on the DEIR, the Wildfire Prevention Plan contains no data or analysis to support the EIR's conclusions that implementing the plan will reduce wildfire risk in any meaningful way. Instead, it provides only vague discussions of the measures that it claims can ameliorate wildfire risk, without making any attempt to quantify these assertions or support them with evidence. (The problem is compounded by the lack of any modeling of current or post-project wildfire behavior on the Project site, described in more detail below.) The FEIR makes no attempt to rectify this shortcoming or supply the missing evidence. Bare conclusions, even if true, are insufficient to fulfill the informational purpose of an EIR. (*Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 736.) The EIR's error is only compounded by the Wildfire Prevention Plan's failure to address or acknowledge the increase in wildfire risk that will result from the Project's increased potential for human ignitions.

C. The EIR Fails to Analyze the Impact to Biological Resources from Increased Fire Risk Resulting from the Project

The FEIR fails to account for the impact to biological resources from increased fire risk from the Project. As the Center pointed out in its comments on the DEIR, wildfires can be disastrous for plant and animal life. If native habitat fire regimes are disrupted, the habitats they provide can become degraded and when fires occur too frequently, type conversion occurs and the native shrublands are replaced by non-native grasses and forbs that burn more frequently and more easily, ultimately eliminating native habitats and biodiversity while increasing fire threat over time. The FEIR completely ignores the evidence submitted by the Center, including numerous peer-reviewed journal articles, that demonstrates the harms to wildlife, habitat, and connectivity from wildfires.

Instead, in its Response to Comments, the FEIR states that "Effects of changes in wildfire frequency and intensity on biological resources, including habitat, are acknowledged in the discussion of effects related to climate change on page 3.7-3 of the Draft EIR." (FEIR RTC at 3-57 [Response O10-29].) It goes on to claim that because the EIR finds "the Proposed Project would not result in significant impacts associated with wildfire ignition, additional discussion regarding the indirect consequences of wildfire on biological habitats is not warranted." (*Id*.) But merely acknowledging that climate change will likely result in wildfire frequency and intensity and stating that it may have an effect on biological resources is not a substitute for evaluating the impact that the Project's increased risk of wildfire ignitions will have on wildlife and habitat. The EIR should be revised to include this analysis and recirculated.

D. The EIR's Description of Existing Wildfire Conditions on the Project Site is Inadequate

The Wildfire Prevention Plan and EIR fail to adequately describe the existing wildfire conditions on the Project site. It is standard practice when preparing an EIR for a residential development project of this size and scope for experts to use modeling software, such as the industry-standard FlamMap, BehavePlus, or similar programs, to provide fire behavior modeling for the Project site. The analysis typically includes descriptions of the Project's site's topography, fuel loads, and wind patterns, and uses those inputs to anticipate wildfire conditions under various scenarios. For example, the Wildfire Protection Plan for the 2,135-home, 1,985-

acre Newland Sierra housing development in San Diego County, used both FlamMap and BehavePlus to estimate fire spread rate, flame length, and ember "spotting" distance. (Dudek 2018a. at p. 35; see also Dudek 2018b. [Fire Protection Plan for Otay Village 14 residential development in San Diego County, using BehavePlus modeling])[9]

In sharp contrast, the FEIR's Wildfire Prevention Plan is strikingly devoid of detail. Although it contains generalized descriptions of the site's vegetation, wind patterns and topography (FEIR Appendix FIRE at pp. 10-14), *it makes no attempt to use this information to model likely fire conditions on the project site*. This is industry standard, critical information and, again, frequently and typically performed by agencies conducting environmental review for housing developments of this size and scope. The County should withhold approval of the project until it performs this critical analysis—including fire spread rates, fire direction, flame-length, and ember "spotting" distance under various scenarios on the Project site—and discloses it to the public in a recirculated EIR. The County has no excuse for failing to supply this analysis.

E. The EIR Fails to Analyze the Project's Impacts to Community Safety During a Wildfire Evacuation

In response to the Center's request that the County prepare a project-specific wildfire evacuation analysis and plan that addresses the Project's impacts on wildfire evacuation safety and times for Project residents and existing nearby residents, the County merely brushed off the Center's concerns, pointing again to the Wildfire Prevention Plan. However, that plan is *entirely silent* on the issue of evacuation and evacuation routes in the event of a wildfire. A mere four pages of the Wildfire Prevention Plan (consisting mostly of graphics) are devoted to "Wildfire Emergency Response," but these four pages focus entirely on fire suppression and response activities and *do not address resident evacuation at all*. (FEIR Appendix FIRE at 31-35.) We remain deeply concerned that the EIR makes no effort to calculate or disclose how adding a permanent population of 4,000 residents, plus additional thousands of visitors, will affect evacuation times and effectiveness for *new and existing residents* in, and in the vicinity of, the Project site.

As Dr. Thomas Cova is a leading expert on environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling, whose work has been cited in EIRs for large scale residential development projects in California. Dr. Cova reviewed the FEIR for the Project (including Appendix FIRE) and provided comments in its evacuation analysis in a report attached as Exhibit 1 ("Cova Report"). As the Cova Report explains:

> Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only

[9] The Center provides this documentation only to demonstrate that performing this type of analysis of fire conditions is not only possible—it is typical. The Center does not contend that this document's analysis is accurate or adequate. The Newland Sierra project was rejected by voter referendum in March 2020, in large part due to public concerns over fire safety.

> possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

(Exhibit 1 at 3 [stating also that "it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios."].)

Notwithstanding the EIR's failure to analyze the Project's impacts to community safety in the event of a wildfire, it is clear that the impacts will be significant. (Exhibit 1 at pp. 3-4.) As expert Dr. Cova explained, "there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site" and "there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety." (*Id.* at pp. 4-5.) This is compounded by the fact that the Project site's evacuees must all travel through the bottleneck of Butts Canyon Rd., after leaving the Project site, providing "very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project ." (Exhibit 1 at p. 2.) It is unconscionable that despite this evidence of significant impacts to public safety if the Project is built, the FEIR does not disclose the effect on on evacuation times from adding thousands of additional residents to the Project area.

Furthermore, the FEIR's Responses to Comments failed to squarely address the concerns the Center raised regarding wildfires and community safety. Instead, the Response to Comments side-stepped or ignored our comments. In particular, in our comments on the DEIR we asked (underlined):

<u>What are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site?</u> The County responded by stating that "While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables." (FEIR RTC O20-31.) The fact that there are a "number of variables" does not excuse the County from performing this critical analysis. As the Cova Report explained, lead agencies frequently undertake this type of analysis for large scale residential development projects. For example, the EIR for the 2,135-home, 1,985-acre Newland Sierra housing development in San Diego County included a project-specific evacuation plan that, *inter alia*, estimated the total number of vehicles on the project site, estimated the time required to evacuate everyone from the project site, and estimated the roadway capacity in the event of an evacuation. (Dudek 2017.)[10] The County cannot simply throw up its hands and declare that this routine analysis is not possible here. The public has a right to know how the Project will affect evacuation times for Project residents and existing residents in the vicinity.

<u>What will the Level of Service be for emergency egress routes from the Project vicinity in the event a wildfire-driven evacuation becomes necessary?</u> The County's response stated that the Level of Service "would not be likely to be relevant in a rural area during a wildfire emergency,

[10] Again, the Center provides this document only to demonstrate that this performing this type of project-specific evacuation analysis is both possible and typical. The Center does not contend that this document's analysis is accurate or adequate.

as shown on these tables, levels of service at project intersections on evacuation routes would generally be acceptable." (FEIR RTC O20-31.) This is patently incorrect. The tables referenced by the County's response indicate that the intersection at Butts Canyon Rd. and Hwy 29 will drop from current peak-hour levels to an "F" rated[11] Level of Service, with 50-minute delays. Given that Butts Canyon Rd. is the *only* egress road for the Project, in the event of a wildfire evacuation requiring project residents (and other nearby residents using Butts Canyon Rd. east of Hwy 29) to evacuate westward, several thousand residents will need to pass through this intersection. If such an evacuation event were to occur during peak-hour times, 50 additional minutes' worth of delay at this intersection would have a significant impact on evacuee safety. The EIR does not disclose this impact or attempt to mitigate it.

<u>What, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable?</u> The County's response provides a link to the Lake County Evacuation Map (which shows no alternative evacuation routes for the Project site), and states, "[t]his map shows all of the existing and potential evacuation routes serving the county and the project site." In so doing, the County entirely sidesteps the question and—like the EIR—fails to disclose that there is no alternative evacuation route in the event that Butts Canyon Rd. becomes impassable due to gridlock, vehicle collisions, being overtaken by wildfire, or other reasons.[12] As the Cova Report explains: "[I]n the event of a wildfire, *all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway*. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable." (Cova Report at 2 [emphasis in original].) Accordingly, the County has failed in its obligation to consider alternatives to the Project to mitigate the Project's significant impacts community safety.

<u>What effect will resident evacuation on Butts Canyon Rd. and/or Hwy 29 or 175 have on the ability and timing for first responders who are responding to wildfire in the vicinity of the Project?</u> The County simply stated: "evacuation in the event of a wildfire is managed by the Lake County Sheriff's Department in coordination with other emergency responders through the Emergency Services agency." This statement of jurisdictional responsibility does not even attempt to answer the Center's question about the *impact* that traffic from the Project site will have on response times for first responders attempting to provide fire suppression or medical assistance.

Finally, in response to our request for project specific analysis, the County's Response to Comments refers readers to a hyperlink to a webpage with the Lake County Community Wildfire Prevention Plan. (FEIR RTC at 3-59.) But as we explained in our previous comments, this plan was prepared in August 2009, prior to the Project, and does not anticipate or address the Project in any way nor account for the thousands of additional evacuees and vehicles *from this Project* that will flood the region in the event of a wildfire in the vicinity of the Project. It does not and cannot substitute for the project-specific analysis that CEQA requires. As with the EIR found

[11] An "F" rated Level of Service means that the intersection suffers from "extreme congestion, with very high delays and long queues unacceptable to most drivers." (FEIR at 3.13-12 [Table 3.13-3].)
[12] As the Camp Fire and Tubbs Fire recently demonstrated, vehicle-clogged roadways overtaken by fire in an evacuation is an especially dangerous scenario. (Arthur 2019, Diskin 2019.)

deficient in *California Clean Energy Commission v. County of Placer* (Dec. 22, 2015, No. C072680) ___Cal.App.5th___ [2015 Cal. App. Unpub. LEXIS 9360, at *1, *78] the FEIR still says "nothing about the impact of the increased population density created by the Project on emergency evacuations in the event a wildfire does occur, nothing about the effect of such evacuations on access for emergency responders and suggested no mitigation measures to address any such concerns."

The public—including future residents of the Project, and existing residents nearby who will be relying on Butts Canyon Rd. for evacuation—have a right to know the full extent of the Project's impacts on wildfire evacuation. The County's failure to analyze or disclose these impacts prejudicially impedes informed decision-making and informed public participation. (*See Sierra Club v. County of Fresno*, (2018) 6 Cal.5th 502, 515.)

F. The EIR Fails to Adequately Evaluate the Project's Cumulative Wildfire Impacts

As we pointed out in our comments on the DEIR, the EIR provides only a single, conclusory paragraph dismissing cumulative wildfire impacts with virtually no analysis. The FEIR acknowledges that "Development of these [other planned] projects [in the near vicinity] would introduce new people and infrastructure to the area. Increased development could potentially add more opportunities for igniting fires, more fuel, and make emergency response operations more complex." (FEIR at 3.16-15.) Then, it concludes, without further analysis and in reliance on its own Wildfire Prevention Plan and two mitigation measures that cumulative wildfire impacts from the Project will be less than significant. (Id.) The FEIR's Response to Comments essentially concedes that its cumulative analysis adds nothing to its analysis of the Project's individual. Quoting the FEIR, the Response to Comments states, "[b]ecause of the discussed factors, the Proposed Project in combination with future projects in the region will not create a significant impact." (FEIR RTC Response O10-32.) But the "discussed factors" is merely a reference to the EIR's analysis of the Project's individual impacts. Merely mentioning two other projects in the vicinity and concluding that there can be no cumulative wildfire impacts is no substitute for the analysis that CEQA and the CEQA guidelines require. The EIR should be revised and recirculated to correct this deficiency.

VI. Conclusion

Thank you for the opportunity to submit comments on the Final Environmental Impact Report for the Guenoc Valley Mixed-Use Planned Development Project. The Center urges the Board not to approve this Project, and at the very least to delay its consideration of the Project until the public has had adequate time to review and comment on the voluminous FEIR and other documents.

Given the possibility that the Center will be required to pursue legal remedies in order to ensure that the County complies with its legal obligations including those arising under CEQA, we would like to remind the County of its duty to maintain and preserve all documents and communications that may constitute part of the "administrative record" of this proceeding. The administrative record encompasses any and all documents and communications that relate to any and all actions taken by the County with respect to the Project, and includes "pretty much everything that ever came near a proposed [project] or [] the agency's compliance with CEQA . . . ." (*County of Orange v. Superior Court* (2003) 113 Cal.App.4th 1, 8.) The administrative record further includes all correspondence, emails, and text messages sent to or received by the County's representatives or employees, that relate to the Project, including any correspondence, emails, and text messages sent between the County's representatives or employees and the Applicant's representatives or employees. Maintenance and preservation of the administrative record requires that, *inter alia*, the County (1) suspend all data destruction policies; and (2) preserve all relevant hardware unless an exact replica of each file is made.

Please do not hesitate to contact the Center with any questions at the number or email listed below.

Sincerely,

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Exhibit 1

Cova Report

Prepared by Thomas J. Cova, Ph.D., Evacuation Consultant, Salt Lake City, UT

Dated: July 2, 2020

Subject: Evacuation analysis and planning for the proposed Guenoc Valley Mixed Use Planned Development Project in Lake County, CA

SUMMARY

I have reviewed the Environmental Impact Report (EIR) and Wildfire Prevention Plan for the Guenoc Valley project. The Guenoc Valley project site is in a very high fire hazard area evidenced by recent fast-moving, intense wildfires in the Project vicinity that caused loss of life. The project is large and proposes to add thousands of people to a very sparsely populated area with a limited transportation network. The EIR does not evaluate or disclose the wildfire evacuation risks associated with introducing this many people and vehicles to the project area and does not include a detailed wildfire evacuation plan to protect the safety of the residents. Prior to approving the project, the County should prepare a project-specific evacuation plan that addresses, at a bare minimum: 1) the possible range of evacuation times for residents and visitors, 2) the possible range of lead times available to act in an urgent wildfire, 3) the pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the Countywide evacuation plan, and 3) detailed alternative plans for protecting residents and visitors when roads become impassible or the time required to evacuate is greater than the time available.

ANALYSIS

The Project Configuration Allows Only One Evacuation Route for Several Thousand Residents

The Guenoc Valley Site consists of 16,000 acres in southwest Lake County, California. The project will include 400 hotel rooms, 450 guest resort residential units, 1400 residential estates, and 500 workforce co-housing units. The EIR proposes 753 total parking spaces for Phase 1 but does not mention how many there might be when the project is complete or how many vehicles are likely to be on the project site, on average, after the project is complete. However, given the number of proposed units (and conservatively assuming one vehicle per unit when California's average number of vehicles per household is two), the site is likely to house at least 2750 vehicles on site when it is completed (i.e. 400 + 450 + 1400 + 500). While some of these units may have no vehicles, and others may have 2 or more, a range of at least two to three thousand vehicles is a reasonable starting assumption for evacuation planning for this project.

Access to the project site is via Butts Canyon Road from Middletown (7 miles to the west), although Butts Canyon Road continues south from the project site to Pope Valley (12 miles to its south). There are no alternative routes in or out of the project site. The Final EIR's Response to Comments O10-31 references the Lake County Evacuation map and states:

> *Regarding the commenter's question "what, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Proposed Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable", as noted on page 3.16-7 of the Draft EIR, the Lake County Wildfire Protection Plan provides an evacuation route map (URL in figure 1). This map shows all of the existing*

and potential evacuation routes serving the county and the project site. The Wildfire Prevention Plan for the Proposed Project includes plans for determining whether evacuation routes are unsafe, and designated meeting locations.

An excerpt of this map around the project site is provided in Figure 1. The map shows that the initial evacuation route is Butts Canyon Road north (and then to SR-29 North or South or SR-175 north), or south to Pope Valley (not shown on map because it's in Napa County). There are no evacuation routes to the east or north of the project site, so evacuees would have to travel southwest to Butts Canyon Road and then either northwest to Middletown or southeast to Pope Valley. This is very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project.

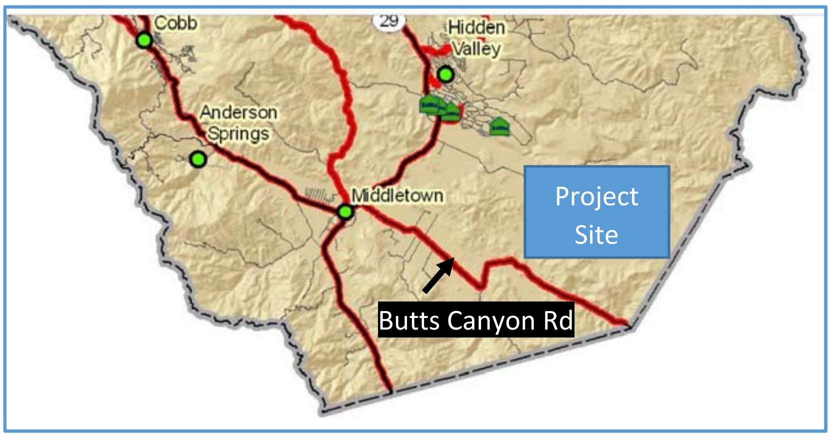

Figure 1. An excerpt taken from the Lake County evacuation map does not show an evacuation route in the project area. (URL: http://www.lakecountyca.gov/Assets/County+Site/Fire+Safe+Council/cwpp/Evacuation.jpg).

In other words, in the event of a wildfire, all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable.

The EIR Does Not Analyze the Project's Wildfire Evacuation Impacts

The project configuration presents an immediate concern due to the limited evacuation egress for project residents and workers trying to reach Butts Canyon Road in an urgent evacuation. Given this concern, and the history of wildfires on the project site, it is critical that the County perform a project-specific wildfire evacuation analysis that includes available lead times and evacuation times under a variety of scenarios.

As noted in the Final EIR Response to Comments O10-31, the time necessary to safely clear the project site can vary according to a number of factors:

Regarding the commenter's question "what are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site," evacuation times would vary

based on a large number of factors, including day of the week, time of day, the fire's location, behavior, winds, and terrain. While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables.

Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

The Project's Wildfire Evacuation Impacts Are Significant

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people (lead time) and the time it takes to protect them (evacuation time). Some of the variables mentioned by the County above (e.g. fire location, behavior, winds and terrain) are important inputs for estimating the lead time that would be available to protect residents. A fire that ignites near the project site (location) and spreads rapidly towards it (winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation of the site. Similarly, the day-of-week and time-of-day are variables affecting the evacuation time. For example, the number of evacuees (residents and visitors) and vehicles that might be on the project site due to weekends, holidays, or events (e.g. sports, music, weddings) will affect the evacuation time.

Wildfire safety hazards arise when the lead time is less than the evacuation time, and the difference between the two is a primary cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the east side of Paradise (lead time). Because of the large number of residents and vehicles that will be added to the area by the project and the recent history of intense, fast-moving wildfires (see the Wildfire Prevention Plan), it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios.

Gross estimates for evacuation time can be calculated using simple assumptions about warning time, response time, vehicle loading, and road capacity. Figure 2 shows the proposed transportation network on the south end of the project that would provide emergency access to Butts Canyon Road (the evacuation route from the project to Middletown or Pope Valley). Note that there are three access points to the project site along Butts Canyon Road (BCR) labeled *Primary Entrance Option 1 (PE1), Primary Entrance Option 2 (PE2), and Secondary Entrance (SE).* Although PE1 and PE2 provide two access points, they quickly merge into one access road to the northeast which create a bottleneck for evacuation purposes. This means that there are effectively two means of egress to Butts Canyon Road from the project: the Primary Exit (PE), which splits and leads to two access points, and the Secondary Exit (SE).

Assuming that the PE and SE both have one traffic lane out each (leaving one lane for emergency vehicle ingress, as is typical), and assuming that each exiting lane can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior), then the total egress from the site to BCR could range from 1200 to a high of 2400 vph. In supply-demand terms, this would be an estimate of the "supply" available to serve the evacuees as they leave the site.

As noted above, there could be a range of 2000-3000 vehicles on the project site depending on the time of day, day of week, or special events, and this would be the "demand" in an evacuation. Dividing the vehicle demand by the exit road supply, the minimum time to evacuate this site could range from an ideal case of lower demand and higher capacity (2000 vehicles / 2400 vph = 0.83 hours) to a much worse case of higher demand and lower capacity (3000 vehicles / 1200 vph = 2.5 hours).

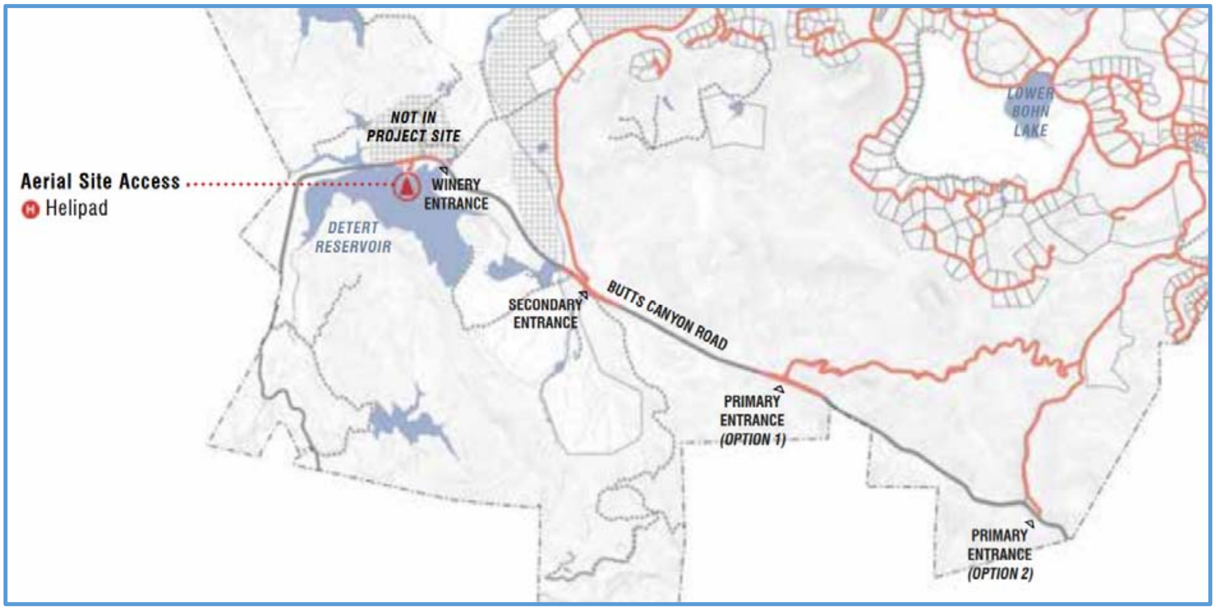

Figure 2. The transportation network that will connect the project site to Butts Canyon Road.

As noted above the second factor that influences the outcome of a wildfire evacuation is the lead time. The question becomes one of whether a wildfire in the vicinity of the project site might offer less than the time to evacuate the community (1 to 2.5 hours), leaving some evacuees at risk of being caught in-transit when the wildfire overtakes the community. This presents an extremely high safety threat. When persons are in vehicles on a road when fire is burning in the immediate area, visibility conditions may become so poor that the vehicles drive off the road or crash into other vehicles and/or flames and heat may overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire originating in Paradise. The EIR and Wildfire Prevention Plan provide little detail and no modeling regarding wildfire behavior and spread rate. However, based on the wildfire history of this region as detailed in the EIR and Wildfire Prevention Plan, there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site.

Additionally, the 2.5 hour evacuation time could be much longer if warning time is prolonged or key intersections are not controlled by law enforcement. These intersections include the two PE's and the SE, as well as the point where BCR intersects with Highway 29. If traffic flow problems occur at any of these locations due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock),

the evacuation could lead to fatalities similar to the 2018 Camp Fire in Paradise or the 2017 Tubbs Fire in Santa Rosa.

In short, the County did not perform a project-specific wildfire evacuation analysis. Even in the absence of such analysis, there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety.

The EIR's Description of Shelter-in-Place Strategies Is Inadequate

As scenarios can be identified where not everyone in the project site would be able to get out in time, the Final EIR (p. 3.16-9) mentions six designated shelter-in-place meeting and staging areas as a back-up option:

> *"The Community Wildfire Protection Plan identifies evacuation routes in the County. Butts Canyon Road is identified as an emergency evacuation route. Depending on where the fire is located, people at the Guenoc Valley Site would be directed to exit the site via the primary roadways to Butts Canyon Road or as a last resort would shelter in place at the six Designated Meeting and Staging Areas. As shown on Figure 2-10, the Proposed Project includes an extensive circulation system with roadways large enough for emergency access vehicles. In addition, these roadways would typically have 50 feet of defensible space cleared on each side of the roadway for a total fire break of 150 feet. Impacts to adopted emergency response or evacuation plans would be less-than-significant. Impacts related to traffic and emergency routes are addressed in Section 3.13 Transportation and Traffic.*
>
> *Depending on the circumstances of a wildfire emergency, it may be difficult to evacuate. In this situation, residents, visitors, and employees will be directed to gather at designated meeting & staging areas where they will be provided information and assistance.*

These six designated meeting and staging areas (DMSA) are shown in Figure 2-10 in the EIR but the locations are vague and the capacities are not given. In order to be effective, these DMSAs would need to be easily accessible (including for disabled people and pedestrians) and provide enough protection for residents to survive a wildfire with an intensity in line with recent past wildfires. Additionally, it is critical that the location of, and access routes to, DMSAs are well publicized and made clear to residents and visitors to the project site through education, signage, and other means. The lack of adequate description in the EIR or Wildfire Prevention Plan of the DMSAs' location, capacity, and protection level is a significant shortcoming; these should be addressed in detail in a project-specific evacuation analysis and plan.

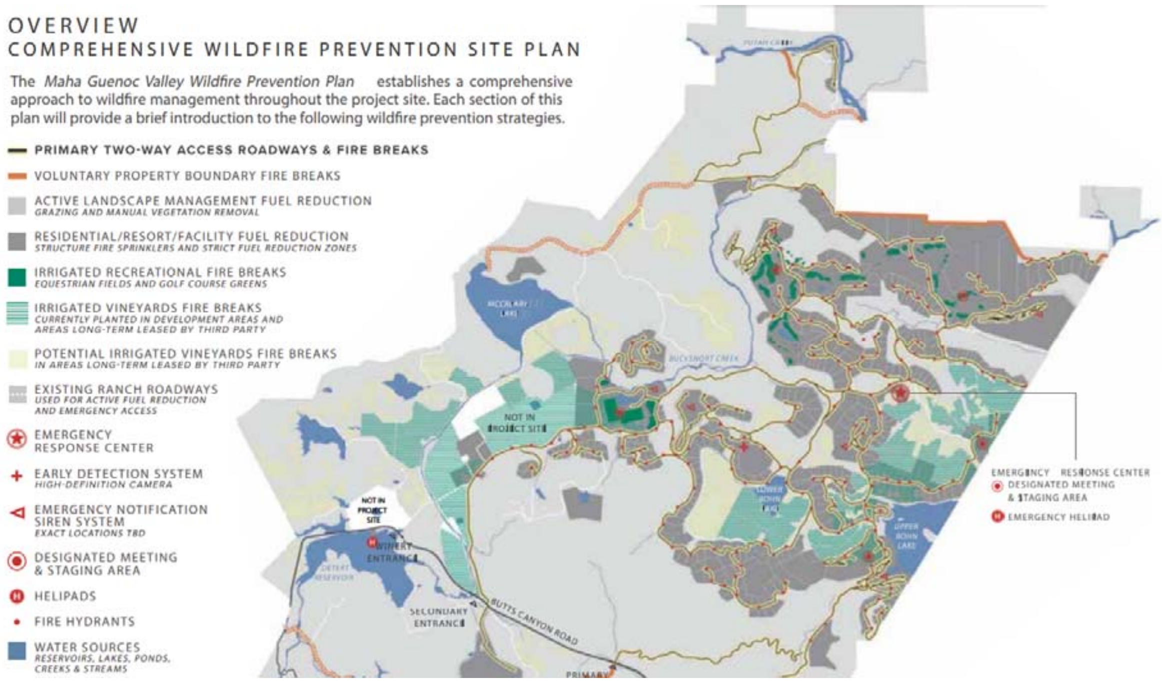

Figure 3. The designated meeting and staging areas are not very visible or easy to assess.

CONCLUSION

The Guenoc Valley project anticipates housing thousands of residents and visitors on a Project site historically susceptible to fire and in a region where large-scale wildfire evacuations have recently been necessary. The project offers only two primary means of egress to Butts Canyon Road, which only offers one direction for evacuees to escape (southwest) from the project site, and then only two directions to travel from there (northwest or southeast on Butts Canyon Road). The evacuation vehicle capacity offered by these roads is relatively low, and a rough estimate is that they could serve 1200 to 2400 vehicles departing per hour. On a given summer weekend day, it's not unlikely that it could take a few hours to evacuate this project site, and there are numerous plausible wildfire scenarios where this much time might not be available. Shelter-in-place is likely to be used in some scenarios where not everyone can evacuate in time, but it is not taken very seriously in the EIR or Wildfire Prevention Plan, which do not describe the access, capacity, and protection level that the various staging areas would offer. I strongly recommend that the County prepare a detailed and comprehensive evacuation plan for this project.

Thomas J. Cova, Ph.D.

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography and the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[1] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[2] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[3] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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Education

1999	Ph.D., Geography, University of California Santa Barbara. Dissertation: *A general framework for optimal site search*.
1995	M.A., Geography, University of California Santa Barbara. Thesis: *A spatial search for neighborhoods that may be difficult to evacuate.*
1986	B.S., Computer and Information Science, University of Oregon. Minor in math; emphasis in software engineering.

Research and Teaching Interests

Environmental Hazards, Emergency Management, Geographic Information Science, Transportation, Sustainability, Coupled Natural-Human Systems.

Professional Experience

2012 –	Professor, Department of Geography, University of Utah.
2005 – 2012	Associate Professor, Department of Geography, U. of Utah.
1999 – 2005	Assistant Professor, Department of Geography, U. of Utah.
1993 – 1996	Research Assistant, National Center for Geographic Information and Analysis (NCGIA), UC Santa Barbara.
1992 – 1997	Teaching Assistant, Department of Geography, UCSB.
1987 – 1992	Systems Analyst, Matthew Bender & Co., Oakland, California.

Other Professional Activities

2014 – 2018	Director, *Certificate in Environmental Hazards & Emergency Management*, Department of Geography, University of Utah.
2003 – 2018	Director, *Center for Natural & Technological Hazards*, Department of Geography, University of Utah.

2001 – 2016	Director, Certificate in Geographic Information Science, Department of Geography, University of Utah.
2011 – 2013	Chair, Hazards, Disasters & Risk Specialty Group, Association of American Geographers, Washington, D.C.
2007 – 2008	Program Chair, 5th International Conference in Geographic Information Science (GIScience 2008), Park City, Utah.
2005 – 2008	Chair (Vice Chair, Past Chair), GIS Specialty Group, Association of American Geographers, Washington, D.C.
2005 – 2008	Chair, Research Projects Committee, University Consortium for Geographic Information Science (UCGIS).
2004 – 2006	Secretary/Treasurer, GIS Specialty Group, Association of American Geographers, Washington, D.C.
2001 – 2003	Academic Councilor, GIS Specialty Group, Association of American Geographers, Washington, D.C.
1999 – 2003	Associate Director for Research, Center for Natural & Technological Hazards, Department of Geography, U of Utah.

Editorial Board Memberships

2020 –	*International Journal of Geographical Information Science*
2018 –	*Journal of Applied Geography*
2011 –	*Journal of Geography & Natural Disasters*.
2011 – 2014	*Journal of Spatial Science*
2009 – 2011	*Professional Geographer*
2001 – 2004	*Computers, Environment & Urban Systems*

Professional Honors and Awards

2016	Excellence in Mentoring Award, College of Social & Behavioral Science (CSBS), University of Utah.
2014 – 2016	Advisor, *Enabling the Next Generation of Hazards Researchers*, D. Thomas, S. Brody, & B. Gerber (PIs), National Science Foundation, CMMI-IMEE.

2008 – 2010 Mentor, *Enabling the Next Generation of Hazards Researchers*, Tom Birkland (PI), National Science Foundation, CMMI-IMEE.

2005 John I. Davidson Award for Practical Papers, American Society for Photogrammetry & Remote Sensing – with P. Sutton and D. Theobald.

2005 Leica Geosystems Award for Best Scientific Paper in Remote Sensing, American Society for Photogrammetry & Remote Sensing (ASPRS) – with P. Sutton and D. Theobald.

2003 – 2005 Fellow, *Enabling the Next Generation of Hazards Researchers*, Raymond Burby (PI), National Science Foundation, CMMI-IMEE.

2003 University Consortium for Geographic Information Science (UCGIS) Young Scholar's Award.

1996 – 1999 Dwight D. Eisenhower Doctoral Fellowship, National Highway Institute, Federal Highway Admin., Dept. of Transportation.

1995 International Geographic Information Foundation (IGIF) Award for Best Student Paper, GIS/LIS '95, Nashville, TN.

1995 Outstanding Student in Transportation, UC Santa Barbara, Western Coal Transportation Association.

RESEARCH AND SCHOLARSHIP

Edited volumes and special issues

2017 Cova, T.J. and Tsou, M., *GIS Methods and Techniques*. Vol 1. in *Comprehensive Geographic Information Systems, B. Huang (EIC).* Oxford:Elsevier.

2011 Cova, T.J. and Miles, S.B. (Eds). *Disaster Risk Reduction and Sustainable Development*, Sustainability (ISSN 2071-1050).

2008 Cova, T.J., Miller, H., Beard, K., Frank, A., Goodchild, M. (Eds.), *Geographic Information Science: 5th International Conference (GIScience 2008),* Park City, Utah. Lecture Notes in Computer Science 5266, Springer-Verlag, Berlin.

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2015	Li, D., Cova, T.J., Dennison, P.E., A household-level approach to staging wildfire evacuation warnings using trigger modeling. *Computers, Environment, & Urban Systems,* 54:56-67.
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2015	Hile, R. and Cova, T.J. (2015) Exploratory testing of an artificial neural network classification for enhancement of the social vulnerability index. *ISPRS International Journal of Geo-Information,* 4(4): 1774-1790.
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2019 Cova, T.J., *Evacuation*. Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires.

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Conference Papers and Posters

2019 Cova, T.J., Geosimulating hazard warning triggers: geometry, dynamics, and timing. *GeoCompuation '19*, September 19, Queenstown, New Zealand.

2015 Li, D., Cova, T.J., Dennison, P.E., An open-source software system for setting wildfire evacuation triggers. ACM SIGSPATIAL EM-GIS'15, November 3, 2015, Seattle, WA.

2013 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers: Modeling and Analysis. *Natural Hazards Workshop*, University of Colorado, Boulder, July (poster).

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2009 Siebeneck, L.K. and Cova, T.J. Current Research at the Center for Natural and Technological Hazards. *Natural Hazards Workshop*, U. of Colorado, Boulder, July (poster).

2008	Cova, T.J. et al., Protective actions in wildfire: the incident commander perspective. *Pacific Coast Fire Conference*, San Diego, November (poster).
2005	Yuan, M., Goodchild, M.F., Cova, T.J., Towards a general theory of geographic representation in GIS (poster*). Conference on Spatial Information Theory (COSIT) 2005*, Ellicottville, New York, September (poster).
2005	Kim, T.H., and Cova, T.J., Tweening Grammars: Deformation Rules for Representing Change between Discrete Geographic Entities*. Geocomputation 2005,* Ann Arbor, MI, August*.*
2001	Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.
2001	Hepner, G.F., Cova, T.J., Forster, R.R., and Miller, H.J., Use of remote sensing and geospatial analysis for transportation hazard assessment: an integrated university, government and private sector consortium, *IEEE/ISPRS Joint Workshop on Remote Sensing and Data Fusion over Urban Areas Proceedings*, IEEE-01EX482,Rome, Italy, pp.241-244.
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1997	Cova, T.J., and Church, R.L., An algorithm for identifying nodal clusters in a transportation network. *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, Maine, June 15-21.
1995	Cova, T.J., and Church, R.L., A spatial search for neighborhoods that may be difficult to evacuate, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 203-212.
1995	Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 354-364.
1994	Cova, T.J. and Goodchild, M.F., Spatially distributed navigable databases for intelligent vehicle highway systems, *Proceedings GIS/LIS '94*, ACSM, Phoenix, AZ, 191-200.

Other Publications

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Evaluating and enhancing public transit systems for operational efficiency and access equity.* TREC Final Report, NITC-RR-1024.

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Integrated performance measures: transit equity & efficiency*. TREC Final Report, NITC-RR-1024.

2008 Siebeneck, L.K. and Cova, T.J. Risk perception associated with the evacuation and return-entry process of the Cedar Rapids, Iowa flood. Quick Response Research Report, Natural Hazards Center, University of Colorado, Boulder.

2006 Cova, T.J., *Concerning Stonegate and Public Safety*. North County Times, San Diego, California, Nov. 3.

2002 Cova, T.J., Like a bat out of hell: simulating wildfire evacuations in the urban interface, *Wildland Firefighter Magazine*, November, 24-29.

2000 Cova, T.J., When all hell breaks loose: firestorm evacuation analysis and planning with GIS, *GIS Visions Newsletter*, August, The GIS Cafe.

2000 Cova, T.J. (2000) Wildfire evacuation. *New York Times letter to the Editor*, June 6.

1996 Church, R., Cova, T., Gerges, R., Goodchild, M., Conference on object orientation and navigable databases: report of the meeting. *NCGIA Technical Report 96-9.*

1994 Church, R., Coughlan, D., Cova, T., Goodchild, M., Gottsegen, J., Lemberg, D., Gerges, R., Caltrans Agreement 65T155, Final Report, *NCGIA Technical Report 94-6*.

Invited Lectures, Presentations and Participation

2019 "Public safety in the wildland-urban interface." Department of Geography, University of Alabama, Tuscaloosa, November.

2019 "Public safety in the wildland-urban interface." Department of Geography, Texas A&M (TAMU), College Station, February.

2018 "ESRI Science Symposium." Panelist, ESRI Conference, San Diego, July.

2018	"Public safety in the wildland-urban interface." Living with Fire in California's Coast Ranges, Sonoma, May.
2017	"Improving situational awareness in wildfire evacuations with volunteered geographic information." NSF IBSS/IMEE Summer Workshop, San Diego, August.
2014	"Modeling adaptive warnings with geographic trigger points." Department of Geography, SDSU, San Diego, CA, April 18.
2013	"Wildfires and geo-targeted warnings." Geo-targeted Alerts and Warnings Workshop. *National Academy of Sciences*, Washington DC, February 21-22.
2012	"Evacuation planning in the wildland-urban interface." California Joint Fire Science Program, Webinar Speakers Series, September.
2010	"Evacuating threatened populations in disasters: space, time & information." University of Minnesota, Spatial Speakers Series (Geography/CS/CE), April.
2009	"The art and science of evacuation modeling." Utah Governor's Conf. in Emergency Management, Provo, May.
2008	"GIScience and public safety." Brigham Young University, November.
2007	"Fire, climate and insurance." Panel Discussion. Leonardo Museum, Salt Lake City, November.
2007	"GIScience and public safety." University of Northern Iowa, April.
2006	"Evacuation and/or Shelter in Place." Panel Discussion, Firewise Conference: Backyards & Beyond, Denver, CO, Nov.
2006	"Evacuation modeling and planning." Colorado Springs Fire Department, Colorado Springs, CO, October.
2006	"Evacuation modeling and planning." Sante Fe Complexity Institute, Sante Fe, NM, August.
2006	"Evacuation modeling and planning." Colorado Wildfire Conference. Vail, CO, April, $1000.
2006	"Dynamic GIS: in search of the killer app." Center for Geocomputation, National U. of Ireland, Maynooth, April.

2006	“Setting wildfire evacuation trigger points with GIS.” University Consortium for Geographic Information Science, Winter meeting, Washington, DC.
2005	“Setting wildfire evacuation trigger points with GIS.” Pennsylvania State University, State College, PA, November.
2004	“The role of scale in ecological modeling,” NSF PI meeting for Ecology of Infectious Diseases, Washington D.C., September.
2004	“The 2003 Southern California wildfires: Evacuate and/or or shelter-in-place,” Natural Hazards Workshop, Boulder, CO.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of Denver, February.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” Colorado Governor’s Conference and Colorado Emergency Management Association (CEMA) Conference, Boulder, CO, February.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of California Los Angeles, February.
2003	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Natural Resources Ecology Lab (NREL), Colorado State University, April.
2003	“When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, University of Arizona, January.
2002	“When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, Western Michigan University, November.
2001	"Regional evacuation analysis in fire-prone areas with limited egress," Departmental colloquium, Department of Geography, University of Denver, May.
2000	“Integrating Site Search Models and GIS,” Colloquium, Department of Geography, Arizona State University, Feb.
1999	“Site Search Problems and GIS,” Colloquium, Department of Geography, University of Utah.

1996 “A spatial search for neighborhoods that may be difficult to evacuate,” Colloquium, Department of Geography, UC Santa Barbara.

1995 “A spatial search for neighborhoods that may be difficult to evacuate,” Regional Research Lab, Bhopal, India.

1995 “A spatial search for neighborhoods that may be difficult to evacuate,” Indian Institute of Technology, Bombay. India.

Papers Presented at Professional Conferences

2018 Cova, T.J., GIScience & Emergency Management: where do we go from here? Association of American Geographers Annual Meeting, New Orleans, LA, April.

2017 Cova, T.J., Simulating warning triggers. Association of American Geographers Annual Meeting, Boston, MA, CA, April.

2016 Cova, T.J., Spatio-temporal representation in modeling evacuation warning triggers. Association of American Geographers Annual Meeting, San Francisco, CA, March.

2015 Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. Association of American Geographers Annual Meeting, Chicago, IL, April.

2014 Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. International Conference on Geographic Information Science (GIScience ’14), Vienna, Austria, September.

2013 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers: modeling and analysis. *Association of American Geographers Annual Meeting*, Los Angeles, CA, April.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the Natural Hazards Workshop, University of Colorado, Boulder, July.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the NSF CMMI Innovation Conference, Boston, July.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers, *Association of American Geographers Annual Meeting,* New York, NY, February.

2011 Cova, T.J., Modeling stay-or-go decisions in wildfires, *Association of American Geographers Annual Meeting,* Seattle, WA, April.

2010 Cova, T.J., Theobald, D.M. and Norman, III, J., Mapping wildfire evacuation vulnerability in the West, *Association of American Geographers Annual Meeting,* Wash. D.C., April.

2010 Cova, T.J., and Van Drimmelen, M.N., Family gathering in evacuations: the 2007 Angora Wildfire as a case study. *National Evacuation Conference*, New Orleans, February.

2010 Siebeneck, L.K., Cova, T.J., Drews, F.A., and Musters, A. Evacuation and shelter-in-place in wildfires: The incident commander perspective. *Great Basin Incident Command Team Meetings*, Reno, April.

2009 Cova, T.J. et al., Protective action decision making in wildfires: the incident commander perspective. *Association of American Geographers Annual Meeting,* Las Vegas, March.

2009 Siebeneck, L.K. and Cova, T.J. Using GIS to explore evacuee behavior before, during and after the 2008 Cedar Rapids Flood. *Association of American Geographers Annual Meeting*, Las Vegas, March.

2009 Lindell, M.K., Prater, C.S., Siebeneck, L.K. and Cova, T.J. Hurricane Ike Reentry. *National Hurricane Conference*, Austin, March.

2008 Cova, T.J., Simulating evacuation shadows, *Association of American Geographers Annual Meeting,* Boston, April.

2007 Cova, T.J., An agent-based approach to modeling warning diffusion in emergencies, *Association of American Geographers Annual Meeting,* San Francisco, March.

2006 Cova, T.J., New GIS-based measures of wildfire evacuation vulnerability and associated algorithms. *Association of American Geographers Annual Meeting,* Denver, March.

2005 Cova, T.J., Dennison, P.E., Kim, T.H., and Moritz, M.A., Setting wildfire evacuation trigger-points using fire spread modeling and GIS. *Association of American Geographers Annual Meeting,* Denver, March.

2004 Cova, T.J., Sutton, P.C., and Theobald, D.M. Light my fire proneness: residential change detection in the urban-wildland interface with nighttime satellite imagery, *Association of American Geographers Annual Meeting*, Philadelphia, March.

2004 Cova, T.J. and Johnson, J.P., A network flow model for lane-based evacuation routing. *Transportation Research Board (TRB) Annual Conference*, Washington, D.C., January.

2003 Cova, T.J. Lane-based evacuation routing, *Association of American Geographers Annual Meeting*, New Orleans, March.

2002 Cova, T.J., Extending geographic representation to include fields of spatial objects, *GIScience 2002*, Boulder, September.

2002 Husdal, J. and Cova, T.J., A spatial framework for modeling hazards to transportation systems, *Association of American GeographersAnnual Meeting,* Los Angeles, March.

2001 Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.

2001 Cova, T.J., Husdal, J., Miller, H.J., A spatial framework for modeling hazards to transportation networks, *Geographic Information Systems for Transportation Conference (GIS-T 2001*), Washington DC, April.

2001 Cova, T.J., Miller, H.J., Husdal, J., A spatial framework for modeling hazards to transportation systems, *Association of American Geographers Annual Meeting*, New York, New York, February.

2000 Cova, T.J., Church, R.L., Goodchild, M.F., Extending geographic representation to include fields of spatial objects, *GIScience 2000,* Savannah, Georgia, November.

2000 Cova, T.J. Microscopic simulation in regional evacuation: an experimental perspective, *Association of American Geographers Annual Meeting*, Pittsburgh, Pennsylvania, March.

1999	Cova, T.J., and Church, R.L., "Exploratory spatial optimization and site search: a neighborhood operator approach," *Geocomputation '99*, Mary Washington College, Fredricksburg, Virginia.
1999	Cova, T.J., and Church, R.L., "Integrating models for optimal site selection with GIS: problems and prospects," *Association of American Geographer Annual Meeting*, Honolulu, Hawaii, March 29.
1998	Cova, T.J., and Church, R.L., "A spatial analytic approach to modeling neighborhood evacuation egress," *Association of American Geographers Annual Meeting,* Boston, Massachusetts.
1997	Church, R.L., and Cova, T.J., "Location search strategies and GIS: a case example applied to identifying difficult to evacuate neighborhoods," *Regional Science Association Annual Meeting*, November, Buffalo.
1997	Cova, T.J. and Church, R.L., "An algorithm for identifying nodal clusters in a transportation network," *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, June.
1996	Cova, T.J., Church, R.L., "A spatial search for difficult neighborhoods to evacuate using GIS," *GIS and Hazards Session*, *Association of American Geographers Annual Meeting*, Charlotte, April.
1995	Cova, T.J., Church, R.L., "A spatial search for neighborhoods that may be difficult to evacuate," *GIS/LIS '95*, Nashville, November.
1995	Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., "Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS," *GIS/LIS '95*, Nashville, November.
1994	Cova, T.J. and Goodchild, M.F., "Spatially distributed navigable databases for intelligent vehicle highway systems," *GIS/LIS '94*, Phoenix, November.

Grants

Externally funded

2019 –	Cova, T.J. (PI), Collins, T.W., Grineski, S.E., Norton, T., *Enabling the Next Generation of Hazards Researchers*. National Science Foundation. Division of Civil, Mechanical & Manufacturing Innovation (CMMI): Humans, Disasters & the Built Environment (HDBE), $480,634.
2018 –	Smith, K. (PI), Cova, T.J., Waitzman, N., Perlich, P., Kowaleski-Jones, L. Research Data Center: Wasatch Front Research Data Center. National Science Foundation, Division of Social Economic Sciences, $298,625.
2017 – 2019	Shoaf, K. (PI) and Cova, T.J. *RAPID: Evacuation Decision-making process of Hospital Administrators in Hurricane Harvey*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $49,301.
2011 – 2015	Cova, T.J. (PI), Dennison, P.E. and Drews, F.A., *Protective action triggers*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $419,784.
2012 – 2014	Cova, T.J. (PI), *State Hazard Mitigation Mapping II.* Utah Division of Emergency Management, $51,608.
2011 – 2012	Cova, T.J. (PI), *State Hazard Mitigation Mapping.* Utah Division of Emergency Management, $51,608.
2007 – 2010	Cova, T.J. (PI) and Drews, F.A. *Protective-action decision making in wildfires.* National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $288,438.
2004– 2006	Yuan, M. (PI), Goodchild, M.F., and Cova, T.J. *Integration of geographic complexity and dynamics into geographic information systems,* National Science Foundation, Social and Behavioral Science—Geography and Spatial Sci., $250,000.
2003– 2004	Cova, T.J. (PI) *Mapping the 2003 Southern California Wildfire Evacuations*, National Science Foundation, Small Grants for Exploratory Research (SGER), CMMI-IMEE, $14,950.
2003 –2008	Dearing, M.D. (PI), Adler, F.R., Cova, T.J., and St. Joer, S. *The effect of anthropogenic disturbance on the dynamics of*

	Sin Nombre, National Science Foundation and NIH, Ecology of Infectious Diseases, $1,933,943.
2000–2004	Hepner, G.F. (PI), Miller, H.J., Forster, R.R., and Cova, T.J. *National Consortium for Remote Sensing in Transportation: Hazards (NCRST-H),* U.S. Department of Transportation, $437,659.
2000–2001	Cova, T.J. (PI) *Modeling human vulnerability to environmental hazards*, Salt Lake City and Federal Emergency Management Agency (FEMA), $20,000.

Internally funded

2004	Cova, T.J. (PI) and Sobek, A. *DIGIT Lab GPS Support*, U. of Utah Technology Instrumentation Grant, $15,000.
2003	Cova, T.J. (PI) *New methods for wildfire evacuation analysis*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.
1999	Cova, T.J. (PI) *Microscopic traffic simulation of regional evacuations: computational experiments in a controlled environment*, Faculty Research Grant (FRG), University Research Committee, University of Utah, $5980.
1999	Cova, T.J. (PI) *Regional evacuation analysis in fire prone areas with limited egress*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.

Media Outreach

2019	Krieger, L., "Camp Fire: when survival means shelter." *San Jose Mercury News*, Feb. 3.
2018	Romero, S., Arango, T., and Fuller, T. "A frantic call, a neighbor's knock, but few official alerts as wildfire closed in." *New York Times*, Nov. 21.
2018	Serna, J., St. John, P., Lin, R-G. "Disaster after disaster, California keeps falling short on evacuating people from harm's way." *Los Angeles Times*, Nov. 28.
2018	Simon, M. "How California needs to adapt to survive future fires." *Wired Magazine*, Nov. 15.
2018	O'Neill, S. "Year-round wildfire season means always living evacuation ready." Morning Addition, *National Public Radio*, Sep. 25.
2017	Mortensen, M. "System used for Amber Alerts can also warn of other emergencies." Utah Public Radio, Dec. 19.

2013 Ryman, A. and Hotstege, S. "Yarnell evacuation flawed and chaotic, experts say." *Arizona Republic and USA Today*, Nov.
2013 Bryson, D., and Campoy, A. "Quick fire response pays off: Colorado credits early alerts with limiting deaths from state's worst-ever blaze." *The Wall Street Journal*, June 17.
2013 Beri, A. "Due to the sequester: people are going to be unsafe, homes are going to burn." *Tampa Bay Times*, Feb.
2012 Zaffos, J. "What the High Park Fire can teach us about protecting homes." *High Country News*, July.
2012 Meyer, J.P. and Olinger, D., "Tapes show Waldo Canyon fire evacuations delayed two hours." *The Denver Post*. July.
2011 Siegel L, and Rogers, N. "Monitoring killer mice from space." *USA Today*, *SLTribune, Fox 13 News, KCPW*, Feb. 15.
2010 Cowan, J., "Esplin defends stay or go policy." *Australian Broadcast Corporation (ABC)*, April 30.
2010 Bachelard, M., "Should the fire-threatened stay or go? That is still the question." *The Age*, Australia, May 2.
2008 Boxall, B., "A Santa Barbara area canyon's residents are among many Californian's living in harm's way in fire-prone areas." *Los Angeles Times*, July 31.
2007 Welch, W.M. et al., "Staggering numbers flee among fear and uncertainty." *USA Today*, Oct. 24.
2007 Krasny, M., "Angora Wildfire Panel Discussion." *KQED Radio*, San Francisco, June 27.
2004 Wimmer, N., "Growing number of communities pose fire hazard." *KSL Channel 5,* Salt Lake City, July 22.
2004 Disaster News Network, "The face of evacuation procedures might be changing as a result of lessons learned from last year's fierce wildfires in California."
2004 Perkins, S., "Night space images show development." *Science News*, Week of April 3rd, 165 (14): 222.
2003 Keahey, J., "Canyon fire trap feared." *SL Tribune*, June.

TEACHING AND MENTORING

Undergraduate Courses

Geoprogramming (~30 students)
Introduction to Geographic Information Systems (~60 students).
Human Geography (~40 students).
Geography of Disasters and Emergency Management (~20 students).
Methods in GIS (~40 students).

Graduate Courses

GIS & Python (~20 students)
Spatial Databases (~30 students)
Seminars: Hazards Geography, Transportation, Vulnerability, GIScience.

Graduate Student Advising

Chaired Ph.D. Committees

2017-	Coleman, A.	Geographic data fusion for disaster management
2016	Li, D.	Modeling wildfire evacuation triggers as a coupled natural-human system (Asst. Professor South Dakota State University)
2010	Siebeneck, L.	Examining the geographic dimensions of risk perception, communication and response during the evacuation and return-entry process. (Assoc. Professor, U. of North Texas)
2010	Cao, L.	Anthropogenic habitat disturbance and the dynamics of hantavirus using remote sensing, GIS, and a spatially explicit agent-based model. (Postdoc, Kelly Lab, UC Berkeley)

Chaired M.S. committees

2019-	Riyadh, A.	Flood resilience in Dhaka, Bangladesh
2018-	Huang, Z.	Autonomous vehicles in hurricane evacuation.
2019	Kar, A.	Optimal vehicle routing in disasters
2017	Yi, Y.	A web-GIS application for house loss notification in wildfires
2017	Latham, P.	Evaluating the effects of snowstorm frequency and depth on skier behavior in Big Cottonwood Canyon, Utah
2016	Bishop, S.	Spatial access and local demand for emergency medical services in Utah
2015	Hile, R.	Exploratory testing of an artificial network classification for enhancement of a social vulnerability index
2015	Unger, C.	Creating spatial data infrastructure to facilitate the collection and dissemination of geospatial data to aid in disaster management
2014	Klein, K.	Tracking a wildfire in areas of high relief using volunteered geographic information: a viewshed application
2012	Amussen, F.	Greek island social networks and the maritime shipping dominance they created (technical report)
2012	Martineau, E.	Earthquake risk perception in Salt Lake City, Utah
2010	Smith, K.	Developing emergency preparedness indices for local government

2010	VanDrimmelen, M.	Family gathering in emergencies: the 2007 Angora Wildfire as a case study
2007	Pultar, E.	GISED: a dynamic GIS based on space-time points
2007	Siebeneck, L.	An assessment of the return-entry process for Hurricane Rita, 2005
2007	Johnson, J.	Microsimulation of neighborhood-scale evacuations
2004	Chang, W.	An activity-based approach to modeling wildfire evacuations

Membership on Ph.D Committees

2017	Campbell, M.	Wildland firefighter travel times
2016	Zhang, L.	Economic geography of China
2015	Huang, H.	Spatial analysis and economic geography
2014	Lao, H.	Spatial analysis, GIS, and economic geography
2013	Burgess, A.	Hydrologic implications of dust in snow in the Upper Colorado River Basin
2012	Davis, J.	
2012	Li, Y.	
2011	Hadley, H.	Transit sources of salinity loading in the San Rafael River, Upper Colorado River Basin, Utah
2009	Medina, R.	Use of complexity theory to understand the geographical dynamics of terrorist networks
2008	McNeally, P.	Holistic geographical visualization of spatial data with applications in avalanche forecasting
2008	Sobek, A.	Generating synthetic space-time paths using a cloning algorithm on activity behavior data
2007	Clay, C.	Biology
2006	Backus, V.	Assessing connectivity among grizzly bear populations near the U.S.-Canada border
2006	Atwood, G.	Shoreline superelevation: evidence of coastal processes of Great Salt Lake, Utah
2006	White, D.	Chronic technological hazard: the case of agricultural pesticides in the Imperial Valley, California
2005	Ahmed, N.	Time-space transformations of geographic space to explore, analyze and communicate transportation systems
2004	Shoukrey, N.	Using remote sensing and GIS for monitoring settlement growth expansion in the eastern part of the Nile Delta Governorates in Egypt (1975-1998)
2004	Hernandez, M.	A Procedural Model for Developing a GIS-Based Multiple Natural Hazard Assessment: Case Study-Southern Davis County, Utah
2003	Wu, Y-H.	Dynamic models of space-time accessibility

2003	Hung, M.	Using the V-I-S model to analyze urban environments from TM imagery
2002	Baumgrass, L.	Initiation of snowmelt on the North Slope of Alaska as observed with spaceborne passive microwave data

<u>Membership on M.S. Committees</u>

2015	Farnham, D.	Food security and drought in Ghana
2015	Fu, L.	Analyzing route choice of bicyclists in Salt Lake City
2014	Li, X.	Spatial representation in the social interaction potential metric: an analysis of scale and parameter sensitivity
2013	Johnson, D.	Parks, Recreation & Tourism
2012	Fryer, G.	Wildland firefighter entrapment avoidance: developing evacuation trigger points utilizing the WUIVAC fire spread model.
2011	Groeneveld, J.	An agent-based model of bicyclists accessing light-rail in Salt Lake City
2011	Matheson, D.S.	Evaluating the effects of spatial resolution on hyperspectral fire detection and temperature retrieval
2010	Larsen, J.	Analysis of wildfire evacuation trigger-buffer modeling from the 2003 Cedar Fire, California.
2010	Smith, G.	Development of a flash flood potential index using physiographic data sets within a geographic information system
2010	Song, Y.	Visual exploration of a large traffic database using traffic cubes
2010	Evans, J.	Parks, Recreation & Tourism
2008	Naisbitt, W.	Avalanche frequency and magnitude: using power-law exponents to investigate snow-avalanche size proportions through time and space.
2008	Kim, H.C.	Civil Engineering
2007	Gilman, T.	Evaluating transportation alternatives using a time geographic accessibility measure
2004	Baurah, A.	An integration of active microwave remote sensing and a snowmelt runoff model for stream flow prediction in the Kuparak Watershed, Arctic Alaska
2004	Bosler, J.	A Development Response to Santaquin City's Natural Disasters.
2004	Bridwell, S.	Space-time masking techniques for privacy protection in location-based services

2004	Deeb, E.	Monitoring Snowpack Evolution Using Interferometric Synthetic Aperture Radar (InSAR) on the North Slope of Alaska, USA
2004	Sobek, A.	Access-U: a web-based navigation tool for disabled students at the University of Utah
2003	Barney, C.	Locating hierarchical urban service centers along the Wasatch Front using GIS location-allocation algorithms
2002	Koenig, L.	Evaluation of passive microwave snow water equivalent algorithms in the depth hoar dominated snowpack of the Kuparuk River Watershed, Alaska, USA
2002	Larsen, C.	Family & Consumer Studies
2002	Krokoski, J.	Geology & Geophysics
2000	Granberg, B.	Automated routing and permitting system for Utah Department of Transportation
2000	Bohn, A.	An integrated analysis of the Tijuana River Watershed: application of the BASINS model to an under-monitored binational watershed

Graduate student awards

2015 R. Hile., M.A. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.

2015 D. Li, Ph.D. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.

2012 K. Klein, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.

2010 L. Cao, Ph.D. Geography: *Student Paper Award*, Spatial Analysis and Modeling (SAM) Specialty Group, Association of American Geographers.

2008 L. Siebeneck, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards Specialty Group, Association of American Geographers.

2007 E. Pultar, M.A. Geography: *Best Paper*, GIS Specialty Group, Association of American Geographers.

2006 J. VanLooy (not primary advisor): *Best Paper*, Rocky Mountain Regional Meeting, Association of American Geographers.

Undergraduate Mentoring and Advising

2015 Mentor, Marli Stevens, Undergraduate Research Opportunity Program: “Margin of Licensed Dog and Cat Populations and Adoptions from Animal Shelters in Utah in 2013-2014.”

2015—	Advisor, Undergraduate Hazards & Emergency Management Certificate students (~10 students so far).
2006—2010	Advisor, Stewart Moffat, Honor's B.S. in Undergraduate Studies: Disaster Management (published journal article).
2005—2007	Advisor, Brian Williams, B.S. in Undergraduate Studies: Comprehensive Emergency Management.
2001—	Advisor, Undergraduate GIS Certificate Students (> 100 students).

Junior Faculty Mentoring

2017—	Andrew Linke, Department of Geography, University of Utah
2014—2017	Ran Wei, Department of Geography, University of Utah
2011—2014	Steven Farber, Department of Geography, University of Utah
2009—2011	Scott Miles, Dept. of Geography, Western Washington U.
2009—2011	Timothy W. Collins, Department of Sociology, UT El Paso

SERVICE

Referee Duties

Journals
Applied Geography
Annals of the Association of American Geographers
Cartographica
Computers Environment & Urban Systems
Disasters
Environmental Hazards: Policy and Practice
Geographical Analysis
Geoinformatica
International Journal of Geographical Information Science
Journal of Geographical Systems
Journal of Transport Geography
Natural Hazards
Natural Hazards Review
Networks and Spatial Economics
Photogrammetric Engineering and Remote Sensing
Professional Geographer
Society & Natural Resources
Transportation Research A: Policy & Practice
Transportation Research B: Methodological
Transportation Research C: Emerging Technologies
Transactions in GIS

National Science Foundation Panels
Decision Risk and Uncertainty (1)
Geography and Spatial Science, Doctoral Dissertation Improvement Grant (4)
Civil & Mech. Systems – Infrastructure Management and Extreme Events (2)
Civil & Mech. Systems - Rural Resiliency (1)
NSF and NIH: Big Data (1)
Hazards SEES: Type 2 (1)

Proposals
Center for Disaster Management & Humanitarian Assistance
Faculty Research Grants, University of Utah (3)

External Promotional Reviews
Full Professor (5), Associate Professor (12)

Activities at Professional Conferences

2000 – 2018	**Paper session co-organizer, chair,** "Hazards, GIS and Remote Sensing" session, Annual Meeting of the Association of American Geographers.
2002 – 2003	**Paper session organizer, chair, and judge, "**GIS Specialty Group Student Paper Competition," Association of American Geographers Annual Meeting.
1999	**Paper session organizer**, "Location Modeling and GIS," Annual Meeting of the Association of American Geographers, Honolulu, Hawaii, March.

University Service

2019 –	RPT Standards Committee, Office of the AVP for Faculty
2014 – 2017	Member, Academic Senate
2014 – 2017	Member, University Promotion & Tenure Advisory Committee (UPTAC)
2011 –	Member, Social Science General Education Committee
1999 – 2009	Delegate, University Consortium for GIScience
2013	Member, Graduate Research Fellowship (GRF) Committee
2010 – 2012	Member Student Evaluations Committee, Undergrad. Studies
2009 – 2012	Member, Graduate Council, College of Soc. and Beh. Science
2003 – 2004	Member, Instit. Review Board (IRB) Protocol Committee
2001 – 2004	Member, Social Science General Education Committee

College Service: Social & Behavioral Science

2014 –	Chair, Review, Promotion & Tenure Committee
2012 – 2014	Member, College Review, Promotion, & Tenure Committee
2015	Member, Superior Teaching Committee
2011 – 2012	Chair, Superior Teaching Committee

2007	Member, Search Committee, Inst. of Public and Intern Affairs
2005, 2006	Member, Superior Research Committee
2002, 2004	Member, Superior Teaching Committee

Departmental Service: Geography

2015 –	Member, Undergraduate Committee
2014 –2017	Representative, University Academic Senate
2014 –	Director, Certificate in Hazards & Emergency Management
2014	Author, Proposal for Cert. in Hazards & Emergency Manage.
2012 –	Chair, Review, Promotion & Tenure Committee
2013	Chair, Search Committee for GIScience Position
2012	Co-author, Proposal for MS in GIScience
2011 – 2012	Director of Graduate Studies
2010	Search Committee Chair, Human Geography Position
2004 – 2015	Member, Graduate Admissions Committee
2004 – 2008	Member, Colloquium Committee
2000 –	Chair, Geographic Information Science Area Committee

Prepared by Thomas J. Cova, Ph.D., Evacuation Consultant, Salt Lake City, UT Dated: July 2, 2020

Subject: Evacuation analysis and planning for the proposed Guenoc Valley Mixed Use Planned Development Project in Lake County, CA

SUMMARY

I have reviewed the Environmental Impact Report (EIR) and Wildfire Prevention Plan for the Guenoc Valley project. The Guenoc Valley project site is in a very high fire hazard area evidenced by recent fast- moving, intense wildfires in the Project vicinity that caused loss of life. The project is large and proposes to add thousands of people to a very sparsely populated area with a limited transportation network. The EIR does not evaluate or disclose the wildfire evacuation risks associated with introducing this many people and vehicles to the project area and does not include a detailed wildfire evacuation plan to protect the safety of the residents. Prior to approving the project, the County should prepare a project- specific evacuation plan that addresses, at a bare minimum: 1) the possible range of evacuation times for residents and visitors, 2) the possible range of lead times available to act in an urgent wildfire, 3) the pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the Countywide evacuation plan, and 3) detailed alternative plans for protecting residents and visitors when roads become impassible or the time required to evacuate is greater than the time available.

ANALYSIS

The Project Configuration Allows Only One Evacuation Route for Several Thousand Residents

The Guenoc Valley Site consists of 16,000 acres in southwest Lake County, California. The project will include 400 hotel rooms, 450 guest resort residential units, 1400 residential estates, and 500 workforce co-housing units. The EIR proposes 753 total parking spaces for Phase 1 but does not mention how many there might be when the project is complete or how many vehicles are likely to be on the project site, on average, after the project is complete. However, given the number of proposed units (and conservatively assuming one vehicle per unit when California's average number of vehicles per household is two), the site is likely to house at least 2750 vehicles on site when it is completed (i.e. 400 + 450 + 1400 + 500). While some of these units may have no vehicles, and others may have 2 or more, a range of at least two to three thousand vehicles is a reasonable starting assumption for evacuation planning for this project.

Access to the project site is via Butts Canyon Road from Middletown (7 miles to the west), although Butts Canyon Road continues south from the project site to Pope Valley (12 miles to its south). There are no alternative routes in or out of the project site. The Final EIR's Response to Comments O10-31 references the Lake County Evacuation map and states:

Regarding the commenter's question "what, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Proposed Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable", as noted on page 3.16-7 of the Draft EIR, the Lake County Wildfire Protection Plan provides an evacuation route map (URL in figure 1). This map shows all of the existing

and potential evacuation routes serving the county and the project site. The Wildfire Prevention Plan for the Proposed Project includes plans for determining whether evacuation routes are unsafe, and designated meeting locations.

An excerpt of this map around the project site is provided in Figure 1. The map shows that the initial evacuation route is Butts Canyon Road north (and then to SR-29 North or South or SR-175 north), or south to Pope Valley (not shown on map because it's in Napa County). There are no evacuation routes to the east or north of the project site, so evacuees would have to travel southwest to Butts Canyon Road and then either northwest to Middletown or southeast to Pope Valley. This is very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project.

Figure 1. An excerpt taken from the Lake County evacuation map does not show an evacuation route in the project area. (URL: http://www.lakecountyca.gov/Assets/County+Site/Fire+Safe+Council/cwpp/Evacuation.jpg).

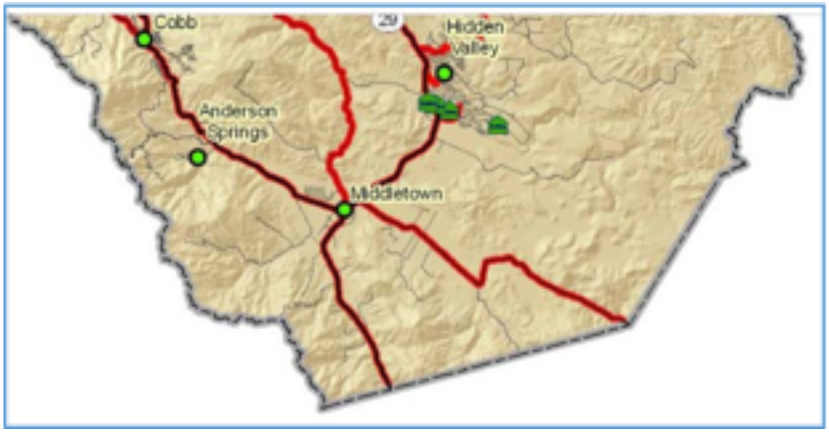
In other words, in the event of a wildfire, all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable.

The EIR Does Not Analyze the Project's Wildfire Evacuation Impacts

The project configuration presents an immediate concern due to the limited evacuation egress for project residents and workers trying to reach Butts Canyon Road in an urgent evacuation. Given this concern, and the history of wildfires on the project site, it is critical that the County perform a project- specific wildfire evacuation analysis that includes available lead times and evacuation times under a variety of scenarios.

As noted in the Final EIR Response to Comments O10-31, the time necessary to safely clear the project site can vary according to a number of factors:

Regarding the commenter's question "what are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site," evacuation times would vary



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based on a large number of factors, including day of the week, time of day, the fire's location, behavior, winds, and terrain. While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables.

Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

The Project's Wildfire Evacuation Impacts Are Significant

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people (lead time) and the time it takes to protect them (evacuation time). Some of the variables mentioned by the County above (e.g. fire location, behavior, winds and terrain) are important inputs for estimating the lead time that would be available to protect residents. A fire that ignites near the project site (location) and spreads rapidly towards it (winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation of the site. Similarly, the day-of-week and time-of-day are variables affecting the evacuation time. For example, the number of evacuees (residents and visitors) and vehicles that might be on the project site due to weekends, holidays, or events (e.g. sports, music, weddings) will affect the evacuation time.

Wildfire safety hazards arise when the lead time is less than the evacuation time, and the difference between the two is a primary cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the east side of Paradise (lead time). Because of the large number of residents and vehicles that will be added to the area by the project and the recent history of intense, fast-moving wildfires (see the Wildfire Prevention Plan), it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios.

Gross estimates for evacuation time can be calculated using simple assumptions about warning time, response time, vehicle loading, and road capacity. Figure 2 shows the proposed transportation network on the south end of the project that would provide emergency access to Butts Canyon Road (the evacuation route from the project to Middletown or Pope Valley). Note that there are three access points to the project site along Butts Canyon Road (BCR) labeled *Primary Entrance Option 1 (PE1), Primary Entrance Option 2 (PE2), and Secondary Entrance (SE).* Although PE1 and PE2 provide two access points, they quickly merge into one access road to the northeast which create a bottleneck for evacuation purposes. This means that there are effectively two means of egress to Butts Canyon Road from the project: the Primary Exit (PE), which splits and leads to two access points, and the Secondary Exit (SE).

Assuming that the PE and SE both have one traffic lane out each (leaving one lane for emergency vehicle ingress, as is typical), and assuming that each exiting lane can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior), then the total egress from the site to BCR could range from 1200 to a high of 2400 vph. In supply-demand terms, this would be an estimate of the “supply” available to serve the evacuees as they leave the site.

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As noted above, there could be a range of 2000-3000 vehicles on the project site depending on the time of day, day of week, or special events, and this would be the “demand” in an evacuation. Dividing the vehicle demand by the exit road supply, the minimum time to evacuate this site could range from an ideal case of lower demand and higher capacity (2000 vehicles / 2400 vph = 0.83 hours) to a much worse case of higher demand and lower capacity (3000 vehicles / 1200 vph = 2.5 hours).

Figure 2. The transportation network that will connect the project site to Butts Canyon Road.

As noted above the second factor that influences the outcome of a wildfire evacuation is the lead time. The question becomes one of whether a wildfire in the vicinity of the project site might offer less than the time to evacuate the community (1 to 2.5 hours), leaving some evacuees at risk of being caught in- transit when the wildfire overtakes the community. This presents an extremely high safety threat. When persons are in vehicles on a road when fire is burning in the immediate area, visibility conditions may become so poor that the vehicles drive off the road or crash into other vehicles and/or flames and heat may overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire originating in Paradise. The EIR and Wildfire Prevention Plan provide little detail and no modeling regarding wildfire behavior and spread rate. However, based on the wildfire history of this region as detailed in the EIR and Wildfire Prevention Plan, there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site.

Additionally, the 2.5 hour evacuation time could be much longer if warning time is prolonged or key intersections are not controlled by law enforcement. These intersections include the two PE's and the SE, as well as the point where BCR intersects with Highway 29. If traffic flow problems occur at any of these locations due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock),

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the evacuation could lead to fatalities similar to the 2018 Camp Fire in Paradise or the 2017 Tubbs Fire in Santa Rosa.

In short, the County did not perform a project-specific wildfire evacuation analysis. Even in the absence of such analysis, there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety.

The EIR's Description of Shelter-in-Place Strategies Is Inadequate

As scenarios can be identified where not everyone in the project site would be able to get out in time, the Final EIR (p. 3.16-9) mentions six designated shelter-in-place meeting and staging areas as a back-up option:

"The Community Wildfire Protection Plan identifies evacuation routes in the County. Butts Canyon Road is identified as an emergency evacuation route. Depending on where the fire is located, people at the Guenoc Valley Site would be directed to exit the site via the primary roadways to Butts Canyon Road or as a last resort would shelter in place at the six Designated Meeting and Staging Areas. As shown on Figure 2-10, the Proposed Project includes an extensive circulation system with roadways

large enough for emergency access vehicles. In addition, these roadways would typically have 50 feet of defensible space cleared on each side of the roadway for a total fire break of 150 feet. Impacts to adopted emergency response or evacuation plans would be less-than-significant. Impacts related to traffic and emergency routes are addressed in Section 3.13 Transportation and Traffic.

Depending on the circumstances of a wildfire emergency, it may be difficult to evacuate. In this situation, residents, visitors, and employees will be directed to gather at designated meeting & staging areas where they will be provided information and assistance.

These six designated meeting and staging areas (DMSA) are shown in Figure 2-10 in the EIR but the locations are vague and the capacities are not given. In order to be effective, these DMSAs would need to be easily accessible (including for disabled people and pedestrians) and provide enough protection for residents to survive a wildfire with an intensity in line with recent past wildfires. Additionally, it is critical that the location of, and access routes to, DMSAs are well publicized and made clear to residents and visitors to the project site through education, signage, and other means. The lack of adequate description in the EIR or Wildfire Prevention Plan of the DMSAs' location, capacity, and protection level is a significant shortcoming; these should be addressed in detail in a project-specific evacuation analysis and plan.

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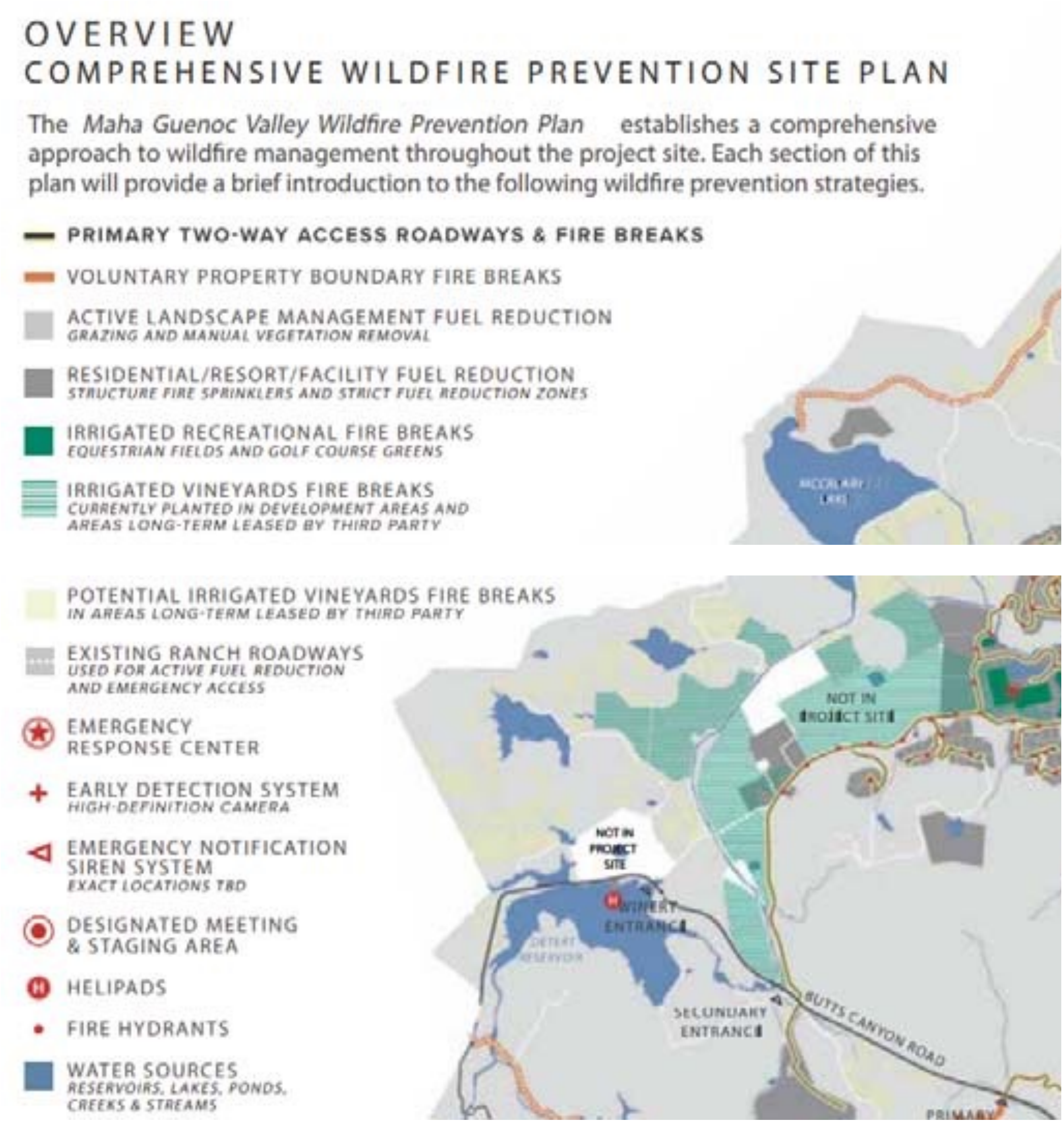

Figure 3. The designated meeting and staging areas are not very visible or easy to assess. **CONCLUSION**

The Guenoc Valley project anticipates housing thousands of residents and visitors on a Project site historically susceptible to fire and in a region where large-scale wildfire evacuations have recently been necessary. The project offers only two primary means of egress to Butts Canyon Road, which only offers one direction for evacuees to escape (southwest) from the project site, and then only two directions to travel from there (northwest or southeast on Butts Canyon Road). The evacuation vehicle capacity offered by these roads is relatively low, and a rough estimate is that they could serve 1200 to 2400 vehicles departing per hour. On a given summer weekend day, it's not unlikely that it could take a few hours to evacuate this project site, and there are numerous plausible wildfire scenarios where this much time might not be available. Shelter-in-place is likely to be used in some scenarios where not everyone can evacuate in time, but it is not taken very seriously in the EIR or Wildfire Prevention Plan, which do not describe the access, capacity, and protection level that the various staging areas would offer. I strongly recommend that the County prepare a detailed and comprehensive evacuation plan for this project.

Thomas J. Cova, Ph.D.

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography and the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[1] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[2] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[3] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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[1] Cova, T. J., Dennison, P. E., Li, D., Drews, F. A., Siebeneck, L. K., & Lindell, M. K. (2017). Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4), 601-611.

[2] Cova, T.J., Theobald, D.M., Normal, J.B., Siebeneck, L.K. (2013) Mapping evacuation vulnerability in the western US: the limits of infrastructure. *GeoJournal*, 78(2): 273-285.

[3] Cova, T.J., Dennison, P.E., Drews, F.A. (2011) Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability*, 3(10): 1662-1687.

Concepts to help formulate wildfire-safe community egress codes

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February 16, 2021

As communities continue to expand into wildfire-prone regions, safety regulations need to be enhanced to protect the public. One example is community egress codes designed to limit development patterns and densities based the available means of egress. Although this topic has not been at the fore in developing fire-prone wildlands, it is becoming increasingly important as communities in the western U.S. experience larger, faster-moving fires that offer less and less time for residents to evacuate. Many communities in the highest fire severity zones were never designed to safely support their current housing, commercial, and industrial density, let alone the proposed development that may be added. This raises the public safety question, "How much is too much?" when it comes to housing, commercial and industrial development in low-egress fire-prone communities. This paper presents geographic concepts that may help in formulating new regulations in fire-prone regions.

New Development with New Road infrastructure

Although evacuation planning has not historically been required in adding new development in fire-prone regions, recent large wildfires raise the question of whether we're reach a turning point. In short, wildfire evacuation risks associated with introducing people and vehicles to a community should be evaluated and disclosed prior to approving additional development. As a bare minimum, the local jurisdiction should prepare a project-specific evacuation plan that addresses the:

1. Possible range of evacuation times for residents, workers and visitors
2. Possible range of lead (available) times to act in an urgent wildfire
3. Pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the region-wide evacuation plan
4. Alternative plans for protecting residents, workers and visitors when roads become impassible or the time required to evacuate is greater than the time available.

Although lead agencies do not usually prepare an evacuation analysis stating the numerous variables affect potential evacuations, this type of planning is essential in assuring public safety. Project-specific evacuation analysis and modeling is not only possible, the data needed is readily available.

There are four principal dimensions that help promote public safety as it pertains to community design in fire-prone areas: 1) vehicle load, 2) number of exits, 3) exit capacity, and 4) exit arrangement. The next sections briefly address these dimensions.

Vehicle load

The **vehicle load** for a given area includes all vehicles that will be used by evacuees from residential, commercial and industrial structures or land uses. This can be represented as:

*vehicle_load = (households * vehicles_per_household) + vehicles_Commercial + vehicles_Industrial*

While vehicle density can be measured as the number of vehicles per unit area (e.g. vehicles per acre), a more useful density measure for evacuation purposes is the number of vehicles per unit of road length (e.g. vehicles per mile). To use this concept in the context of a regulation, it can be restated as the required minimum average length per vehicle (e.g. 10 feet per vehicle) or the maximum number of vehicles per mile. A minimum of 10 feet per vehicle in a high severity fire zone means that at most 528 vehicles could be present per mile of roadway (i.e. 5280 feet / 10 feet per vehicle = 528 vehicles per mile). While the length of the threshold can be debated, without a defined threshold it would be possible to have an unlimited number of vehicles, which would place residents at risk in a wildfire-prone region.

Using the equation above and a maximum of 528 vehicles per mile, a community with 3 miles of roads (in any configuration) and no commercial or industrial development, and assuming 2 vehicles per household, could have up to 792 households (based solely on vehicle load limitations):

*3 miles of roadway * 528 vehicles_per_mile = 1584 vehicles*
(1584 vehicles / 2 vehicles_per_household) + 0 + 0 = 792 households

Adding commercial and industrial vehicles to this community would reduce the number of households that could be constructed or added, if the vehicle density is to remain below 528 vehicles per mile. The maximum vehicle density threshold can also be varied depending on land use and fire severity. For example, a look-up table could be developed to set it higher in areas that are predominantly industrial or those with less wildfire risk.

Number of exits

The second consideration is the minimum **number of exits.** An *exit* in this context is a road segment that a resident in the community or evacuation zone must traverse to leave it. A community with one road connecting it to the rest of the network has one exit, and one with a choice between two roads to leave it has two exits. In the case of a defined evacuation zone, an exit is any road that allows people within the zone to travel to areas outside the zone (i.e. roads that cross the evacuation zone boundary). Each exiting road provides a *means of egress* for anyone inside the community or zone to leave it.

A required minimum number of exits can be represented with a table that links the estimated vehicle load in an area to the required minimum number of exit roads. Consider this example table:

Vehicles	Minimum exit roads
1 – 600	1
601 – 900	2
901 – 1200	3
1200 <	4

While the thresholds can be debated, the concept of requiring a minimum number of exit roads avoids the possibility of developing a “one-way-in-one-way-out” community with an unlimited number of vehicles (due to households, commercial, industrial activities) where residents have little to no chance of evacuating quickly in a dire wildfire scenario. Using the equation for vehicle load above, a community with 400 household vehicles (200 households assuming 2 vehicles per household), 150 from commercial activities, and 100 from industrial activities would require 2 exits (i.e. 400 + 150 + 100 = 650 => 2 exits).

<u>Exit capacity</u>
The third consideration is **exit capacity**. This regulation relies on the sum of the exit road capacities to determine the maximum vehicle load allowed in an area. Consider that all roads have a maximum number of vehicles that can be served in a given unit of time (e.g. 600 vehicles per hour or vph). To translate this into something useful for evacuation egress regulations, we can set a minimum capacity for the combined exits such that the minimum evacuation time does not exceed 1 hour (Note: an evacuation could take much longer). This is to avoid building a community where the least time it would take to evacuation would be 2, 3 or 4+ hours.

With a defined upper bound on the **minimum evacuation time**, we can calculate the maximum vehicle load in a given area based on the capacity of the exits. For example, if a community has one exit that can serve 600 vph (assume it ends with a stop sign at a major road), then 600 vehicles would be the maximum vehicle load (600 vehicles / 600 vph = 1 hour). A community with two exits that can each serve 600 vph could have a vehicle load of 1200. As in the prior cases, the thresholds can be adjusted, but without a regulation that connects the vehicles load in an area to the exit capacity, it becomes possible to develop communities in fire-prone areas with thousands of homes and commercial/industrial activities that could not safely be evacuated in a dire wildfire.

<u>Exit arrangement</u>
The last consideration is **exit arrangement.** This can be viewed as the minimum distance between any two exits in a community, assuming the community has more than one. Simply put, the exits should not be closer than one-half the furthest distance between any two households (or facilities) that rely on the exits. So, if the furthest distance between two households in a community is 1 mile and the community has two exits, the exits should not be closer than 0.5 miles (between any two points along either exit road). If the exits are too close, then they will not offer evacuees independent means of egress and more than one may quickly be blocked by the same wildfire.

New Development on Existing Road infrastructure
In addition to development along new road infrastructure, wildfire-safe regulations are also needed when adding development along existing road infrastructure. The configuration of rural communities with substandard roads presents an immediate concern due to the limited evacuation egress for residents, visitors and workers trying to reach collector roads or highways. Given this concern and the history of wildfires in fire-prone communities, it is critical that the local jurisdiction require a community-specific wildfire evacuation analysis that includes likely lead times and evacuation times. The evacuation analyses can be conducted on existing communities to evaluate existing wildfire evacuation conditions, and to determine if increases in the population associated with a new development should be approved. An evacuation analysis can identify significant bottlenecks and alternative evacuation routes that could become impassable under a variety of scenarios. Furthermore, infrastructure mitigation measures can be evaluated to determine if the most significant risks can be reduced to an acceptable level of impact.

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people **(lead time)** and the time it takes to protect them **(evacuation time**). If lead time falls below evacuation time, a scenario get can become dire. Some variables (e.g. ignition location, winds, fuel moisture, terrain, fire behavior) are important inputs for estimating the lead time that might be available to protect residents. A fire that ignites near a community and spreads rapidly towards it (due to winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation. This can be exacerbated by the day-of-week and time-of-day variations in the vehicle load. For example, the number of vehicles (evacuating residents, workers and visitors) that might be in a community at any one time can vary dramatically depending on land use, which affects the evacuation time (e.g. industry, commercial activity, sporting events, concerts, weddings, holidays).

Wildfire safety hazards arise when the lead time falls below the evacuation time, and the difference between the two is a principal cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the northeast side of Paradise (lead time). This led to a community burnover where many residents were evacuating through the fire. If the estimated evacuation and lead times are known to be of unacceptable risk in a community subject to fast-moving wildfires, it is critical to evaluate them under a range of likely scenarios prior to adding development for more residents, workers, and tourists (vehicle load).

Gross estimates for evacuation time can be calculated using simple assumptions about **warning time, response time, vehicle loading, and road capacity.** Assuming that two-lane roads built to fire safe standards have one traffic lane for egress (and one lane for emergency vehicle ingress), and assuming that an egress lane to a collector road can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior, back-round traffic from surrounding communities). Likewise, if two similar roads are available to evacuate, the egress capacity could range from 1200 to 2400 vph. In supply-demand terms, this would be an estimate of the “supply” available to serve the evacuees as they leave a community. The egress “demand” is estimated by the vehicle load which depends on the time of day, day of week, or special events. Dividing the vehicle demand by the egress road supply provides an estimate of **the minimum evacuation time**. While this is a very blunt measure of the actual time to evacuate a community (which could be much longer), it has significant value in establishing egress regulations (i.e. the minimum should not be too great).

For example, assuming a community with 1000 households and 2 cars per household (or 2000 vehicles) exits along one road, the minimum evacuation time could range from an ideal high-capacity case of (2000 vehicles / 1200 vph = 1.7 hours), to a lower-capacity case (2000 vehicles / 600 vph = 3.3 hours). If there are two roads available for safe egress to the collector road, the minimum evacuation time is halved to (2000 vehicles / 2400 vph = 0.83 hours) for the high-capacity case or (2000 vehicles / 1200 vph = 1.6 hours) for the lower-capacity case. However, if workers or visitors increase the evacuee vehicle load, a much worse case of higher demand, such as 3000 vehicles and lower capacity exits could lead to a greater minimum evacuation time (3000 vehicles / 600 vph = 5 hours). This would not be an acceptable, as any wildfire that offered less than 5 hours of lead time could result in a community burnover with many evacuees in transit. This presents an extremely high safety threat, as visibility conditions may become so poor that the vehicles drive off the road or impact other vehicles and/or flames and heat overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire in Paradise.

Additionally, the evacuation time could be much longer if **warning time is prolonged** or key exits and intersections are not controlled by law enforcement. If traffic flow problems occur at intersections or along collector roads due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock), this could also lead to fatalities. As the 2018 Camp Fire in Paradise and 2017 Tubbs Fire in Sonoma County recently demonstrated, vehicles overtaken by fire in an evacuation is an especially dangerous scenario.

Conclusion:
In summary, while there are many ways to develop standards that limit development in fire-prone areas to the number, capacity, and arrangement of the exits relied upon in a wildfire, it is important that development not proceed unchecked to the point that public safety is severely compromised and the residents have no realistic chance of safely evacuating in a dire wildfire scenario. The 2018 Camp Fire in Paradise, California offers the best example of a town with an evacuation plan of 2 to 3 hours that only had about 90 minutes before homes were burning.

CREDENTIALS
I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography at the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2005 I published an article questioning whether fire-prone communities would someday have a maximum occupancy and proposed possible standards.[1] In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[2] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[3] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[4] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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[2] Cova, T. J., Dennison, P. E., Li, D., Drews, F. A., Siebeneck, L. K., & Lindell, M. K. (2017). Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4), 601-611.
[3] Cova, T.J., Theobald, D.M., Normal, J.B., Siebeneck, L.K. (2013) Mapping evacuation vulnerability in the western US: the limits of infrastructure. *GeoJournal*, 78(2): 273-285.
[4] Cova, T.J., Dennison, P.E., Drews, F.A. (2011) Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability*, 3(10): 1662-1687.

From:	Deborah Eppstein
To:	Crystal Acker
Subject:	Scoping for cannabis EIR- fire risk and fire safe regulations
Date:	Friday, March 10, 2023 3:54:46 PM
Attachments:	Scoping- Cannabis EIR, wildfire issues 3-9-23.pdf

EXTERNAL

Hi Crystal,
Please include this document on wildfire risk and the state fire safe regulations in the scoping comments, also to be provided to Ascent, for the upcoming cannabis EIR.

Thank you.

Deborah Eppstein
deppstein@gmail.com

Wildfire Safety Issues for Scoping for Cannabis EIR
March 9, 2023
Prepared by Deborah Eppstein

Major areas that need to be analytically studied for risk and safety from wildfires include Evacuation Risk and Increased Risk of Wildfire, as well as the requirement to meet the CCR Title 14 State Minimum Fire Safe Regulations 2023.

EVACUATION
Current evacuation routes and evacuation times and bottlenecks need to be fully analyzed for all areas in the County. Fire risk designations are a moving target, with many homes destroyed in areas classified as low or moderate fire risk, and with many residents under mandatory evacuation in areas of low and moderate fire risk, in addition to areas of high and very high fire risk. For many of these areas on dead-end roads, there is only one way out, with roads then feeding into larger roadways that themselves have proven to become clogged for hours (eg Highway 12). Many wildfires are very fast moving with minimal advance warning.

Evacuation models for determining evacuation time vs road conditions and number of vehicles evacuating have been developed (see Tom Cova, University of Utah) and such scientific methodology needs to be employed. Some of these references are attached.

If such scientific studies determine that existing evacuation times are already dangerous, no new development should be added to such areas. For example, stating that a proposed development would increase number of vehicles by only an insignificant percent is defying safety if evacuation times are already unsafe before the new development is included.

WILDFIRE RISK

Increased wildfire risk from added development must also be analyzed. It is well documented that construction, energy infrastructure, vehicles and people increase wildfire risk. The location of the proposed development relative to areas of high fire risk must be analyzed, including wind patterns during high wind events as Sonoma County and neighboring counties have experienced, topography, wildfire fuel, including added risks from previous wildfires that have increased fuel due to dry standing and fallen timber and/or excess undergrowth.

Studies should not diminish added risk even though a high level of existing risk already exists. Added fire risk from vehicle trips and human activities must be analyzed relative to location on a road; ie location in remote areas may increase risk significantly more than the same activities in less remote areas. Residents of high fire risk areas likely are much more careful than are outside workers (eg, throwing cigarettes from a car window, driving older vehicles prone to backfiring). Such activities have been observed by residents.

Added fire risk from cannatourism must be evaluated. This would include added vehicle miles, increased numbers of people, and added risk due to careless behaviors of people who are impaired.

Energy use and infrastructure requirements must be closely evaluated. Indoor and/or mixed light cultivation require high levels of energy. If these are allowed in high fire prone areas, the added fire risk may be significant. For example, the 6500 sf indoor/greenhouse cannabis operation approved at 2000 Los Alamos Rd is calculated (using county numbers) to use the electricity of 160 new homes, yet the increased risk of fire ignition due to this was not studied.

Analyze cumulative energy use, including use in greenhouses, hoop houses, and vehicle miles traveled. CEQA guideline § 15126.2(b) treats "wasteful, inefficient, or unnecessary" energy consumption as a significant environmental impact. This pertains to mixed light and indoor cultivation, and processing.

Identify any relocation, construction, or upgrade of electric distribution lines.

The EIR should also evaluate added fire risk from accidents including from faulty wiring. Previous fires have been caused by cannabis operations due to faulty or illegal installed wiring. Just because a permit requires that all wiring be done legally does not make it happen. Code enforcement and inspection resources need to be taken into consideration.

Wildfire Risk and the General Plan

- Objective LU-4.1 in the General Plan (p. LU-35). Assure that development occurs only where physical public services and infrastructure, including school and park facilities, public safety, access and response times, water and wastewater management systems, drainage, and roads are planned to be available in time to serve the projected development.
- Policy LU-7d in the General Plan (p. LU-44). Avoid new commercial, industrial, and residential land use designations in areas subject to "high" or "very high" fire hazards, as identified in the Public Safety Element.
- Goal PS-3. Prevent unnecessary exposure of people and property to risks of damage or injury form wildland and structural fires.
- Objective PS-3.2. Regulate new development to reduce the risks of damage and injury from known fire hazards to acceptable levels.
- Policy PS-3b. Consider the severity of natural fire hazards, potential damage from wildland and structural fires, adequacy of fire protection and mitigation measures consistent with the Public Safety Element in the review of projects.
- Policy PS-3f. Encourage strong enforcement of State requirements for fire safety by the California Department of Forestry and Fire Protection. This means no new development including cannabis cultivation can be considered on parcels in the SRA and VHFHSZ of the LRA accessed by roads not meeting the Title 14 State Fire Safe Standards- eg dead-end roads more than 1 mile (or less pursuant to § 1273.08), roads less than 20 ft wide, as well as the other requirements of Article 2 §§ 1270.00-1273.09. No commercial operation can be accessed by a driveway, only by a road meeting the above requirements. No exceptions can be granted for roads outside the development parcel pursuant to § 1270.07.

From: Kim Roberts-Gutzman
To: Cannabis
Subject: 1700 Barlow Lane Sebastopol CA
Date: Saturday, March 11, 2023 9:24:08 AM

EXTERNAL

Sonoma County

I own the private deeded easement road that Lobro uses for his cannabis production. There is none stop traffic 24/7. Some of these vehicles drive in an unsafe manner, speeding at 50 or 60. This is a dirt road that dead ends at a neighbors house. We are sick and tired of the dust and noise.

Kim Roberts
1750 Barlow Lane
Sebastopol. CA

From:	Wendy Smit
To:	Cannabis
Subject:	Comments on EIR Scope from Milo Baker Chapter, CNPS
Date:	Saturday, March 11, 2023 12:16:33 PM

EXTERNAL

To: Crystal Acker, Project Manager
Pat Angel, Ascent Environmental

Thank you for the opportunity to comment on the scope of the upcoming EIR preparation. I am writing as a representative of the Milo Baker Chapter, California Native Plant Society. Our group strives to help planned land use that benefits our woodlands and grasslands as well as wise human uses. I spoke up at the recent scoping meeting about our ideas however I want to get these in writing, also.

Our main concern is the expansion of cultivated areas of our county, beyond what has already been converted to planted crops such as grapes. Many of our local plants reside in the wilds, and are threatened by disturbance. This includes not only rare and endangered populations but also our iconic and typical landscapes of vegetation. As the scope of the EIR is planned, please keep in mind any impacts future cannabis cultivation would have on these current relatively wild areas, on a landscape scale.

In addition, please take into account the possibility of an ordinance that has the same and better protections as in existing ordinances such as the VESCO (Vineyard and Orchard Site Development), Agricultural Grading and Drainage, as well as replant licensing. Would a Best Management Practices for Cannabis be part of the ordinance?

Adequate Plant Surveys before development are critical to understanding what is potentially lost by disturbance. Will these be a part of the requirements?

Also, an area that is essential is the impact on county government staffing, compliance and enforcement. What agency is undertaking this work and how will it impact it's other responsibilities? How will new planning requirements impact surveillance of illegal grows?

It has been estimated that an additional 65,000 acres could be planted in cannabis. Our hope is that these potential acres can be approved in areas that are currently already cropland and will not encroach into new cleared and plowed acres.

Finally, it is difficult to adequately comment on the scope of the EIR without knowing more about the proposed ordinance. I look forward to future releases of that information.

Sincerely,
Wendy Smit

Past President, Milo Baker Chapter CNPS
Member Conservation Committee

From:	Anna Ransome
To:	Crystal Acker; Cannabis
Cc:	district4; district5; Susan Gorin; David Rabbitt; Chris Coursey
Subject:	Cannabis EIR NOP - Graton Exclusion Zone
Date:	Sunday, March 12, 2023 7:52:23 PM
Attachments:	Graton Exclusion Letter FOG-Acker 3-12-23.docx

EXTERNAL

Please see attached.

Anna Ransome for Friends of Graton (FOG)

TO: Crystal Acker (cannabis@sonoma-county.org)

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, District4 <District4@sonoma-county.org>

From: Anna Ransome for Friends of Graton (FOG)

Date: March 11, 2023

Subject: Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zones

Dear Crystal Acker, Cannabis Sonoma County:

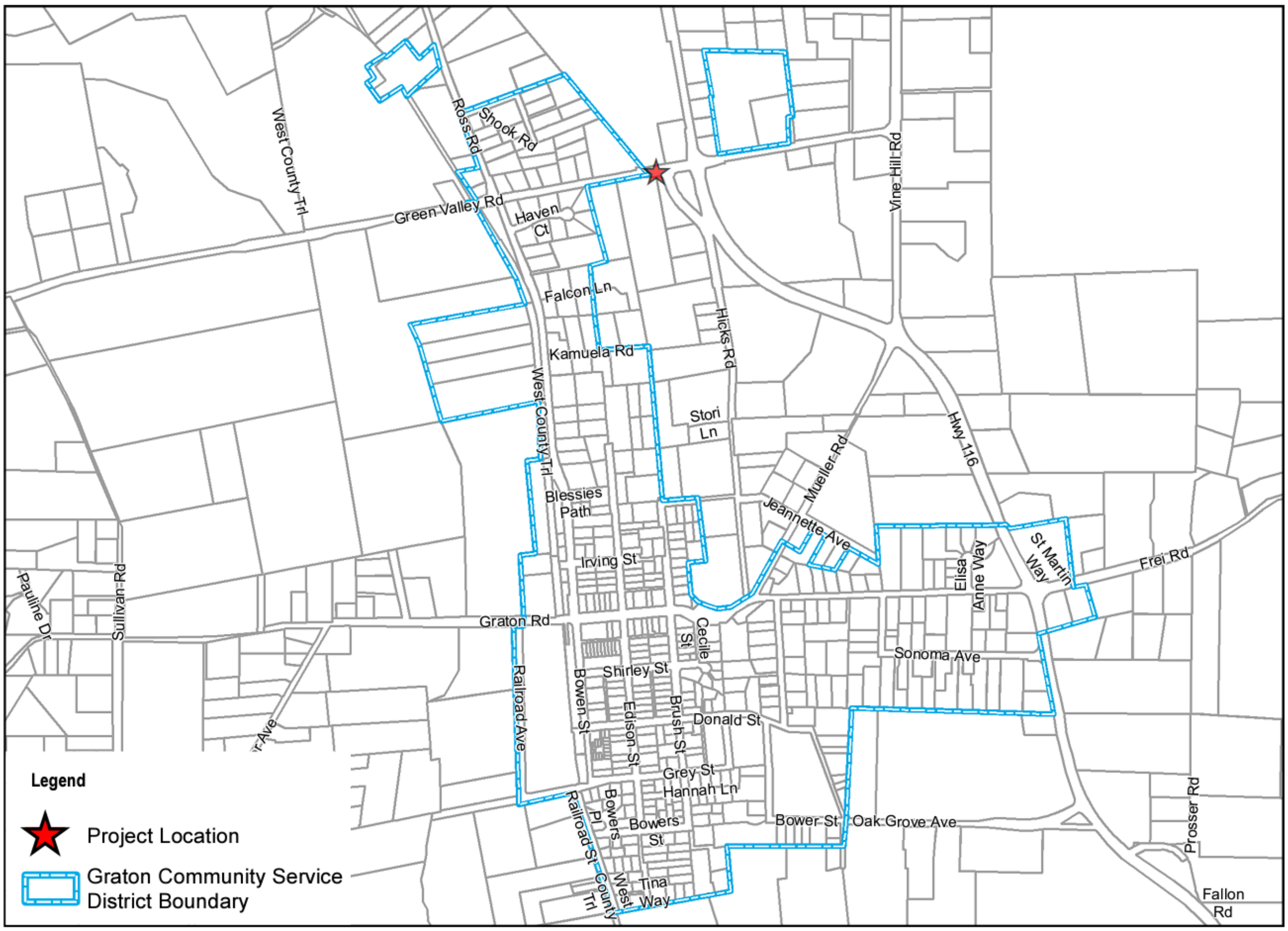
Sonoma County officials have recommended using exclusion zones as one way to help lessen conflicts between residences and commercial cannabis operations. We support the concept of both inclusion and exclusion zones and request that the EIR scoping process include significant studies of alternative ways to determine the boundaries of these zones and mechanisms to establish them. The exclusion zones would prohibit the commercial cultivation, processing and/or sales of cannabis in rural neighborhood enclaves, with a buffer to reduce impacts to those on the edges of these areas.

Graton is considered a village or hamlet by most people who reside here. When a large scale commercial cannabis operation was proposed for a property south of town in 2018, Friends of Graton (FOG) gathered 592 signatures on a petition to stop it. Clearly, there is a strong local resistance to commercial cannabis activity in the Graton area.

Our community has been burdened with a large amount of commercial activity, due to having M1 zoning surrounded by residences. Commercial retail activity has not been a significant burden on residents, but two high-impact processing facilities have been problematic over the 35 years I have lived here. These manufacturing zonings are grandfathered-in, but residents will balk at having additional commercial activity in the immediate vicinity.

We would therefore recommend a commercial cannabis exclusion zone to include all the area inside the Graton Community Services District (GCSD) borders with the addition of a buffer of 1000’ to minimize potential impacts of commercial cannabis, such as odor, lighting, noise, aesthetics, crime and increased activity.

Below is a map of the Graton Community Services District for your reference. The Draft EIR should include a study of adjacent areas outside the GCSD that would qualify for inclusion in a Commercial Cannabis Exclusion Zone, such as the Mueller and Hicks Road areas, which are similar to district parcels but not included in the GCSD. These areas could also have the potential to be annexed to the GCSD in the future. The 1000' setback/buffer should extend around the perimeter of the protected area.



Additionally, the Atascadero Creek and adjacent wetlands run through the valley alongside the town and have BH zoning indicating sensitive biotic resources. The West County Trail runs along the old railroad right-of-way and also uses surface streets in parts of Graton, and deserves protection from the impacts of commercial cannabis. We request analysis of the potential impacts of commercial cannabis on the creek, riparian and wetlands.

FOG, is allied with Neighbors of West County (NOW) and you will be receiving other communications from NOW with additional Cannabis EIR scoping comments. Thank you for consideration of our comments.

Anna Ransome for Friends of Graton (FOG)

P.O. Box 364, Graton CA 95444

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	Cannabis Program Update -Scoping - Zoning Changes
Date:	Sunday, March 12, 2023 8:26:55 PM
Attachments:	SCOPING - CANNABIS EIR ZONE CHANGES.docx

EXTERNAL

Via email

From Brantly Richardson

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR **3/12/23**

ZONING CHANGES: (From the NOP) The Cannabis Program Update would result in a series of zoning changes that may retain, replace, expand on, or eliminate existing provisions of the current cannabis ordinance.

Scientifically analyze the impacts of any zoning changes that replace, expand on or eliminate existing provisions of the current cannabis ordinance on parcels where cultivation (or mfg., sale, etc.) is currently prohibited. Identify these impacts and possible mitigations. The analysis must be data driven, including by not limited to the following concerns.

1. Increase in crime and attendant sheriff and police expenses. Include data showing zones where all crimes occurred historically.
2. Increase in complaints to Code Enforcement and expenses incurred by that Department and other staff to investigate. Include data showing where all complaints historically are initiated.
3. Increase in difficulty of tax collector to determine sales tax or canopy tax. Increase in other potential and projected incurred administrative and monitoring expenses vs projected revue from the zoning change.
4. Increase of all Neighborhood Compatibility issues including but not limited to: crime risk, Aesthetics/Visual Resources, odor/Air Quality (including presence of Beta-Myrcene, a listed carcinogen, including the potential exposure to nearby populations), transportation, water quantity and quality, Hazards and Hazardous Materials, wildfire evacuation, noise, Land Use/Planning (how consistent or inconsistent with existing uses, i.e.: residential, schools, parks, etc.).
5. Analyze and determine what additional requirements (i.e.: larger setbacks, larger parcel size, odor abatement plan, noise control, visual deterrent, resource availability, etc.) would be necessary for proposal of a new use (cannabis) that is inconsistent with current uses in such area.
6. Analyze potential economic impacts to surrounding area, and neighboring homes caused by different use than traditional occurring in such areas. Evaluate methods and processes to compensate affected neighbors.
7. Analyze other county cannabis ordinances to determine best practices on managing inconsistent uses within a zoned district. Considering zoning has not necessarily been the best indicator of actual uses, expand this analysis to consider the current specific uses of an area vs new uses being proposed.

Because any zoning change contemplated will expand the scope of current law and current uses, all proposed changes require the following analysis upfront:

a) a more thorough and extensive background study to understand the impacts (to both existing and future residences/businesses/schools/parks/etc.). Since such a proposal is not just expanding an already existing use within an area, but proposing a new use to a new area, the study must be more robust to contemplate the additional complexities and new impacts. The NOP recognizes a similar concern when requiring "The analysis will address compatibility of cannabis operations with traditional agricultural land uses", two uses much more similar, than commercial cultivation with a neighborhood of homes. and

b) identify the more stringent rules requirements since any proposed use will be inconsistent with current uses in an area.

c) an evaluation of how any proposed new use will be detrimental to an established area.

Crystal Acker, Supervising Planner crystal.acker@sonoma-county.org
cannabis@sonoma-county.org

Re: Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR **3/12/23**

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b) identify the more stringent rules requirements since any proposed use will be inconsistent with current uses in an area.

c) an evaluation of how any proposed new use will be detrimental to an established area.

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	CANNABIS PROGRAM UPDATE - SCOPING - ECONOMIC ANALYSIS 3.12.23
Date:	Sunday, March 12, 2023 8:09:37 PM
Attachments:	Economic Analysis Requied - 2-26-2023.docx

EXTERNAL

Via email

From Brantly Richardosn

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR - Economic Analysis

The Framework for the revised cannabis ordinance (March 2022) includes an economic analysis "to help inform relevant policy decisions."

Study, confirm or refute the HdL economic report released March 2023. https://sonoma-county.legistar.com/View.ashx?M=F&ID=11658055&GUID=9AF6DE4F-C9BA-4C84-B3E6-313B573F0575

Include the following criteria in the economic analysis:

Include a robust and credible baseline financial and economic analysis of all aspects of the cannabis industry operations including: Cultivation (Outdoor, Mixed light, Indoor). Processing. Manufacturing, Testing, Retail (Dispensaries, Delivery)

Analyze cultivation operations of various sizes and types (outdoor; indoor; mixed light). Evaluate Sonoma County's commercial cannabis cultivation operations viability in relation to the statewide cannabis industry, both legal and illegal. Evaluate state viability for future federal legalization. Evaluate expected revenues derived from taxes, fines for violations, permit and inspection fees, etc. Include all expenses and costs incurred by all County departments (including Sherriff and Courts) involved in implementing and administrating the program.

Ascertain if there would be sufficient income from all cannabis operations to meet the County's legal and promised obligations to establish and maintain the required education, health, and safety programs as required by Proposition 64. Analyze potential future health expenses.

Analyze the economic impact of county and state payments to growers due to disaster losses (flood/drought/fire)

Analyze whether economic benefits of outdoor cultivation outweigh the negative impacts on neighborhoods and the environment.

Analyze if revenue will support services needed including but not limited to staffing costs to implement the program, including permitting, compliance inspection, and code enforcement; permit and inspection fees and other applicant-incurred costs to obtain permits and run permitted operations; and civil penalties. Determine if the product pays for itself with reduced revenues.

Analyze impacts to public services such as landfill costs resulting from disposal of waste from the various cannabis operations.

Analyze the impact of canna-tourism on the current revenue from the Transit Occupancy Tax. Napa County concluded that canna-tourism would undermine existing tourism and harm its tax base. Study and compare Napa report. https://www.winebusiness.com/content/file/9111_Report_082019.pdf with Sonoma County.

Analyze how canna-tourism and wine tourism might overlap and dangers to public safety due to known augmented intoxication from combining cannabis with alcohol.

Study two additional policy options:

1) significantly reducing the size, type, and scope of cannabis cultivation

2) the elimination of ALL cultivation in the County.

Present the full range of policy options.

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR - Economic Analysis

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2) the elimination of ALL cultivation in the County.

Present the full range of policy options.

From:	Deborah Eppstein
To:	Crystal Acker
Subject:	Exclusion Zone Request for Los Alamos Rd area
Date:	Sunday, March 12, 2023 7:44:50 PM
Attachments:	Exclusion Zone Proposal for Los Alamos Road 3-13-23.docx

EXTERNAL

Crystal, Please include the attached request for Cannabis Exclusion Zone for the upcoming draft cannabis EIR and subsequent new ordinance.

Thank you.

Deborah Eppstein
deppstein@gmail.com

Cannabis Exclusion Zone Request for Los Alamos Road

We request that Los Alamos Road, and all roads accessed by it, be listed as an Exclusion Zone for Cannabis Cultivation and Processing. The reasons include:

1) Los Alamos Rd is a dead-end long, winding and dangerous mountain road, traversing through high and very high fire hazard severity zones according to CalFire designations. It all burned in the 2020 Glass Fire, with dangerous and slow evacuation for residents. The 2017 Nuns Fire reached the end of Los Alamos Rd and top of Cougar Lane.
2) This is a remote location, which sheriff response times far greater than 20 minutes. It takes 20 minutes alone just to drive up Los Alamos Rd.
3) This is a class 4 water scarce zone.
4) It would negatively impact the scenic character.
5) It would negatively impact the residents due to increased traffic and increased evacuation hazard, as well as increased risk of new ignitions due to increased traffic and employees.
6) Los Alamos Rd does not meet the minimum requirements of the Title 14 State Fire Safe Regulations which apply to public roads as it is 6 miles dead-end with steep drop-offs and cliffs on either side and narrows to one lane for the upper portions. No exceptions can be applied to public roads under the fire safe regulations, and the only mitigation for a dead-end road is a second access meeting the road requirements of the fire safe regulations (i.e., 20 ft wide, improved surface, grade limits, etc). That second acess/egress does not exist. Thus no new development, which includes cannabis operations, can occur accessed by Los Alamos Rd.

From: Mary Plimpton
To: Crystal Acker; Cannabis
Subject: CANNABIS EIR
Date: Sunday, March 12, 2023 7:39:04 PM

EXTERNAL

We are writing as property owners/tax payers in Franz Valley.

Regarding the scoping for the EIR for the ordinance governing cannabis businesses in Sonoma County, we ask that evaluations include a baseline survey of current conditions and future outlooks, to include:

- Water/hydrology report (data from 2021-2022) – and outlook for 1, 5, 10, and 20 years
    - The County's new groundwater/well permitting assessment program meshes nicely.
- Riparian and wildlife survey
- Air quality report, with air/odor circulation/recirculation measurements
- Fire history and future fire risk evaluations
- Baseline crime data and risk evaluations
- Fiscal impact
    - Profile of cannabis market
    - Cost of cannabis production to growers
        - Tax rate
        - Net profit
    - Cost of cannabis production to County
        - Cost to inspect
        - Cost to enforce regulations
        - Net tax benefit to County
- Cost of law enforcement specific to cannabis businesses in years 2010; 2015; 2020
    - Estimated cost of law enforcement specific to cannabis businesses for 2025
- Do taxes collected from cannabis businesses (from growers to processers to consumer sales) cover the costs to the County to inspect, enforce, and to respond to criminal predations?
- Clarify property owners' Rights to Enjoy their Property AND claims of Right To Farm
    - How will complaints be evaluated and adjudicated when cannabis is introduced to an established community
        - By a heritage property owner
        - By a new property owner
        - By a non-resident property owner
- How will complaints be evaluated and adjudicated if
        - A heritage well runs dry

        - Who pays to truck in water?
            - Injured property owner?
            - County?
- How will complaints be evaluated and adjudicated if adjacent businesses are negatively impacted by newly introduced cannabis business?
    - If, for example, adjacent vineyards are tainted by terpenes from newly introduced cannabis
        - Loss of value of heritage crop
        - Loss of tax revenue to County
- If values of properties adjacent to cannabis businesses are negatively impacted
    - Property values fall
    - Tax revenues fall
    - Net impact on Sonoma County coffers?

Thank you for your consideration.

Hal and Mary Plimpton
8425 Franz Valley School Road
Calistoga, CA 94515 (Sonoma County)

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	CANNABIS UPDATE EIR - SCOPING-AGRICULTURAL AND FOREST ELEMENT 3.12.23
Date:	Sunday, March 12, 2023 8:21:03 PM
Attachments:	Scoping Agricultural and Forest 3.10.23.docx

EXTERNAL

Via email

From: Nancy and Brantly Richardson

Cannabis Update EIR – Public Comment on the Notice of Preparation 3/12/23

Agricultural and Forest Element – General Plan Amendments

In the analysis and discussion of the potential impacts associated with a General Plan Amendment to include cannabis within the meaning of "agriculture" and "agricultural Use" as used in the Sonoma County General Plan

1. Analyze the legal opinion County Counsel opined during the planning commission hearing that it lacks legal authority to make this change under current California Law.
2. Analyze the consequences and potential impacts of adhering to an illegal policy.
3. Clarify whether such a General Plan amendment is possible unless California law changes.
4. Provide a clearly written justification of any proposed amendments for public evaluation.

From the Notice of Preparation:

Agricultural & Forest Resources. *The EIR will describe the County's current agricultural resources and land uses, including lands subject to Williamson Act Land Conservation contracts, consistent with the Sonoma County General Plan. The General Plan identifies preservation of agricultural land for agricultural uses as the primary goal for the three agricultural land use categories: Land Intensive Agriculture, Land Extensive Agriculture, and Diverse Agriculture. To support that goal, the General Plan includes many policies to protect and enhance agricultural lands and to encourage land uses related to agricultural production, agricultural support, and visitor-serving uses that promote agriculture. The analysis will address compatibility of cannabis operations* *with traditional agricultural land uses and potential conversion of agricultural lands to non-agricultural uses. The analysis will also include a discussion of potential impacts associated with a General Plan Amendment to include cannabis within the meaning of "agriculture" and "agricultural use" as used in the Sonoma County General Plan. The EIR will describe the County's current forested/timber resources and land uses consistent with the Sonoma County General Plan. The analysis will address compatibility of cannabis operations with timber resources and potential conversion of timberlands.*

Cannabis Update EIR – Public Comment on the Notice of Preparation   3/12/23

Agricultural and Forest Element – General Plan Amendments

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From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	CANNABIS UPDATE EIR - SCOPING-HYDROLOGY AND WATER QUALITY 3.12.23
Date:	Sunday, March 12, 2023 8:13:06 PM
Attachments:	Scoping Water resources final 3.10.23.docx

EXTERNAL

Via email
From: Nancy Richardson

Cannabis Update EIR – Public Comment Hydrology and Water Quality

Scientifically analyze water supplies for all water zones and surface water, and account for predicted prolonged drought, hotter weather, and the future possibility of loss of water from Potter Valley. Include projected water needs for the next 20 years for residences, future housing growth, agriculture, cannabis, commercial, and industrial uses. The analysis should include California Department of Fish and Wildlife studies as well as Water Board studies.

Identify all impaired watersheds, map all parcels in the public trust resources area (PTRA) and all parcels located above or near the three Sustainable Groundwater Management Act (SGMA) identified aquifers. Note: Recent GSA models are not based on current or future drought scenarios. Analyze any additional measures necessary to protect these areas from depletion and other impacts. Provide accurate baseline water resource data and a detailed analysis of how cannabis operations could impact that resource. Include in all water use analyses various drought scenarios into the future.

Identify areas sensitive to overdraft, well interference, or streamflow depletion, identify the most commonly assessed potential impacts related to cannabis water use.

Identify the 43 established sub watersheds in the Russian River region and other aquifers in the fractured geology of Sonoma County

Identify and map areas not on public water. Identify existing wells and their impact on groundwater, streamflow, and aquifer replenishment.

Establish baseline water consumption conditions including all cannabis permits already issued, all operating in the Penalty Relief Program (PRP) and all pending and reasonably foreseeable future permits.

Analyze net-zero usage both existing and proposed and any current harmful and cumulative impacts including but not limited to recharge, stream flow reduction and sustainability.

Analyze water consumption of all combinations of cultivation to establish a minimum consumption figure for each type. Establish standard guidelines for water usage per square foot by different types of cultivation and establish a minimum amount/figure to be used when evaluating projects and cumulative impacts.

Identify all users holding water rights in the Upper Russian River in order they can be evaluated as a draw on the water system.

Analyze relation of cannabis and residential groundwater pumping impacts on streamflow and ecosystems. Attach https://iopscience.iop.org/article/10.1088/2515-7620/ab534d/pdf

Note: The Sonoma County General Plan was last revised in 2004. The water resources element Is out of date. (Revise the water element in the 2004 County General Plan?)

Analyze how groundwater can be protected to allow for continued support of all land uses into the future, including cannabis, traditional agriculture, residential uses, and commercial/industrial development.

Identify with updated analyses and evaluate availability of water to meet cannabis demand when consideration is given to all other land uses.

Analyze prohibiting cannabis cultivation in all Class 3 and 4 groundwater areas and Class 2 groundwater areas that have experienced water shortage (e.g., wells going dry) since 2020.

Analyze the effect of rainwater catchment on water recharge, downstream flows and groundwater depletion.

Analyze requiring that cannabis cultivation result in no net depletion of water resources.
Analyze a cannabis moratorium until water availability has been established scientifically.

cannabis@sonoma-county.org

Cannabis Update EIR – Public Comment 3/23
Hydrology and Water Quality

Scientifically analyze water supplies for all water zones and surface water, and account for predicted prolonged drought, hotter weather, and the future possibility of loss of water from Potter Valley. Include projected water needs for the next 20 years for residences, future housing growth, agriculture, cannabis, commercial, and industrial uses. The analysis should include California Department of Fish and Wildlife studies as well as Water Board studies.

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Identify areas sensitive to overdraft, well interference, or streamflow depletion, identify the most commonly assessed potential impacts related to cannabis water use.

Identify the 43 established sub watersheds in the Russian River region and other aquifers in the fractured geology of Sonoma County

Identify and map areas not on public water. Identify existing wells and their impact on groundwater, streamflow, and aquifer replenishment.

Establish baseline water consumption conditions including all cannabis permits already issued, all operating in the Penalty Relief Program (PRP) and all pending and reasonably foreseeable future permits.

Analyze net-zero usage both existing and proposed and any current harmful and cumulative impacts including but not limited to recharge, stream flow reduction and sustainability.

Analyze water consumption of all combinations of cultivation to establish a minimum consumption figure for each type. Establish standard guidelines for water usage per square foot by different types of cultivation and establish a minimum amount/figure to be used when evaluating projects and cumulative impacts.

Identify all users holding water rights in the Upper Russian River in order they can be evaluated as a draw on the water system.

Analyze relation of cannabis and residential groundwater pumping impacts on streamflow and ecosystems. Attach https://iopscience.iop.org/article/10.1088/2515-7620/ab534d/pdf

Note: The Sonoma County General Plan was last revised in 2004. The water resources element Is out of date. (Revise the water element in the 2004 County General Plan?)

Analyze how groundwater can be protected to allow for continued support of all land uses into the future, including cannabis, traditional agriculture, residential uses, and commercial/industrial development.

Identify with updated analyses and evaluate availability of water to meet cannabis demand when consideration is given to all other land uses.

Analyze prohibiting cannabis cultivation in all Class 3 and 4 groundwater areas and Class 2 groundwater areas that have experienced water shortage (e.g., wells going dry) since 2020.

Analyze the effect of rainwater catchment on water recharge, downstream flows and groundwater depletion.

Analyze requiring that cannabis cultivation result in no net depletion of water resources.
Analyze a cannabis moratorium until water availability has been established scientifically.

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Cc:	"Lynda"; David Rabbitt; Susan Gorin; Chris Coursey; James Gore
Subject:	Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zones
Date:	Monday, March 13, 2023 7:57:06 AM
Attachments:	SCOPING - CANNABIS EIR Exclusion Zones for FreestoneGoldRidge and Ragle Ranch areas Mar13 2023.docx

EXTERNAL

Date: March 13, 2023

To: **cannabis@sonoma-county.org**, **crystal.acker@sonoma-county.org**

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, District4 <District4@sonoma-county.org>, Crystal Acker <crystal.acker@sonoma-county.org>

Subject: Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for **Exclusion Zones**

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

Our Sonoma County Cannabis Ordinance has stumbled over the last many years mainly due to incompatible commercial cultivation sites being too close to rural residential neighborhoods. This has created angst for all parties: growers, neighbors and the County. It is evident that the needs and desires of these groups are fundamentally incompatible. If the EIR and updated ordinance can get the separation criteria correct, future conflicts will be minimized, allowing the growers to grow and residents to enjoy their properties. To address this issue the NOP document (referencing the Framework adopted by the BOS in March 2022) requires studying and establishing “criteria and mapping of Exclusion Zones”.

Given this, please analyze the creation of exclusion zones where the commercial cultivation, processing, and sale of cannabis is prohibited. Analyze designating specific areas as exclusion zones in the ordinance, thereby providing sufficient environmental review to allow such designation without Board of Zoning Adjustment or Board of Supervisor hearings for specific parcels.

In light of this requirement are two scoping requests. One, specific to the West County where many of the NOW members reside (Neighbors of West County, a group of over 500 residences) and Two, a more general exclusion guideline to be applied to Sonoma County as a whole.

1) We ask that the following West County residential neighborhoods be analyzed and designated as Exclusion Zones: **Freestone Gold Ridge Area (attachment G) and Ragle Ranch Area (attachment F).**

    a. The majority of these areas have become primarily residential in nature, with little to no commercial activity. A highly valuable commercial product is incompatible with residential homes and their activities. In effect, these areas are now dense neighborhoods.
        i. There are approximately 2,052 parcels within the two exclusion zones that are DA and under 10 acres in size. The Sebastopol area is a hodgepodge of small-acreage RR, AR, and DA all mixed together in nonsensical fashion among large RR, DA, and RRD parcels. These area’s need protection!
    b. These areas have expansive scenic corridor acreage.
    c. These areas contain sensitive waterways like Blucher creek, Atascadero creek, Green Valley creek, etc.
    d. These areas contain family recreational uses like West County trail, Ragle Ranch Park, Sebastopol Peace Park, etc.

e. These areas have no long-term water studies to truly understand the availability and the impact on homeowners' wells should a water intensive crop like cannabis require deep wells.
f. The current zonings of Agricultural, Resource and Rural Residential in these areas no longer reflect the actual use on the ground and are no longer adequate in defining where cannabis is allowed. Again these areas have been carved up into smaller parcels (10 acres or less), are residential in nature and cannot provide adequate separation between homes and commercial cannabis.
g. The maps are a rough outline of the areas to be excluded. We request the County study the actual parcel data in these areas and, as necessary, add other smaller parcel-ized areas into these exclusion zone.
h. The County must establish reasonable safeguards at the border of an exclusion zone so as to avoid impacts and conflicts. These should include adequate setbacks (i.e.: 1,000ft), and an Odor Abatement Plan, etc.
i. Should cannabis operations already exist within these boundaries, there should be no grandfathering-in of such operations; there should be no extension of permit periods. Rather the County must study and establish a reasonable timeframe to halt such operations, such a 2 to 3 year window or not renewing such permit at the end of its term.

2) Secondly, Analyze allowing areas to become exclusion zones as a zoning change by petition for the exclusion of commercial cultivation, processing, or sale of cannabis into all like neighborhood areas and designate all these neighborhoods as exclusion zones when one or more of the following criteria are met:

(a) Areas where Drought Relief has been sought. This includes Sonoma County cannabis growers, of which approximately 30% have applied for Drought Relief in 2022. This points to a self-admission that cannabis can NOT be grown in an environmentally sustainable way in these locations through the range of weather cycles recently seen and projected into the future. Study how to terminate these permits and move these growers to a more suitable location.
(b) Areas where commercial cannabis activity is detrimental to the residential character of neighborhoods;
(c) Residential neighborhoods and areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together
(d) Traditional agriculture-zoned areas that are now primarily residential in nature. See further discussion below on EDRN zoning
(e) Areas where there is strong local resistance to commercial cannabis activity.
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(h) Areas where the roads are inadequate, including shared-access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.
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(j) Areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought, areas where water availability has not been verified.
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The Ad Hoc Committee, the vast majority of which were from the Cannabis industry, thought the exclusion zone recommendation understood the need to protect residences. We trust the final EIR and Ordinance will reflect such by protecting our neighborhoods with exclusion zones.

Thank you
NOW Neighbors of West County
Bill Krawetz

EDRN - Existing Developed Rural Neighborhoods zones:

Please study Santa Barbara County's EDRN zone implementation and their impact on neighborhood compatibility with cannabis grows.

Although there is much to dislike about how Santa Barbara County handles commercial cannabis, they have been at it longer than Sonoma County, have faced many of the same compatibility issues and resolved some. One such solution was the establishment of EDRN zones in 2016 and further refined in 2022 for cannabis.

In 2016 these EDRN zones were established to protect Ag lands from residential sprawl. These were areas in Ag lands that ended up being pockets of housing. The EDRN definition and designation were created specifically to "to keep pockets of rural residential development from expanding onto adjacent agricultural lands….. The County intends to contain the primarily residential areas as designated, and protect the surrounding agricultural lands from residential sprawl." These EDRN were codified in the zoning maps, parcel by parcel. Following the rollout of commercial cannabis, including cultivation inside these zones, many neighborhood compatibility conflicts arose similar to Sonoma County. Therefore in 2022 the County amended its EDRN zoning definition to prohibit Commercial cannabis activities WITHIN these zones.

Existing Developed Rural Neighborhood defined: An area shown on the Comprehensive Plan maps within which development has occurred historically with lots smaller than those found in the surrounding Rural or Inner Rural Areas

Date: March 13, 2023

To: **cannabis@sonoma-county.org, crystal.acker@sonoma-county.org**

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, District4 <District4@sonoma-county.org>, Crystal Acker <crystal.acker@sonoma-county.org>

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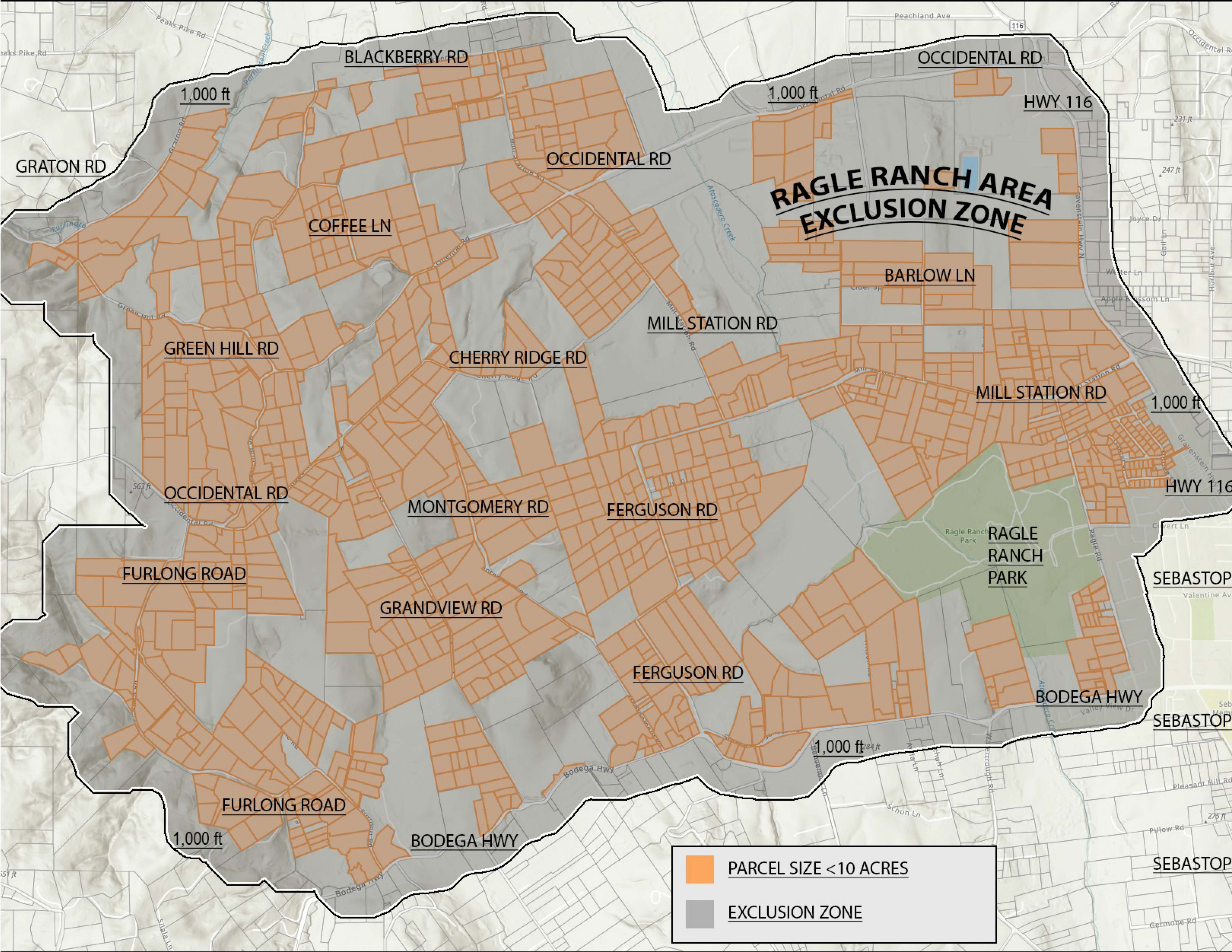
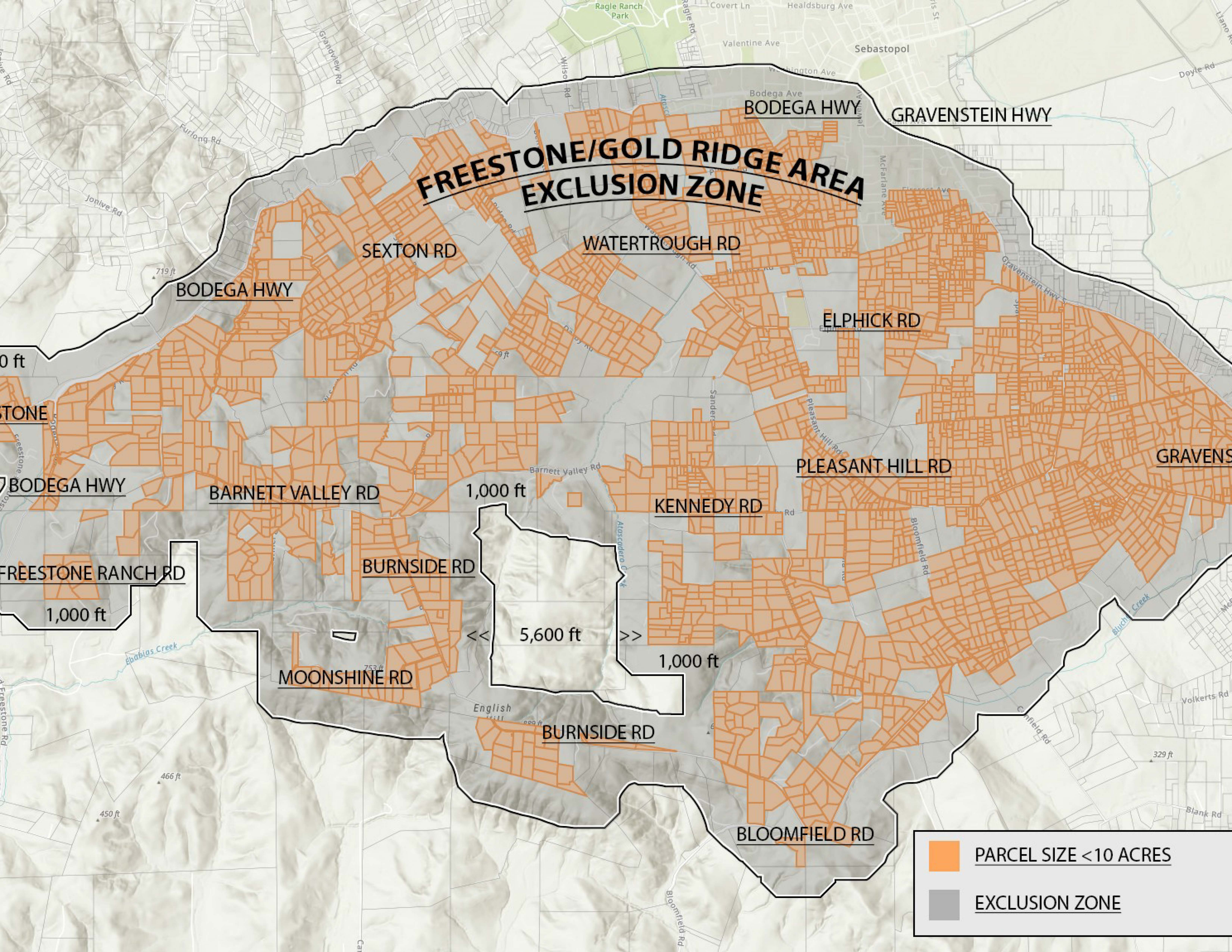


RAGLE RANCH AREA
EXCLUSION ZONE
BLACKBERRY RD
OCCIDENTAL RD
HWY 116
1,000 ft
GRATON RD
OCCIDENTAL RD
COFFEE LN
BARLOW LN
MILL STATION RD
GREEN HILL RD
CHERRY RIDGE RD
MILL STATION RD
1,000 ft
OCCIDENTAL RD
MONTGOMERY RD
FERGUSON RD
HWY 116
RAGLE
RANCH
PARK
FURLONG ROAD
SEBASTOP
GRANDVIEW RD
FERGUSON RD
BODEGA HWY
SEBASTOP
1,000 ft
FURLONG ROAD
1,000 ft
BODEGA HWY
SEBASTOP
PARCEL SIZE <10 ACRES
EXCLUSION ZONE



FREESTONE/GOLD RIDGE AREA
EXCLUSION ZONE
Ragle Ranch Park
Covert Ln
Healdsburg Ave
Valentine Ave
Sebastopol
Bodega Ave
BODEGA HWY
GRAVENSTEIN HWY
SEXTON RD
WATERTROUGH RD
BODEGA HWY
ELPHICK RD
0 ft
STONE
BODEGA HWY
BARNETT VALLEY RD
1,000 ft
Barnett Valley Rd
PLEASANT HILL RD
GRAVENS
KENNEDY RD
FREESTONE RANCH RD
BURNSIDE RD
1,000 ft
<< 5,600 ft >>
1,000 ft
MOONSHINE RD
English Hill
BURNSIDE RD
BLOOMFIELD RD
Ebabias Creek
PARCEL SIZE <10 ACRES
EXCLUSION ZONE

From:	Deborah Eppstein
To:	Cannabis
Cc:	Crystal Acker
Subject:	Fwd: Scoping for cannabis EIR- fire risk and fire safe regulations
Date:	Monday, March 13, 2023 8:00:46 AM
Attachments:	Scoping- Cannabis EIR, wildfire issues 3-9-23.pdf

EXTERNAL

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Scoping for cannabis EIR- fire risk and fire safe regulations
Date: March 10, 2023 at 3:52:36 PM PST
To: Crystal Acker <crystal.acker@sonoma-county.org>

Hi Crystal,
Please include this document on wildfire risk and the state fire safe regulations in the scoping comments, also to be provided to Ascent, for the upcoming cannabis EIR.

Thank you.

Deborah Eppstein
deppstein@gmail.com

Deborah Eppstein
deppstein@gmail.com

Wildfire Safety Issues for Scoping for Cannabis EIR
March 9, 2023
Prepared by Deborah Eppstein

Major areas that need to be analytically studied for risk and safety from wildfires include Evacuation Risk and Increased Risk of Wildfire, as well as the requirement to meet the CCR Title 14 State Minimum Fire Safe Regulations 2023.

EVACUATION
Current evacuation routes and evacuation times and bottlenecks need to be fully analyzed for all areas in the County. Fire risk designations are a moving target, with many homes destroyed in areas classified as low or moderate fire risk, and with many residents under mandatory evacuation in areas of low and moderate fire risk, in addition to areas of high and very high fire risk. For many of these areas on dead-end roads, there is only one way out, with roads then feeding into larger roadways that themselves have proven to become clogged for hours (eg Highway 12). Many wildfires are very fast moving with minimal advance warning.

Evacuation models for determining evacuation time vs road conditions and number of vehicles evacuating have been developed (see Tom Cova, University of Utah) and such scientific methodology needs to be employed. Some of these references are attached.

If such scientific studies determine that existing evacuation times are already dangerous, no new development should be added to such areas. For example, stating that a proposed development would increase number of vehicles by only an insignificant percent is defying safety if evacuation times are already unsafe before the new development is included.

WILDFIRE RISK

Increased wildfire risk from added development must also be analyzed. It is well documented that construction, energy infrastructure, vehicles and people increase wildfire risk. The location of the proposed development relative to areas of high fire risk must be analyzed, including wind patterns during high wind events as Sonoma County and neighboring counties have experienced, topography, wildfire fuel, including added risks from previous wildfires that have increased fuel due to dry standing and fallen timber and/or excess undergrowth.

Studies should not diminish added risk even though a high level of existing risk already exists. Added fire risk from vehicle trips and human activities must be analyzed relative to location on a road; ie location in remote areas may increase risk significantly more than the same activities in less remote areas. Residents of high fire risk areas likely are much more careful than are outside workers (eg, throwing cigarettes from a car window, driving older vehicles prone to backfiring). Such activities have been observed by residents.

Added fire risk from cannatourism must be evaluated. This would include added vehicle miles, increased numbers of people, and added risk due to careless behaviors of people who are impaired.

Energy use and infrastructure requirements must be closely evaluated. Indoor and/or mixed light cultivation require high levels of energy. If these are allowed in high fire prone areas, the added fire risk may be significant. For example, the 6500 sf indoor/greenhouse cannabis operation approved at 2000 Los Alamos Rd is calculated (using county numbers) to use the electricity of 160 new homes, yet the increased risk of fire ignition due to this was not studied.

Analyze cumulative energy use, including use in greenhouses, hoop houses, and vehicle miles traveled. CEQA guideline § 15126.2(b) treats "wasteful, inefficient, or unnecessary" energy consumption as a significant environmental impact. This pertains to mixed light and indoor cultivation, and processing.

Identify any relocation, construction, or upgrade of electric distribution lines.

The EIR should also evaluate added fire risk from accidents including from faulty wiring. Previous fires have been caused by cannabis operations due to faulty or illegal installed wiring. Just because a permit requires that all wiring be done legally does not make it happen. Code enforcement and inspection resources need to be taken into consideration.

Wildfire Risk and the General Plan

- Objective LU-4.1 in the General Plan (p. LU-35). Assure that development occurs only where physical public services and infrastructure, including school and park facilities, public safety, access and response times, water and wastewater management systems, drainage, and roads are planned to be available in time to serve the projected development.
- Policy LU-7d in the General Plan (p. LU-44). Avoid new commercial, industrial, and residential land use designations in areas subject to "high" or "very high" fire hazards, as identified in the Public Safety Element.
- Goal PS-3. Prevent unnecessary exposure of people and property to risks of damage or injury form wildland and structural fires.
- Objective PS-3.2. Regulate new development to reduce the risks of damage and injury from known fire hazards to acceptable levels.
- Policy PS-3b. Consider the severity of natural fire hazards, potential damage from wildland and structural fires, adequacy of fire protection and mitigation measures consistent with the Public Safety Element in the review of projects.
- Policy PS-3f. Encourage strong enforcement of State requirements for fire safety by the California Department of Forestry and Fire Protection. This means no new development including cannabis cultivation can be considered on parcels in the SRA and VHFHSZ of the LRA accessed by roads not meeting the Title 14 State Fire Safe Standards- eg dead-end roads more than 1 mile (or less pursuant to § 1273.08), roads less than 20 ft wide, as well as the other requirements of Article 2 §§ 1270.00-1273.09. No commercial operation can be accessed by a driveway, only by a road meeting the above requirements. No exceptions can be granted for roads outside the development parcel pursuant to § 1270.07.

From:	Deborah Eppstein
To:	Cannabis
Cc:	Crystal Acker
Subject:	Fwd: Evacuation models from Dr. Cova
Date:	Monday, March 13, 2023 8:00:55 AM
Attachments:	Cova TJ Community Egress Concepts 2021 copy.pdf Cova Report pdf July 6 2020 Guenoc valley.pdf 2020-07-06 CBD comments Guenoc Valley Mixed Use Development FEIR copy.pdf Tom Cova DOI 2005 Should Fire-Prone Communities Have a Maximum Occupancy.pdf

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EXTERNAL

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Fwd: Evacuation models from Dr. Cova
Date: March 10, 2023 at 3:59:05 PM PST
To: Crystal Acker <crystal.acker@sonoma-county.org>

Here are the attachments form Dr. Cova's work.

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Fwd: Evacuation models from Dr. Cova
Date: January 10, 2022 at 6:48:27 PM PST
To: Scott Orr <Scott.Orr@sonoma-county.org>, Crystal Acker <Crystal.Acker@sonoma-county.org>

Hi Scott and Crystal- can you please include these documents in the scoping evaluations for the cannabis EIR and draft cannabis ordinance? These are the documents I referred to in my December 16 email on wildfire safety.

Thanks- and here's to a really good 2022

Best,
Debby

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Evacuation models from Dr. Cova
Date: January 10, 2022 at 11:19:52 AM PST
To: Tennis Wick <Tennis.Wick@sonoma-county.org>

Dear Tennis,
In follow up, here is some useful information which should be

and straightforward to implement on evacuation planning and modeling from Dr. Tom Cova, an evacuation planning expert from University of Utah.

The 1st attachment describes the model. I suggest starting here - it is readily understandable and should be applicable to development on all roads in the WUI in Sonoma County. This could form a basis for the evacuation planning for Sonoma County as well as determining safe levels of future development.

The 2nd attachment is Dr Cova's evacuation analysis that was convincing to the Lake County Judge in denying the EIR from the Guenoc Valley mixed use project proposal.
The 3rd attachment is the full document where analysis was included as Exhibit 1, and also contains Dr. Cova's full CV.
The 4th attachment is an earlier (2005) publication by Dr. Cova discussing concepts to consider to determine maximum development the WUI.

I look forward to herring your comments!

Thanks,
Debby
Deborah Eppstein
801-556-5004

Deborah Eppstein
deppstein@gmail.com

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deppstein@gmail.com

Concepts to help formulate wildfire-safe community egress codes

Thomas J. Cova, Ph.D.
Evacuation Consultant, Salt Lake City, UT
February 16, 2021

As communities continue to expand into wildfire-prone regions, safety regulations need to be enhanced to protect the public. One example is community egress codes designed to limit development patterns and densities based the available means of egress. Although this topic has not been at the fore in developing fire-prone wildlands, it is becoming increasingly important as communities in the western U.S. experience larger, faster-moving fires that offer less and less time for residents to evacuate. Many communities in the highest fire severity zones were never designed to safely support their current housing, commercial, and industrial density, let alone the proposed development that may be added. This raises the public safety question, "How much is too much?" when it comes to housing, commercial and industrial development in low-egress fire-prone communities. This paper presents geographic concepts that may help in formulating new regulations in fire-prone regions.

New Development with New Road infrastructure

Although evacuation planning has not historically been required in adding new development in fire-prone regions, recent large wildfires raise the question of whether we're reach a turning point. In short, wildfire evacuation risks associated with introducing people and vehicles to a community should be evaluated and disclosed prior to approving additional development. As a bare minimum, the local jurisdiction should prepare a project-specific evacuation plan that addresses the:

1. Possible range of evacuation times for residents, workers and visitors
2. Possible range of lead (available) times to act in an urgent wildfire
3. Pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the region-wide evacuation plan
4. Alternative plans for protecting residents, workers and visitors when roads become impassible or the time required to evacuate is greater than the time available.

Although lead agencies do not usually prepare an evacuation analysis stating the numerous variables affect potential evacuations, this type of planning is essential in assuring public safety. Project-specific evacuation analysis and modeling is not only possible, the data needed is readily available.

There are four principal dimensions that help promote public safety as it pertains to community design in fire-prone areas: 1) vehicle load, 2) number of exits, 3) exit capacity, and 4) exit arrangement. The next sections briefly address these dimensions.

Vehicle load

The **vehicle load** for a given area includes all vehicles that will be used by evacuees from residential, commercial and industrial structures or land uses. This can be represented as:

*vehicle_load = (households * vehicles_per_household) + vehicles_Commercial + vehicles_Industrial*

While vehicle density can be measured as the number of vehicles per unit area (e.g. vehicles per acre), a more useful density measure for evacuation purposes is the number of vehicles per unit of road length (e.g. vehicles per mile). To use this concept in the context of a regulation, it can be restated as the required minimum average length per vehicle (e.g. 10 feet per vehicle) or the maximum number of vehicles per mile. A minimum of 10 feet per vehicle in a high severity fire zone means that at most 528 vehicles could be present per mile of roadway (i.e. 5280 feet / 10 feet per vehicle = 528 vehicles per mile). While the length of the threshold can be debated, without a defined threshold it would be possible to have an unlimited number of vehicles, which would place residents at risk in a wildfire-prone region.

Using the equation above and a maximum of 528 vehicles per mile, a community with 3 miles of roads (in any configuration) and no commercial or industrial development, and assuming 2 vehicles per household, could have up to 792 households (based solely on vehicle load limitations):

*3 miles of roadway * 528 vehicles_per_mile = 1584 vehicles*
(1584 vehicles / 2 vehicles_per_household) + 0 + 0 = 792 households

Adding commercial and industrial vehicles to this community would reduce the number of households that could be constructed or added, if the vehicle density is to remain below 528 vehicles per mile. The maximum vehicle density threshold can also be varied depending on land use and fire severity. For example, a look-up table could be developed to set it higher in areas that are predominantly industrial or those with less wildfire risk.

Number of exits

The second consideration is the minimum **number of exits.** An *exit* in this context is a road segment that a resident in the community or evacuation zone must traverse to leave it. A community with one road connecting it to the rest of the network has one exit, and one with a choice between two roads to leave it has two exits. In the case of a defined evacuation zone, an exit is any road that allows people within the zone to travel to areas outside the zone (i.e. roads that cross the evacuation zone boundary). Each exiting road provides a *means of egress* for anyone inside the community or zone to leave it.

A required minimum number of exits can be represented with a table that links the estimated vehicle load in an area to the required minimum number of exit roads. Consider this example table:

Vehicles	Minimum exit roads
1 – 600	1
601 – 900	2
901 – 1200	3
1200 <	4

While the thresholds can be debated, the concept of requiring a minimum number of exit roads avoids the possibility of developing a "one-way-in-one-way-out" community with an unlimited number of vehicles (due to households, commercial, industrial activities) where residents have little to no chance of evacuating quickly in a dire wildfire scenario. Using the equation for vehicle load above, a community with 400 household vehicles (200 households assuming 2 vehicles per household), 150 from commercial activities, and 100 from industrial activities would require 2 exits (i.e. 400 + 150 + 100 = 650 => 2 exits).

Exit capacity

The third consideration is **exit capacity**. This regulation relies on the sum of the exit road capacities to determine the maximum vehicle load allowed in an area. Consider that all roads have a maximum number of vehicles that can be served in a given unit of time (e.g. 600 vehicles per hour or vph). To translate this into something useful for evacuation egress regulations, we can set a minimum capacity for the combined exits such that the minimum evacuation time does not exceed 1 hour (Note: an evacuation could take much longer). This is to avoid building a community where the least time it would take to evacuation would be 2, 3 or 4+ hours.

With a defined upper bound on the **minimum evacuation time**, we can calculate the maximum vehicle load in a given area based on the capacity of the exits. For example, if a community has one exit that can serve 600 vph (assume it ends with a stop sign at a major road), then 600 vehicles would be the maximum vehicle load (600 vehicles / 600 vph = 1 hour). A community with two exits that can each serve 600 vph could have a vehicle load of 1200. As in the prior cases, the thresholds can be adjusted, but without a regulation that connects the vehicles load in an area to the exit capacity, it becomes possible to develop communities in fire-prone areas with thousands of homes and commercial/industrial activities that could not safely be evacuated in a dire wildfire.

Exit arrangement

The last consideration is **exit arrangement.** This can be viewed as the minimum distance between any two exits in a community, assuming the community has more than one. Simply put, the exits should not be closer than one-half the furthest distance between any two households (or facilities) that rely on the exits. So, if the furthest distance between two households in a community is 1 mile and the community has two exits, the exits should not be closer than 0.5 miles (between any two points along either exit road). If the exits are too close, then they will not offer evacuees independent means of egress and more than one may quickly be blocked by the same wildfire.

New Development on Existing Road infrastructure
In addition to development along new road infrastructure, wildfire-safe regulations are also needed when adding development along existing road infrastructure. The configuration of rural communities with substandard roads presents an immediate concern due to the limited evacuation egress for residents, visitors and workers trying to reach collector roads or highways. Given this concern and the history of wildfires in fire-prone communities, it is critical that the local jurisdiction require a community-specific wildfire evacuation analysis that includes likely lead times and evacuation times. The evacuation analyses can be conducted on existing communities to evaluate existing wildfire evacuation conditions, and to determine if increases in the population associated with a new development should be approved. An evacuation analysis can identify significant bottlenecks and alternative evacuation routes that could become impassable under a variety of scenarios. Furthermore, infrastructure mitigation measures can be evaluated to determine if the most significant risks can be reduced to an acceptable level of impact.

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people **(lead time)** and the time it takes to protect them **(evacuation time**). If lead time falls below evacuation time, a scenario get can become dire. Some variables (e.g. ignition location, winds, fuel moisture, terrain, fire behavior) are important inputs for estimating the lead time that might be available to protect residents. A fire that ignites near a community and spreads rapidly towards it (due to winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation. This can be exacerbated by the day-of-week and time-of-day variations in the vehicle load. For example, the number of vehicles (evacuating residents, workers and visitors) that might be in a community at any one time can vary dramatically depending on land use, which affects the evacuation time (e.g. industry, commercial activity, sporting events, concerts, weddings, holidays).

Wildfire safety hazards arise when the lead time falls below the evacuation time, and the difference between the two is a principal cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the northeast side of Paradise (lead time). This led to a community burnover where many residents were evacuating through the fire. If the estimated evacuation and lead times are known to be of unacceptable risk in a community subject to fast-moving wildfires, it is critical to evaluate them under a range of likely scenarios prior to adding development for more residents, workers, and tourists (vehicle load).

Gross estimates for evacuation time can be calculated using simple assumptions about **warning time, response time, vehicle loading, and road capacity.** Assuming that two-lane roads built to fire safe standards have one traffic lane for egress (and one lane for emergency vehicle ingress), and assuming that an egress lane to a collector road can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior, back-round traffic from surrounding communities). Likewise, if two similar roads are available to evacuate, the egress capacity could range from 1200 to 2400 vph. In supply-demand terms, this would be an estimate of the "supply" available to serve the evacuees as they leave a community. The egress "demand" is estimated by the vehicle load which depends on the time of day, day of week, or special events. Dividing the vehicle demand by the egress road supply provides an estimate of **the minimum evacuation time**. While this is a very blunt measure of the actual time to evacuate a community (which could be much longer), it has significant value in establishing egress regulations (i.e. the minimum should not be too great).

For example, assuming a community with 1000 households and 2 cars per household (or 2000 vehicles) exits along one road, the minimum evacuation time could range from an ideal high-capacity case of (2000 vehicles / 1200 vph = 1.7 hours), to a lower-capacity case (2000 vehicles / 600 vph = 3.3 hours). If there are two roads available for safe egress to the collector road, the minimum evacuation time is halved to (2000 vehicles / 2400 vph = 0.83 hours) for the high-capacity case or (2000 vehicles / 1200 vph = 1.6 hours) for the lower-capacity case. However, if workers or visitors increase the evacuee vehicle load, a much worse case of higher demand, such as 3000 vehicles and lower capacity exits could lead to a greater minimum evacuation time (3000 vehicles / 600 vph = 5 hours). This would not be an acceptable, as any wildfire that offered less than 5 hours of lead time could result in a community burnover with many evacuees in transit. This presents an extremely high safety threat, as visibility conditions may become so poor that the vehicles drive off the road or impact other vehicles and/or flames and heat overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire in Paradise.

Additionally, the evacuation time could be much longer if **warning time is prolonged** or key exits and intersections are not controlled by law enforcement. If traffic flow problems occur at intersections or along collector roads due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock), this could also lead to fatalities. As the 2018 Camp Fire in Paradise and 2017 Tubbs Fire in Sonoma County recently demonstrated, vehicles overtaken by fire in an evacuation is an especially dangerous scenario.

Conclusion:
In summary, while there are many ways to develop standards that limit development in fire-prone areas to the number, capacity, and arrangement of the exits relied upon in a wildfire, it is important that development not proceed unchecked to the point that public safety is severely compromised and the residents have no realistic chance of safely evacuating in a dire wildfire scenario. The 2018 Camp Fire in Paradise, California offers the best example of a town with an evacuation plan of 2 to 3 hours that only had about 90 minutes before homes were burning.

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography at the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2005 I published an article questioning whether fire-prone communities would someday have a maximum occupancy and proposed possible standards.[1] In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[2] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[3] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[4] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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[2] Cova, T. J., Dennison, P. E., Li, D., Drews, F. A., Siebeneck, L. K., & Lindell, M. K. (2017). Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4), 601-611.
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Prepared by Thomas J. Cova, Ph.D., Evacuation Consultant, Salt Lake City, UT Dated: July 2, 2020

Subject: Evacuation analysis and planning for the proposed Guenoc Valley Mixed Use Planned Development Project in Lake County, CA

SUMMARY

I have reviewed the Environmental Impact Report (EIR) and Wildfire Prevention Plan for the Guenoc Valley project. The Guenoc Valley project site is in a very high fire hazard area evidenced by recent fast- moving, intense wildfires in the Project vicinity that caused loss of life. The project is large and proposes to add thousands of people to a very sparsely populated area with a limited transportation network. The EIR does not evaluate or disclose the wildfire evacuation risks associated with introducing this many people and vehicles to the project area and does not include a detailed wildfire evacuation plan to protect the safety of the residents. Prior to approving the project, the County should prepare a project- specific evacuation plan that addresses, at a bare minimum: 1) the possible range of evacuation times for residents and visitors, 2) the possible range of lead times available to act in an urgent wildfire, 3) the pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the Countywide evacuation plan, and 3) detailed alternative plans for protecting residents and visitors when roads become impassible or the time required to evacuate is greater than the time available.

ANALYSIS

The Project Configuration Allows Only One Evacuation Route for Several Thousand Residents

The Guenoc Valley Site consists of 16,000 acres in southwest Lake County, California. The project will include 400 hotel rooms, 450 guest resort residential units, 1400 residential estates, and 500 workforce co-housing units. The EIR proposes 753 total parking spaces for Phase 1 but does not mention how many there might be when the project is complete or how many vehicles are likely to be on the project site, on average, after the project is complete. However, given the number of proposed units (and conservatively assuming one vehicle per unit when California's average number of vehicles per household is two), the site is likely to house at least 2750 vehicles on site when it is completed (i.e. 400 + 450 + 1400 + 500). While some of these units may have no vehicles, and others may have 2 or more, a range of at least two to three thousand vehicles is a reasonable starting assumption for evacuation planning for this project.

Access to the project site is via Butts Canyon Road from Middletown (7 miles to the west), although Butts Canyon Road continues south from the project site to Pope Valley (12 miles to its south). There are no alternative routes in or out of the project site. The Final EIR's Response to Comments O10-31 references the Lake County Evacuation map and states:

Regarding the commenter's question "what, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Proposed Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable", as noted on page 3.16-7 of the Draft EIR, the Lake County Wildfire Protection Plan provides an evacuation route map (URL in figure 1). This map shows all of the existing

and potential evacuation routes serving the county and the project site. The Wildfire Prevention Plan for the Proposed Project includes plans for determining whether evacuation routes are unsafe, and designated meeting locations.

An excerpt of this map around the project site is provided in Figure 1. The map shows that the initial evacuation route is Butts Canyon Road north (and then to SR-29 North or South or SR-175 north), or south to Pope Valley (not shown on map because it's in Napa County). There are no evacuation routes to the east or north of the project site, so evacuees would have to travel southwest to Butts Canyon Road and then either northwest to Middletown or southeast to Pope Valley. This is very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project.

Figure 1. An excerpt taken from the Lake County evacuation map does not show an evacuation route in the project area. (URL: http://www.lakecountyca.gov/Assets/County+Site/Fire+Safe+Council/cwpp/Evacuation.jpg).

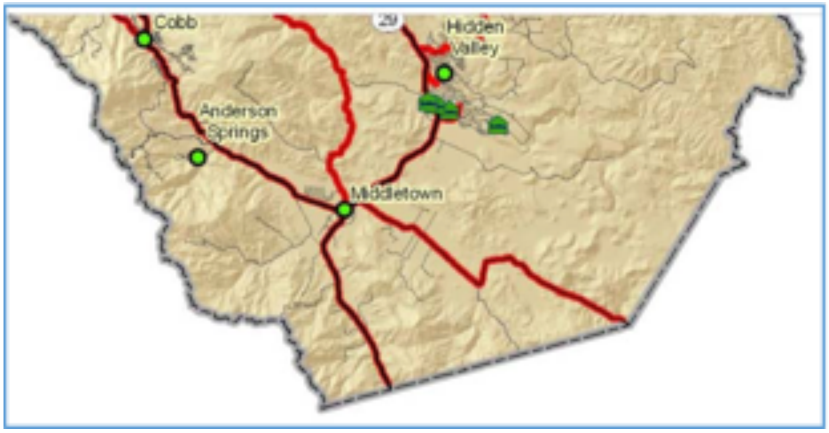
In other words, in the event of a wildfire, all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable.

The EIR Does Not Analyze the Project's Wildfire Evacuation Impacts

The project configuration presents an immediate concern due to the limited evacuation egress for project residents and workers trying to reach Butts Canyon Road in an urgent evacuation. Given this concern, and the history of wildfires on the project site, it is critical that the County perform a project- specific wildfire evacuation analysis that includes available lead times and evacuation times under a variety of scenarios.

As noted in the Final EIR Response to Comments O10-31, the time necessary to safely clear the project site can vary according to a number of factors:

Regarding the commenter's question "what are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site," evacuation times would vary



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based on a large number of factors, including day of the week, time of day, the fire's location, behavior, winds, and terrain. While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables.

Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

The Project's Wildfire Evacuation Impacts Are Significant

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people (lead time) and the time it takes to protect them (evacuation time). Some of the variables mentioned by the County above (e.g. fire location, behavior, winds and terrain) are important inputs for estimating the lead time that would be available to protect residents. A fire that ignites near the project site (location) and spreads rapidly towards it (winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation of the site. Similarly, the day-of-week and time-of-day are variables affecting the evacuation time. For example, the number of evacuees (residents and visitors) and vehicles that might be on the project site due to weekends, holidays, or events (e.g. sports, music, weddings) will affect the evacuation time.

Wildfire safety hazards arise when the lead time is less than the evacuation time, and the difference between the two is a primary cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the east side of Paradise (lead time). Because of the large number of residents and vehicles that will be added to the area by the project and the recent history of intense, fast-moving wildfires (see the Wildfire Prevention Plan), it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios.

Gross estimates for evacuation time can be calculated using simple assumptions about warning time, response time, vehicle loading, and road capacity. Figure 2 shows the proposed transportation network on the south end of the project that would provide emergency access to Butts Canyon Road (the evacuation route from the project to Middletown or Pope Valley). Note that there are three access points to the project site along Butts Canyon Road (BCR) labeled *Primary Entrance Option 1 (PE1), Primary Entrance Option 2 (PE2), and Secondary Entrance (SE).* Although PE1 and PE2 provide two access points, they quickly merge into one access road to the northeast which create a bottleneck for evacuation purposes. This means that there are effectively two means of egress to Butts Canyon Road from the project: the Primary Exit (PE), which splits and leads to two access points, and the Secondary Exit (SE).

Assuming that the PE and SE both have one traffic lane out each (leaving one lane for emergency vehicle ingress, as is typical), and assuming that each exiting lane can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior), then the total egress from the site to BCR could range from 1200 to a high of 2400 vph. In supply-demand terms, this would be an estimate of the “supply” available to serve the evacuees as they leave the site.

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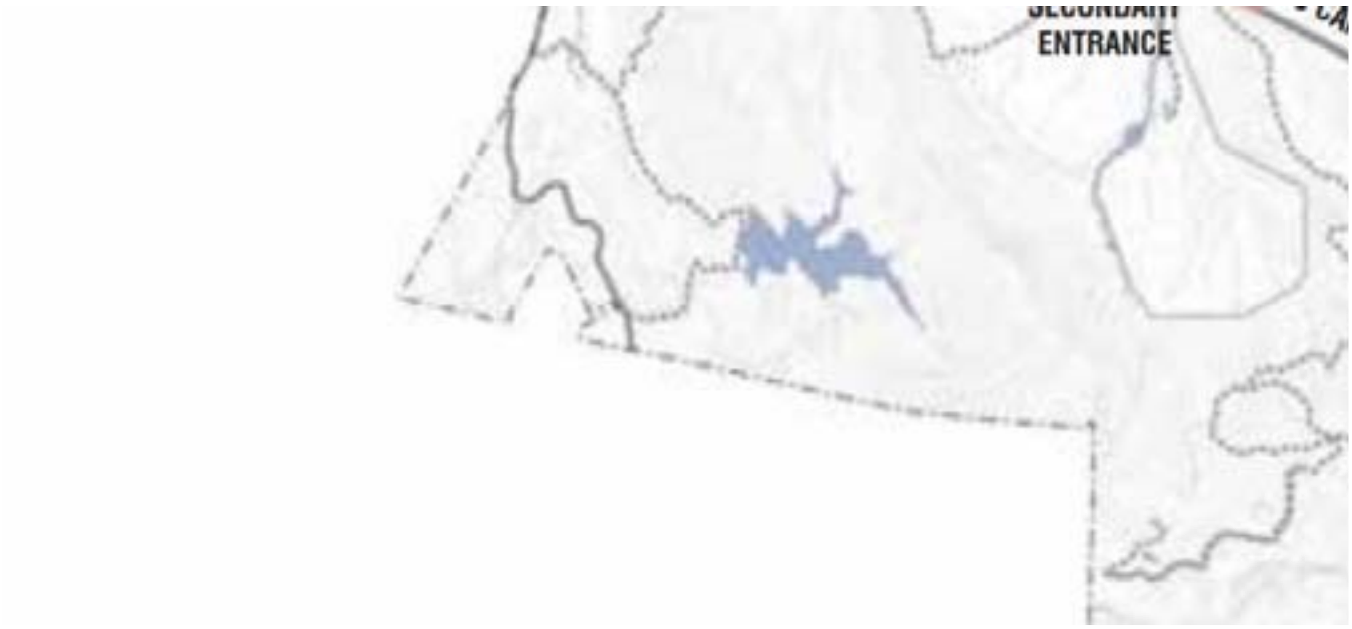
As noted above, there could be a range of 2000-3000 vehicles on the project site depending on the time of day, day of week, or special events, and this would be the “demand” in an evacuation. Dividing the vehicle demand by the exit road supply, the minimum time to evacuate this site could range from an ideal case of lower demand and higher capacity (2000 vehicles / 2400 vph = 0.83 hours) to a much worse case of higher demand and lower capacity (3000 vehicles / 1200 vph = 2.5 hours).

Figure 2. The transportation network that will connect the project site to Butts Canyon Road.

As noted above the second factor that influences the outcome of a wildfire evacuation is the lead time. The question becomes one of whether a wildfire in the vicinity of the project site might offer less than the time to evacuate the community (1 to 2.5 hours), leaving some evacuees at risk of being caught in- transit when the wildfire overtakes the community. This presents an extremely high safety threat. When persons are in vehicles on a road when fire is burning in the immediate area, visibility conditions may become so poor that the vehicles drive off the road or crash into other vehicles and/or flames and heat may overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire originating in Paradise. The EIR and Wildfire Prevention Plan provide little detail and no modeling regarding wildfire behavior and spread rate. However, based on the wildfire history of this region as detailed in the EIR and Wildfire Prevention Plan, there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site.

Additionally, the 2.5 hour evacuation time could be much longer if warning time is prolonged or key intersections are not controlled by law enforcement. These intersections include the two PE’s and the SE, as well as the point where BCR intersects with Highway 29. If traffic flow problems occur at any of these locations due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock),



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the evacuation could lead to fatalities similar to the 2018 Camp Fire in Paradise or the 2017 Tubbs Fire in Santa Rosa.

In short, the County did not perform a project-specific wildfire evacuation analysis. Even in the absence of such analysis, there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety.

The EIR's Description of Shelter-in-Place Strategies Is Inadequate

As scenarios can be identified where not everyone in the project site would be able to get out in time, the Final EIR (p. 3.16-9) mentions six designated shelter-in-place meeting and staging areas as a back-up option:

"The Community Wildfire Protection Plan identifies evacuation routes in the County. Butts Canyon Road is identified as an emergency evacuation route. Depending on where the fire is located, people at the Guenoc Valley Site would be directed to exit the site via the primary roadways to Butts Canyon Road or as a last resort would shelter in place at the six Designated Meeting and Staging Areas. As shown on Figure 2-10, the Proposed Project includes an extensive circulation system with roadways

large enough for emergency access vehicles. In addition, these roadways would typically have 50 feet of defensible space cleared on each side of the roadway for a total fire break of 150 feet. Impacts to adopted emergency response or evacuation plans would be less-than-significant. Impacts related to traffic and emergency routes are addressed in Section 3.13 Transportation and Traffic.

Depending on the circumstances of a wildfire emergency, it may be difficult to evacuate. In this situation, residents, visitors, and employees will be directed to gather at designated meeting & staging areas where they will be provided information and assistance.

These six designated meeting and staging areas (DMSA) are shown in Figure 2-10 in the EIR but the locations are vague and the capacities are not given. In order to be effective, these DMSAs would need to be easily accessible (including for disabled people and pedestrians) and provide enough protection for residents to survive a wildfire with an intensity in line with recent past wildfires. Additionally, it is critical that the location of, and access routes to, DMSAs are well publicized and made clear to residents and visitors to the project site through education, signage, and other means. The lack of adequate description in the EIR or Wildfire Prevention Plan of the DMSAs’ location, capacity, and protection level is a significant shortcoming; these should be addressed in detail in a project-specific evacuation analysis and plan.

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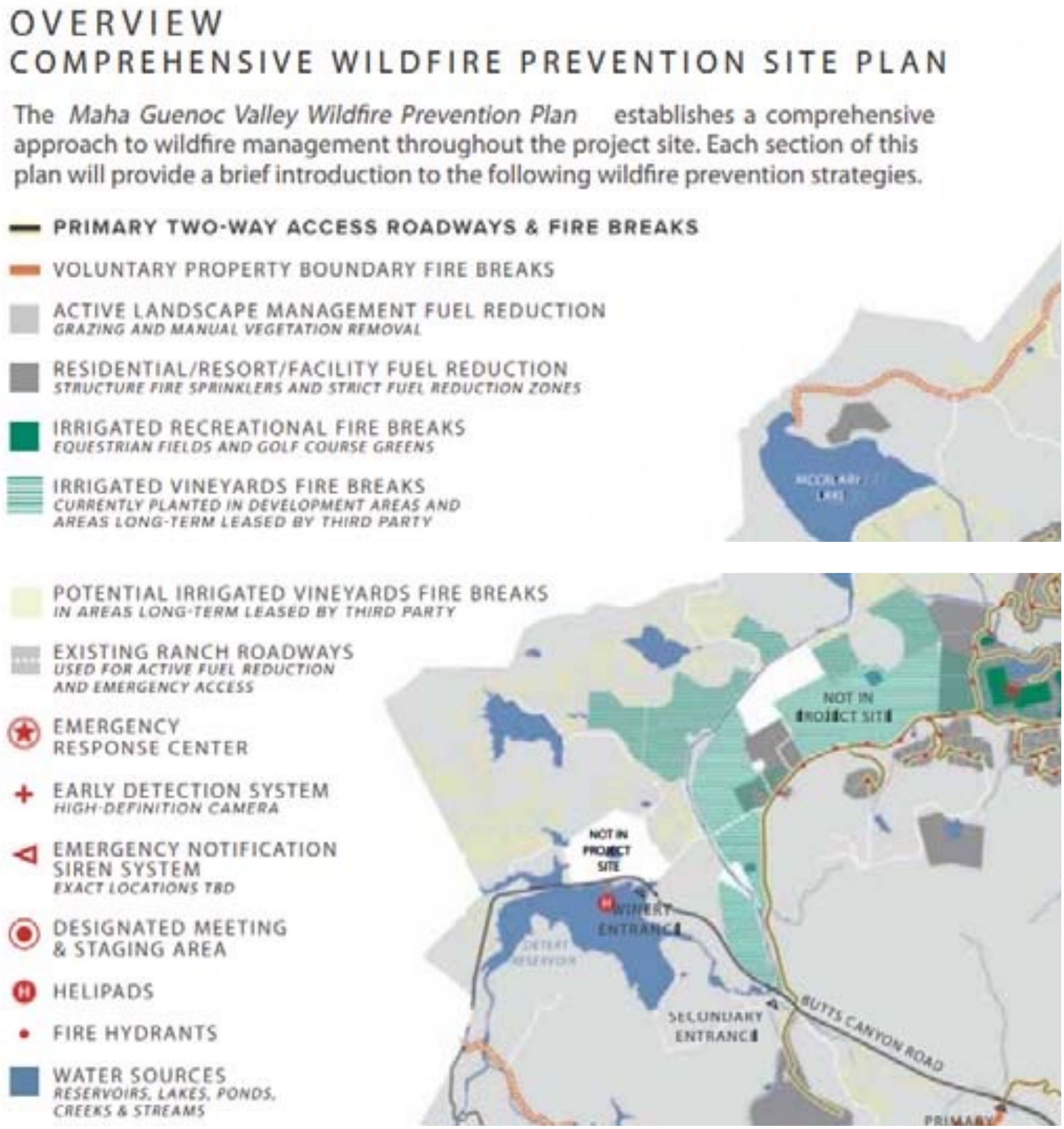

Figure 3. The designated meeting and staging areas are not very visible or easy to assess. **CONCLUSION**

The Guenoc Valley project anticipates housing thousands of residents and visitors on a Project site historically susceptible to fire and in a region where large-scale wildfire evacuations have recently been necessary. The project offers only two primary means of egress to Butts Canyon Road, which only offers one direction for evacuees to escape (southwest) from the project site, and then only two directions to travel from there (northwest or southeast on Butts Canyon Road). The evacuation vehicle capacity offered by these roads is relatively low, and a rough estimate is that they could serve 1200 to 2400 vehicles departing per hour. On a given summer weekend day, it's not unlikely that it could take a few hours to evacuate this project site, and there are numerous plausible wildfire scenarios where this much time might not be available. Shelter-in-place is likely to be used in some scenarios where not everyone can evacuate in time, but it is not taken very seriously in the EIR or Wildfire Prevention Plan, which do not describe the access, capacity, and protection level that the various staging areas would offer. I strongly recommend that the County prepare a detailed and comprehensive evacuation plan for this project.

Thomas J. Cova, Ph.D.

6

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography and the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[1] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[2] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[3] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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[3] Cova, T.J., Dennison, P.E., Drews, F.A. (2011) Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability*, 3(10): 1662-1687.

7/6/2020

Sent via email and UPS

County of Lake
Board of Supervisors
Attn: Carol Huchingson, County Administrative Officer
255 N. Forbes Street
Lakeport, CA 95453
Carol.huchingson@lakecountyca.gov

Re: Guenoc Valley Mixed-Use Planned Development Project Final Environmental Impact Report, SCH No. 2019049134

Dear Supervisors:

These comments are submitted on behalf of the Center for Biological Diversity (the "Center") regarding the Guenoc Valley Mixed-Use Planned Development Project (the "Project"). These comments follow our April 21, 2020 comments on the Draft Environmental Impact Report ("DEIR") for the Project, in which we raised serious concerns that the Project would have significant environmental impacts and identified numerous deficiencies in the DEIR. Unfortunately, instead of taking the opportunity to conduct more rigorous environmental review or revise the Project to reduce its significant impacts, Lake County (the "County") has responded largely by downplaying, obscuring, or denying the deficiencies in its environmental review. Furthermore, in the County's rush to approve the Project, it has robbed the public of adequate time to review the expansive environmental documents associated with the Project. The County should not approve the Project or certify the FEIR until, at a minimum, the County has rectified these deficiencies; otherwise, the County will be in violation of the California Environmental Quality Act ("CEQA"), Public Resources Code § 21000 et seq., and California Code of Regulations, title 14, § 15000 et seq ("CEQA Guidelines").

The Center is a non-profit, public interest environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center has over 1.7 million members and online activists throughout California and the United States. The Center has worked for many years to protect imperiled plants and wildlife, open space, air and water quality, and overall quality of life for people of California, including Lake County.

I. The EIR's Analysis of and Mitigation for the Project's Impacts on Biological Resources is Inadequate

A. The FEIR Fails to Adequately Assess Impacts to Sensitive Habitats and Aquatic Resources and Relies on Insufficient Mitigation Ratios to Address Impacted Resources

The FEIR fails to adequately assess and mitigate impacts to aquatic resources and sensitive habitats and disregards the best available science. The FEIR states that "a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts" (FEIR at 3-48), yet the mitigation ratios and steps to ensure effective, ecologically functional mitigation are insufficient. MM 3.4-17 only requires a mitigation ratio of 2:1 for preservation/restoration/enhancement, while the mitigation ratio for created habitat is only 1:1 for aquatic resources. In addition, only lands selected for preservation are to be approved by the County, and for enhanced/restored/created mitigation, the "minimum success criteria" that "Mitigation shall be deemed complete once the qualified biologist has determined that the success of restoration or habitat creation activities meets or exceeds 80 percent" is vague and insufficient. There are no "defined success criteria" for aquatic resources mitigation as the FEIR states (FEIR at 3-48). Defined success criteria are only provided in MM 3.4-15, which also has a low mitigation ratio of 2:1 for preservation/restoration, stating that achieving 75% acreage with the "monitoring biologist [] consider[ing] percent cover, species composition, overall health of plantings, and other indicators when determining success of establishment" (FEIR at 3.4-97). This is only provided for some, not all, of the sensitive habitats, and it hardly constitutes as providing defined success criteria. What species will be included when determining species composition? Native/invasive plants? Vertebrates? Invertebrates? Will presence/absence surveys take into account breeding individuals vs. foraging individuals? How will such data be collected? Will survey protocols follow agency guidelines? What time of day or during what season will surveys be conducted? What are "other indicators" to be used? Will functional hydrology and soil health be considered? The proposed mitigation leaves the reader with more questions than answers regarding whether impacts due to the Project will be avoided, and if impacts are unavoidable, if they will be adequately minimized or mitigated to less than significant.

The FEIR states that "Simply requiring mitigation to occur at high ratios with no scientific basis would not serve to ensure mitigation. Rather, a set mitigation ratio with monitoring, adaptive management, and minimum success criteria, as presented within the Draft EIR, serves to effectively offset impacts." (FEIR at 3-48). This argument misses the point of the Center's comments, and disregards scientific studies that specifically speak to the need for higher mitigation ratios (along with long-term monitoring, identified and measurable success criteria, and adaptive management strategies) to improve chances of adequately mitigating impacts to habitats and species (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Stein et al. 2018). The FEIR needs to take into account that, due to the proposed Project, habitat loss and species displacement are immediate, while any gains from their mitigation is uncertain. Moilanen et al. (2009) found that "very high offset ratios may be needed to guarantee a robustly fair exchange" and that "considerations of uncertainty, correlated success/failure, and time discounting should be included in the determination of the offset ratio to avoid a significant risk that the exchange is unfavorable for conservation in the long run." The FEIR fails to consider the best available science and adequately assess and mitigate impacts to aquatic resources and other sensitive habitats.

Given the importance of these heterogenous and varying aquatic resources to numerous native, rare, and special-status animals and plants, connectivity, and overall biodiversity, the FEIR should provide higher mitigation ratios that take the types of mitigation to be implemented into consideration, as not all mitigation is created equal. Preservation of existing habitat where sensitive and/or special-status species are known to occur through avoidance should be the primary focus, as restoration, enhancement, and creation of habitats can have limited success due to the challenges of establishing the appropriate hydrology (Sudol and Ambrose 2002; Windmiller and Calhoun 2007; Matthews and Endress 2008; Stein et al. 2018). For example, riparian/stream habitats are difficult to replace or create because of their complex hydrological, physical, and biotic structure, and it can take many years before an established riparian mitigation site might (or might not) become as ecologically functional as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Bronner et al. 2013). Adaptive management, collecting measurable performance standards based on habitat functions to determine mitigation success, and improved documentation strategies are necessary to increase the success rate mitigation for aquatic resources and sensitive habitat types, like riparian mitigation sites (Sudol and Ambrose 2002; Ambrose et al. 2006; Matthews and Endress 2008; Bronner et al. 2013).

Thus, if compensatory mitigation includes enhanced, restored, or created habitats, higher mitigation ratios coupled with extended years of effective monitoring and adaptive management strategies are needed to improve chances of establishing equivalent ecological function as the lost habitat (Sudol and Ambrose 2002; Ambrose et al. 2006; Windmiller and Calhoun 2007; Matthews and Endress 2008; Moilanen et al. 2009; Bronner et al. 2013; Stein et al. 2018). Mitigation ratios of 2:1 for preservation or restoration/enhancement and 1:1 for created habitat with unspecified, measurable success criteria and no requirement to implement adaptive management strategies are insufficient and do not align with current scientific knowledge. Mitigation for aquatic resources (and other sensitive habitats) should be at least 3:1 with in-kind preservation, 5:1 with restoration/enhancement, and 10:1 with created habitat. All mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities) should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies, and protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. If higher mitigation ratios are not feasible, the FEIR must provide evidence and analysis supporting that conclusion. With one third of America's plant and animal species vulnerable to impacts from human activity and one fifth at risk of extinction (Stein et al 2018), it is crucial that strategies to prevent further degradation and loss of remaining aquatic resources, sensitive habitats, and biodiversity are explicit and scientifically sound. Again, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, and the proposed mitigation is not founded in the best available science.

B. The EIR's Setbacks are Insufficient to Effectively Mitigate Impacts to Aquatic Resources, Including Riparian Corridors (Streams and Associated Upland Habitat), Wetlands, Ponds, and Reservoirs

Riparian ecosystems have long been recognized as biodiversity hotspots performing important ecological functions in a transition zone between freshwater systems and upland habitats. As the Center previously commented, many species that rely on these aquatic habitats also rely on the adjacent upland habitats (*e.g.*, riparian areas along streams, and grassland habitat adjacent to wetlands). In fact, 60% of amphibian species, 16% of reptiles, 34% of birds and 12% of mammals in the Pacific Coast ecoregion (which includes Lake County) depend on riparian-stream systems for survival (Kelsey and West 1998). Many other species, including mountain lions and bobcats, often use riparian areas and natural ridgelines as migration corridors or foraging habitat (Dickson et al, 2005; Hilty & Merenlender, 2004; Jennings & Lewison, 2013; Jennings & Zeller, 2017). Additionally, fish rely on healthy upland areas to influence suitable spawning habitat (Lohse et al. 2008), and agricultural encroachment on these habitats and over-aggressive removal of riparian areas have been identified as a major driver of declines in freshwater and anadromous fish as well as California freshwater shrimp (*e.g.*, Stillwater Sciences 2002; Lohse et al. 2008; Moyle et al. 2011). Loss of biodiversity due to lack of habitat contributes to ecosystem degradation, which will diminish a multitude of ecosystem services in the long-term.

Yet the FEIR disregards the Center's previous comments that are supported by scientific literature, stating that "While the statements that the commenter makes may be true for a given species within a specific context, they generally do not apply within the context of the Proposed Project and Lake County on the whole." (FEIR at 3-49). This logic is flawed and unsupported. The Project is located in an area identified by scientists as having high terrestrial and riparian permeability and linkage potential (Gray et al. 2018) with heterogeneous habitats associated with aquatic resources (almost 200 acres of riparian stream habitat [if not more] as well as over 400 acres of emergent wetlands, over 650 acres of ponds and reservoirs, over 122 acres of jurisdictional wetlands, and over 10 acres of jurisdictional open waters in the Project area. Dismissing studies that clearly demonstrate that a wide variety of wildlife, including special-status species known or have the potential to occur in the Project area, require large areas of intact upland habitat connected to aquatic resources (*i.e.*, riparian habitat, emergent wetlands, vernal pools, etc.) to survive and sustain healthy populations and ecosystems highlights the FEIR's failure to adequately assess and mitigate impacts to biological resources in the Project area. Setbacks of 20-30 ft from aquatic resources are insufficient to support the entire life cycle and metapopulation dynamics of special-status species like western pond turtles (*Actinemys marmorata*) and foothill yellow-legged frogs (FYLF; *Rana boylii*), both known to occur in and adjacent to the Project area. The FEIR fails to use the best available science, and instead suggests that the numerous studies that report the importance of riparian habitats to biodiversity and the need for adequate connectivity between aquatic resources and upland habitat somehow do not apply to the Project area, even when the studies specifically look at special-status species known to occur in the Project area.

For example, several studies highlighted in the Center's previous comments discuss life history and migration patterns of western pond turtles and FYLF (Twitty et al. 1967; Holland 1994; Semlitsch and Bodie 2003; Bury and Germano 2008; Zaragoza et al. 2015). Western pond turtles are known to nest as far as 1,312 feet from aquatic habitat and can be found overwintering up to 1640 feet from aquatic habitat, as well as migrating over 3,280 feet (1 km) (Holland 1994; Zaragoza et al. 2015), and Bury and Germano (2008) found that "most individuals rapidly depart basking sites when disturbed by either visual or auditory stimuli of people (e.g., waving an arm, shouting) at distances of over 100 m [(328 feet)]." Adult FYLF have been observed in abandoned rodent burrows and under logs as far as 100 m (328 feet) from streams (Zeiner 1988) and juvenile FYLF have been found up to 600 feet upslope from their natal stream channel (Twitty et al. 1967). Yet the FEIR states that "western pond turtles and foothill yellow-legged frog (both of which are CDFW species of special concern) are more restricted in their ability to move far from streams because of a higher probability of desiccation and lower probability of finding adequate refuge relative to other parts of their range" because "the majority of the perennial and intermittent streams in the Area of Potential Effects have narrow riparian zones because of the well-drained soils and high prevalence of surface rock" (FEIR at 3-50) without providing any information to support their claim. This is conjecture and not founded on any science. Larger setbacks at aquatic resources that take into account connectivity with heterogeneous habitats, especially where special-status species are known to occur, have the potential to occur, or historically occurred, are needed to adequately minimize impacts to the species, populations, and ecosystems. The FEIR fails to adequately assess and mitigate impacts to aquatic resources and associated special-status species.

The FEIR misleadingly states that the federally threatened California red-legged frog (CRLF, *Rana draytonii*) "does not occur on the Guenoc Valley Site and is not documented to occur in Lake County" (FEIR at 3-49). Guenoc Valley and much of Lake County are within the current and historical range of CRLF. In fact, there are several recorded observations of CRLF in Lake County.[1] And although CRLF were not encountered in several potential locations in the Plan area, it is misleading to state that CRLF do not occur there. According to the USFWS 2005 CRLF survey protocol, "Multiple survey visits conducted throughout the survey-year (January through September) increases the likelihood of detecting the various life stages of the CRF. For example, adult frogs are most likely to be detected at night between January 1 and June 30, somewhere in the vicinity of a breeding location, whereas, sub-adults are most easily detected during the day from July 1 through September 30." (USFWS 2005). But only targeted nighttime amphibian visual encounter surveys were conducted August 14-16, 2018 and May 14-15, 2019, which is insufficient to determine the presence or potential presence of CRLF in or adjacent to the Project area (Appendix BRA1 at 16). The USFWS recommends up to eight surveys within six weeks to detect CRLF, with two day surveys and four night surveys recommended during the breeding season (January 1 – June 30) and one day and one night survey during the non-breeding season, with each survey taking place at least seven days apart. (USFWS 2005). Surveys were not conducted following USFWS guidance and recommendations to optimize chances of CRLF detection. In addition, surveys were conducted at "selected habitats across the Property," but the locations of the surveys are not provided in the appendix (Appendix BRA1 at 16). To conclude that CRLF "does not occur on the Guenoc Valley Site" (FEIR at 3-49) is an overstatement, as surveys were not optimal, and even if presence was not detected, it could be that they were present, but the surveyors did not see them. The FEIR fails to adequately describe, assess, and mitigate impacts to CRLF and other sensitive species that rely on aquatic resources and associated upland habitat.

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[1] Data are available from the MVZ Herp Collection (Arctos) database, the Global Biodiversity Information Facility (GBIF; www.gbif.org), and Amphibiaweb (www.amphibiaweb.org).

Given that CRLF were historically present and are currently potentially present in the County and suitable habitat is present at the Project site, adequate setbacks and connectivity should be implemented. In a study that found radiotracked CRLFs moving up to 2.8 km (~1.7 mi) and a median distance of movement of 150 m (~492 ft) from breeding ponds, researchers aptly state that "maintaining populations of pond-breeding amphibians requires that all essential habitat components be protected; these include (1) breeding habitat, (2) nonbreeding habitat, and (3) migration corridors. In addition, a buffer is needed around all three areas to ensure that outside activities do not degrade any of the three habitat components."(Fellers and Kleeman 2007). Thus, at aquatic resources where CRLF are observed, potentially present, or were historically present, setbacks should at least 500 ft. Ideally, buffers should be even greater to accommodate the furthest dispersers, as larger buffers would allow for increased chances for establishment or re-establishment in unoccupied habitats, as often happens in metapopulation dynamics, or to increase resilience to climate change (Semlitsch and Bodie 2003; Cushman 2006). Again, the FEIR fails to consider the best available science to adequately assess and mitigate impacts to aquatic resources and the rare, sensitive, or special-status species that rely on the aquatic resources and connectivity with upland habitat.

These are just a few examples of how the FEIR inadequately assesses and mitigates impacts to aquatic resources, special-status species, and sensitive habitats. Note that this is not a comprehensive list of inadequacies that need to be addressed for the FEIR to comply with CEQA.

C. The FEIR Fails to Adequately Assess and Mitigate Impacts to Wildlife Movement and Habitat Connectivity

The FEIR states that while the site is "relatively large" and within the Pacific Flyway, "the Proposed Project does not propose modification of waterbodies in such a way that would make them significantly less useful as stopover points for migratory birds" (FEIR at 3-45). However, the FEIR fails to consider that if these heterogeneous habitats, like wetlands, streams, riparian habitats, grasslands, etc., are degraded in and around the Project site, they will no longer be able to support the numerous migratory birds that traverse the Pacific Flyway. As discussed previously, science has shown that 20- to 30-foot setbacks from aquatic resources is insufficient to protect the water quality and biodiversity of these systems. Without healthy ecosystems that support the vegetation and food resources (invertebrates, fish, herps, etc.) that many migratory birds rely on for rest, recovery, and nesting, the habitats in and adjacent to the Project area would no longer provide much needed connectivity for hundreds of millions of birds that traverse the Pacific Flyway throughout the year.

The FEIR goes on to state that designated open space, MM 3.4-17, and 20- to 30-foot setbacks from aquatic resources provide for regional movement while also providing habitat for less mobile species, like western pond turtles and FYLF (FEIR at 3-45). However, as discussed previously, the FEIR fails to consider the best available science, and the low mitigation ratios and minimal setbacks from aquatic resources are insufficient to support special-status animals and plants and overall biodiversity and ecosystem function in the Project area. And although the FEIR provides 1:1 mitigation of removed open space to preserved open space, the mitigation ratio should be higher, especially if the removed open space includes aquatic resources, sensitive habitats, or habitat that supports or may support special-status species and/or is important to connectivity. And, as mentioned previously, all mitigation (preservation, restoration/enhancement, creation of habitat of aquatic resources as well as other sensitive natural communities), in designated open space or otherwise, should be implemented in consultation with local and regional biologists, indigenous groups, and government agencies. Mitigation lands should be protected in perpetuity, and the mitigation on these lands should include funded long-term monitoring, specified measurable success criteria, and adaptive management strategies. The proposed amendment to the Open Space Preservation Plan should include prioritization of preserving designated open space and avoiding removal, but if development occurs in designated open space then higher mitigation ratios that include long-term monitoring and adaptive management should be required.

The FEIR fails to adequately assess and mitigate impacts to functional connectivity. Although identifying designated open space with a minimum width of 475 ft and proposing 300-foot wide habitat and residential habitat easements to make up the FEIR's proposed wildlife paths through the Project area is a good start towards mitigating impacts to wildlife connectivity, it is insufficient and does not adequately consider the best available science. No movement studies were conducted in the area to determine that animals would actually move through the proposed wildlife paths, and the FEIR fails to consider edge effects of human activities on wildlife, wildlife movement, and habitat connectivity. As mentioned in the Center's previous comments, edge effects of development in and adjacent to open space will likely impact key, wide-ranging predators, such as mountain lions and bobcats (Crooks 2002; Riley et al. 2006; Delaney et al. 2010; Lee et al. 2012; Smith et al. 2015; Vickers et al. 2015; Smith et al. 2017; Wang et al. 2017), as well as smaller species with poor dispersal abilities, such as song birds, small mammals, and herpetofauna (Cushman 2006; Slabbekoorn and Ripmeester 2008; Benítez-López et al. 2010; Kociolek et al. 2011). Negative edge effects from human activity, such as traffic, lighting, noise, domestic pets, pollutants, invasive weeds, and increased fire frequency, have been found to be biologically significant up to 300 meters (~1000 feet) away from anthropogenic features in terrestrial systems (Environmental Law Institute 2003). In addition, the FEIR fails to consider, assess, or mitigate impacts to identified riparian and terrestrial least-cost pathways adjacent to the Project area (FEIR Habitat and Connectivity Assessment Appendix at 19-21). Thus, it is unclear if wildlife would move through the proposed wildlife paths; impacts due to the proposed Project would not be adequately mitigated in areas where the width of the designated open space is 475 ft wide or in 300-foot wide habitat or residential habitat easements, and the Project could have impacts to riparian and terrestrial permeability adjacent to the Project area. Although MM 3.4-19 requires wildlife-friendly fencing in some portions of the Project area and MM 3.4-21 was added to mitigate impacts of domestic cats (FEIR at 3.4-102), it is not enough to minimize impacts of human activities on wildlife movement and habitat connectivity.

The proposed development and roadways will increase traffic and further fragment the landscape, which could affect the diverse animals and plants in the area. For instance, field observations and controlled laboratory experiments have shown that traffic noise can significantly degrade habitat value for migrating songbirds (Ware et al. 2015). Subjects exposed to 55 and 61 dBA (simulated traffic noise) exhibited decreased feeding behavior and duration, as well as increased vigilance behavior (Ware et al. 2015). Such behavioral shifts increase the risk of starvation, thus decreasing survival rates. Another study also highlighted the detrimental impacts of siting development near areas protected for wildlife. The study noted that "Anthropogenic noise 3 and 10 dB above natural sound levels . . . has documented effects on wildlife species richness, abundance, reproductive success, behavior, and physiology" (Buxton et al. 2017). The study further noted that "there is evidence of impacts across a wide range of species [] regardless of hearing sensitivity, including direct effects on invertebrates that lack ears and indirect effects on plants and entire ecological communities (*e.g.*, reduced seedling recruitment due to altered behavior of seed distributors)" (Buxton et al. 2017). Moreover, human transportation networks and development resulted in high noise exceedances in protected areas (Buxton et al. 2017).

In addition, preliminary results from studies underway by researchers at UC Davis and University of Southern California, as well as those by other researchers, suggest that the light, noise, and other aspects of roads can have negative impacts on wildlife numbers and diversity near the roadways (Shilling 2020; Vickers 2020). The researchers found a significant difference between species richness and species type, with lower richness and fewer species at along roadsides compared to background areas 1 km away from the roads (Shilling 2020). They also found that as traffic noises surpassed 60 dBC, the number of visits by small to large mammals decreased, and most of the species in their study avoid traffic noise (Shilling 2020). It is clear that different species have variable sensitivities to noise and light associated with development and transportation infrastructure; this can lead to changes in species distributions and population health and survival, which can have ecosystem-level impacts (*e.g.*, Suraci et al. 2019). The FEIR fails to adequately assess and mitigate impacts of edge effects on functional connectivity.

Edge effects of human activities have also been documented specifically on mountain lions. One study found that mountain lions are so fearful of humans and noise generated by humans that they will abandon the carcass of a deer and forgo the feeding opportunity just to avoid humans (Smith et al. 2017).[2] The study concluded that even "non-consumptive forms of human disturbance may alter the ecological role of large carnivores by affecting the link between these top predators and their prey" (Smith et al. 2017). In addition, mountain lions have been found to respond fearfully upon hearing human vocalizations, avoiding the area and moving more cautiously when hearing humans (Smith et al. 2017; Suraci et al. 2019). Other studies have demonstrated that mountain lion behavior is impacted when exposed to other evidence of human presence, such as lighting or vehicles/traffic (Wilmers et al. 2013; Smith et al. 2015; Wang et al. 2017). Mountain lions are protected under Prop 117 as a "specially protected species," and although they do not receive California Endangered Species Act (CESA) protections in the Project area, mountain lions in Southern California and along the Central Coast are candidates for CESA listing. This highlights the importance of mountain lions in California ecosystems. As the last remaining wide-ranging top predator in the region, the ability to move through large swaths of interconnected habitat is vital for genetic connectivity and their long-term survival. Impacts to mountain lions in the region could have severe ecological consequences; loss of the ecosystem engineer could have ripple effects on other plant and animal species, potentially leading to a decrease in biodiversity and diminished overall ecosystem function. Many

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[2] *See also* Sean Greene, "How a fear of humans affects the lives of California's mountain lions," *Los Angeles Times* (June 27, 2017), available at http://beta.latimes.com/science/sciencenow/la-sci-sn-pumas-human-noise-20170627-story.html.

scavengers, including California condors, kit foxes, raptors, and numerous insects, would lose a reliable food source (Ruth and Elbroch 2014; Barry et al. 2019). Fish, birds, amphibians, reptiles, rare native plants, and butterflies would potentially diminish if this apex predator were lost (Ripple and Beschta 2006; Ripple and Beschta 2008; Ripple et al. 2014). Therefore, new development projects must carefully consider impacts to movement and connectivity for these and other wide-ranging carnivores. The FEIR fails to adequately assess and mitigate impacts to wildlife connectivity.

The FEIR fails to consider the need for corridor redundancy (*i.e*. the availability of alternative pathways for movement). Corridor redundancy is important in regional connectivity plans because it allows for improved functional connectivity and resilience. Compared to a single pathway, multiple connections between habitat patches increase the probability of movement across landscapes by a wider variety of species, and they provide more habitat for low-mobility species while still allowing for their dispersal (Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). In addition, corridor redundancy provides resilience to uncertainty, impacts of climate change, and extreme events, like flooding or wildfires, by providing alternate escape routes or refugia for animals seeking safety (Cushman et al., 2013; Mcrae et al., 2008; Mcrae et al., 2012; Olson & Burnett, 2008; Pinto & Keitt, 2008). Although the FEIR proposes 300-foot wide habitat and residential habitat easements for the proposed wildlife paths, they are insufficient to overcome edge effects for many species' movement, leaving only one constrained north-south pathway through the Project area via the designated open space while east-west movement is almost completely severed.

Corridor redundancy is critical when considering the impacts of climate change on wildlife movement and habitat connectivity. Climate change is increasing stress on species and ecosystems, causing changes in distribution, phenology, physiology, vital rates, genetics, ecosystem structure and processes, and increasing species extinction risk (Warren et al. 2011). A 2016 analysis found that climate-related local extinctions are already widespread and have occurred in hundreds of species, including almost half of the 976 species surveyed (Wiens 2016). A separate study estimated that nearly half of terrestrial non-flying threatened mammals and nearly one-quarter of threatened birds may have already been negatively impacted by climate change in at least part of their distribution (Pacifici et al. 2017). A 2016 meta-analysis reported that climate change is already impacting 82 percent of key ecological processes that form the foundation of healthy ecosystems and on which humans depend for basic needs (Scheffers et al. 2016). Genes are changing, species' physiology and physical features such as body size are changing, species are moving to try to keep pace with suitable climate space, species are shifting their timing of breeding and migration, and entire ecosystems are under stress (Parmesan and Yohe 2003; Root et al. 2003; Parmesan 2006; Chen et al. 2011; Maclean and Wilson 2011; Warren et al. 2011; Cahill et al. 2012). Therefore, functional habitat connectivity is critical for many animals and plants to adapt to climate change. Again, the FEIR failed to use the best available science and adequately assess and mitigate impacts to wildlife movement and functional connectivity.

D. The FEIR Fails to Adequately Assess and Mitigate Impacts to the Western Bumble Bee (*bombus occidentalis occidentalis*), a Candidate Species Under the California Endangered Species Act

The FEIR fails to analyze the Project's potentially significant impacts on the Western bumble bee. The Western bumble bee (*Bombus occidentalis occidentalis*) was listed by the California Fish and Game Commission as a candidate species under CESA in June 2019. Accordingly, the species' status as a candidate requires that it be included among the species analyzed in the FEIR. (FEIR at 3.4-23; Fish & Game Code § 2068.) Yet the FEIR for the Project did not include any evaluation of the proposed Project's impacts on the western bumble bee. Although the species' historical distribution covers the area of the Project site (The Xerces Society for Invertebrate Conservation 2018), the FEIR is entirely silent on the species and fails to include it in the list of special status species considered in the FEIR (FEIR at 3.4-24). Habitat loss, degradation, and modification due to agricultural intensification and urban development and the use of chemical contaminants (*e.g.*, insecticides, herbicides, fungicides) pose a significant threat to the bee's ability to survive and reproduce (The Xerces Society for Invertebrate Conservation 2018), yet this special-status species is not mentioned in the FEIR. Thus, the FEIR fails to adequately describe, assess, and mitigate impacts to the western bumble bee, a candidate species under CESA.

II. The EIR's Analysis of and Mitigation for the Project's Greenhouse Gas Emissions Remains Inadequate

The FEIR's analysis of the proposed Project's GHG emissions fails to correct the numerous deficiencies we identified in our comments on the DEIR and remains inadequate. The FEIR confirms once more that the Project would result in significant amounts of GHG emissions during construction and operation of the Project. (See FEIR p. 3.7-11, Table 3.7-1A [total annual construction emissions of 22,509 MT; p. 3.7-15, Table 3.7-3 total Project operational emissions with mitigation of 30,846 MT annually].) Yet it does not properly analyze or fully mitigate all of the Project's significant GHG impacts. (See Pub. Res. Code § 21002; CEQA Guidelines § 15126.2.) In particular, the EIR makes no real effort to reign in the Project's astounding increase in Vehicle Miles Traveled ("VMT"), the largest contributor by far to the Project's overall GHG emissions. Additionally, its proposed mitigation for the Project's VMT and GHG emissions is vague, improperly deferred, and unenforceable and the EIR fails to consider all feasible mitigation and alternatives to reduce the Project's GHG emissions impacts to less than significant levels.

A. The EIR Fails to Provide Enough Information About its Emissions and Mitigation Calculations to Allow for Informed Decision-making

As we explained in our comments on the DEIR, the document fails to provide readers with information essential to understanding its analysis of the Project's GHG emissions; the County merely dismissed instead of correcting this shortcoming. Although the Response to Comments encourages readers to consult the 24 pages of tables in its Appendix AIR, these tables simply present readers with raw data and no means for interpreting or understanding it. (See DEIR Appendix AIR.) An EIR must "disclose the analytic route the agency traveled from evidence to action." (*California Clean Energy Committee v. City of Woodland* (2014) 225 Cal.App.4th 173, 205 [internal punctuation omitted].) The County's reliance on 24 pages of tables containing numeric inputs for the subsequent several hundred pages of tables that together constitute the GHG emissions analysis does not adequately apprise the public of how the County calculated the Project's GHG emissions.

Again, as we pointed out in our prior comments, EIR makes the same omission with respect to the purported effectiveness of its proposed mitigation measures. The EIR claims that the mitigation measures it proposes will result in FEIR p. 3.7-14 (Table 3.7-3 claiming that, with mitigation, total project emissions will be reduced by 30% to 30,846 MT annually, down from 44,162 MT annually without mitigation [Table 3.7-2]). Despite our prior concerns, the EIR still fails entirely to disclose how it arrived at these calculations for quantifying the mitigation measures' effectiveness in reducing or avoiding GHG emissions. Mitigation measures' effectiveness and enforceability must be supported by substantial evidence in the record. *Sacramento Old City Assn. v. City Council* (1991) 229 Cal.App.3d 1011, 1027. The County's response to our comments on this issue (the relevant Response to Comment 10-22) is wholly inadequate—it did not address or even acknowledge our concern regarding the lack of evidence to support the County's conclusions about the measures' estimated GHG reductions.

The EIR should be revised to include this information and recirculated so that the public can adequately review and comment on this crucial aspect of the DEIR's GHG analysis.

B. The EIR's Mitigation for the Project's GHG Emissions is Inadequate, Unenforceable, Vague, and/or Improperly Deferred

As we pointed out in our comments on the DEIR, the proposed mitigation for the Project's significant GHG impacts is badly lacking. The County's failure to reduce the Project's GHG emissions to less than significant undermines achievement of the statewide goals for GHG emissions reductions, including the following:

- Assembly Bill 32 (2006) requires statewide greenhouse gas reductions to 1990 levels by 2020 and continued reductions beyond 2020.
- Senate Bill 32 (2016) requires at least a 40 percent reduction in greenhouse gas emissions by 2030.
- Pursuant to Senate Bill 375 (2008), the California Air Resources Board establishes greenhouse gas reduction targets for metropolitan planning organizations (MPOs) to achieve based on land use patterns and transportation systems specified in Regional Transportation Plans and Sustainable Community Strategies. Current targets for the largest metropolitan planning organizations range from 13% to 16% reductions by 2035.
- Executive Order B-30-15 (2015) sets a GHG emissions reduction target of 40 percent below 1990 levels by 2030.
- Executive Order S-3-05 (2005) sets a GHG emissions reduction target of 80 percent below 1990 levels by 2050.
- Executive Order B-16-12 (2012) specifies a GHG emissions reduction target of 80 percent below 1990 levels by 2050 specifically for transportation.
- Senate Bill 391 requires the California Transportation Plan to support 80 percent reduction in GHGs below 1990 levels by 2050.

- The California Air Resources Board Mobile Source Strategy (2016) describes California's strategy for containing air pollutant emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.
- The California Air Resources Board's 2017 Climate Change Scoping Plan Update: The Strategy for Achieving California's 2030 Greenhouse Gas Target describes California's strategy for containing greenhouse gas emissions from vehicles, and quantifies VMT growth compatible with achieving state targets.

As the Center explains below, the County should revise its mitigation for the Project's GHG impacts to ensure that it complies with CEQA, adopt additional feasible mitigation measures to reduce the Project's impacts to less than significant levels, and recirculate a revised EIR for public review and comment on the additional mitigation measures.

i. The EIR's Mitigation for the Project's Mobile Source Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The Project's remote location and residential/resort uses will result in a significant increase in mobile source emissions. The majority of trips generated by the project will originate far from the project thus giving rise to high total and per capita VMT. (See FEIR at 3.13-2 [showing that a majority of Project-generated trips will involve travel to or from areas located miles from the Project site, with 29% to/from Clearlake or North, and 19% south of Middletown].) Transportation-generated (i.e., "mobile") GHG emissions account for an astounding 24,585 $MTCO_2e$ annually—over 79% of the Project's total mitigated operational emissions of 30,846 $MTCO_2e$ annually. (FEIR at p. 3.7-15, Table 3.7-3) What's more, the FEIR acknowledges that "the Proposed Project would not meet the recommended OPR threshold of a 15 percent reduction in per capita VMT over existing conditions. This would be a significant impact." (FEIR at p. 13.3-28.) In fact, the Projects impacts are much worse—they result in an *increase* in per capita VMT in Lake County from existing conditions, in both the short and the long term. (FEIR at p. 3.13-28, Table 3.13-7.)

As the California Supreme Court has observed: "the Scoping Plan … assumes continued growth and depends on *increased efficiency* and conservation in land use and transportation from all Californians." (*Center for Biological Diversity v. Department of Fish & Wildlife* (2015) 62 Cal.4th 204, 220.) More recently, the Fourth District Court of Appeal strongly affirmed the importance of reducing VMT in order to meet the state's GHG reduction targets, as described in the CARB Scoping Plan. The Court explained:

> [T]he 2017 CARB Scoping Plan . . . is the state's blueprint for meeting GHG emission reduction targets. (*Center for Biological Diversity, supra*, 62 Cal.4th at p. 220.) The Scoping Plan recognizes that in the past, "development patterns have led to sprawling suburban neighborhoods, a vast highway system, growth in automobile ownership, and under-prioritization of infrastructure for public transit and active transportation." The Scoping Plan states, "VMT reductions are necessary to achieve the 2030 target and must be part of any strategy evaluated in this Plan." (Italics added.) The Scoping Plan emphasizes that "California must

> reduce demand for driving" and "lower-VMT future development patterns are essential to achieving public health, equity, economic, and conservation goals."
>
> "Local land use decisions play a particularly critical role in reducing GHG emissions associated with the transportation sector . . . .
>
> "While the State can do more to accelerate and incentivize these local decisions, local actions that reduce VMT are also necessary to meet transportation sector-specific goals and achieve the 2030 target under [Sen. Bill No. 32.] Through developing the Scoping Plan, CARB staff is more convinced than ever that, in addition to achieving GHG reductions from cleaner fuels and vehicles, California must also reduce VMT." (Italics added.)
>
> VMT reduction is an integral part of California's strategy to reach 2030 and 2050 GHG emission reduction targets.

(*Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *117-118].)

The 11th annual California Green Innovation Index, which tracks the state's annual progress in reducing GHG emissions found in 2019 that

> [G]iven that transportation is by far the largest-emitting sector—and with most of the emissions coming from on-road light-duty passenger vehicles—the current upward trajectory of VMT and surface transportation GHG emissions [in California] cannot continue if the state is to meet its climate goals.

(Next 10 2019 at p. 31.)[3] As the OPR Technical Advisory states, meeting statewide targets for GHG reductions "will require substantial reductions in existing VMT per capita to curb greenhouse gases." (OPR Technical Advisory 2017, p. 7; see also CARB 2017, p. 75 [Scoping Plan stating that "VMT reductions are necessary to achieve the 2030 [GHG emissions] target."].)

Yet the Project completely disregards the need to *reduce* VMT in order to ensure that the state can meet its statewide GHG reduction targets. Instead it results in a sharp *increase* in daily per capita VMT in Lake County from existing conditions (FEIR at p. 3.13-28, Table 3.13-7), which it acknowledges as a significant impact (FEIR at p. 13.3-28). And the project does not commit to *any reductions in mobile source GHG emissions from mitigation measures.* (FEIR at pp. 3.7-14 to – [Tables 3.7-2 and 3.7-3 showing that "mitigated" and "unmitigated" mobile source GHG emissions *remain exactly the same*].) The County cannot simply abandon its obligation to reduce the Project's greenhouse gas emissions from mobile sources.

The EIR relies on GHG mitigation measure MM 3.7-1, which, with respect to the Project's mobile emissions states:

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[3] As of 2011, The transportation sector was the largest single contributor to California GHG emissions, accounting for 37 percent of all emissions; passenger vehicles accounted for almost three quarters of this total. (PPIC 2011.)

Transportation Demand Management Measures
Implement Mitigation Measure 3.13-4 to develop and implement a transportation demand management plan to achieve a reduction in vehicle miles traveled as a result of the Proposed Project. At a minimum these measures will include:
- Dedicate on-site parking for shared vehicles (vanpools/carpools).
- Provide adequate, safe, convenient, and secure on-site bicycle parking and storage in the commercial portion of the project.
- Use of an electric fleet for internal transport vehicles (excluding trucks and other ranch vehicles for on-going agricultural and grazing activities) to the extent feasible (no less than 75 percent), including the golf course.

(FEIR at 3.7-16.) Measure 3.7-1 incorporates by reference traffic mitigation measure MM 3.13-4, which the FEIR claims "would also reduce project GHG emissions by reducing the overall mobile trips generated by the Proposed Project." (FEIR at 3.7-14.) While the County has made some minor wording changes to the text of MM 3.13-4 and included for the first time in the FEIR an administrative draft Transportation Demand Management plan ("TDM")[4], these changes do not remedy the concerns we raised in our DEIR comments that the proposed mitigation is vague, improperly deferred, unenforceable, and the EIR does not demonstrate that it will be effective.

At first blush, measures MM 3.7-1, MM 3.13-4 and the TDM may appear substantive, but a closer examination reveals the measures to be toothless and to fall short of CEQA's standards for mitigation. Examples of such shortcomings in MM 3.13-4 include, but are not limited to:

- *Provide Shuttle Service* – the provision notes that "There are currently no plans for Lake Transit to run buses along Butts Canyon Road near the project site and the nearest bus stops are about six miles away in Middletown. While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." Yet it does not commit to funding, expanding, or improving transit options that would connect the Project to Middletown and Clearlake. The provision states that "Alternatively, the project could potentially provide a frequent direct weekday shuttle service specifically for employees," but does not require it. Nor does the provision require *any* transit options for Project site residents (as opposed to guests or employees).

[4] In response to our comments on the DEIR, the County belatedly published an Appendix TDM to the FEIR. This document does not allay our prior concerns that the County is impermissibly deferring transportation demand management measures. We note that FEIR Appendix TDM is marked on its first page as a "Confidential Administrative Draft" and watermarked as "DRAFT" on every page—undermining any claim that it is final and binding on the Applicant. Moreover, the EIR's mitigation measures do not require County *approval* of the TDM—only that it be "submitted" by the Applicant, after which the County "shall verify compliance with the plan" though the County apparently has no ability to disapprove an inadequate plan. (FEIR at 3.13-36.) Finally, MM 3.13-4 lists "strategies shall be identified within the TDM plan" but stops conspicuously short of actually *requiring* implementation of those strategies.

- *TDM Coordinator* – The provision states that "Management shall designate a "TDM coordinator" to coordinate, monitor and publicize TDM activities. The effectiveness of providing a TDM Coordinator on auto mode share is uncertain but is generally seen as a supportive measure." While this idea behind this provision is laudable, there is no evidence of its effectiveness at contributing anything toward reducing the Project's GHG emissions.

Similarly, Appendix TDM describes 15 "strategies" to reduce VMT, but does not contain the requisite performance criteria. The language used to describe the other "strategies" is generally vague, aspirational, and lacking in specifics or actual enforceable requirements.

Nor does the administrative draft TDM contain any quantitative target or performance criteria for ensuring that a certain number of VMT reductions are actually achieved. Although the TDM purports to implement a monitoring and reporting program, in the absence of such standards or performance criteria, any such activities are meaningless. The administrative draft TDM states, "The Project sponsor shall adjust the TDM plan based on the monitoring results if they demonstrate that measures in the TDM plan are not achieving the reduction goal." But crucially, *there is no reduction goal*. This vague language is no substitute for concrete performance standards. Furthermore, taken together, MM 3.7-1, 3.13-4, and the administrative draft TDM allow the project applicant in the future to determine the extent it believes it is "feasible" to reduce VMT, with little or no oversight by the County and without standards by which to determine feasibility. This approach violates CEQA's standards for mitigation measures. (*See Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529, at *73-*75.)

Feasible mitigation measures for reducing VMT-associated GHG emissions exist that were not considered or evaluated in the EIR. These include, but are not limited to:

- Committing to Transit options. (See OPR Technical Advisory 2017 at 22.) Although MM 3.13-4 states that the Project "could potentially provide a frequent direct weekday shuttle service specifically for employees" it makes no commitment to providing any such service. (FEIR at 3.13-37). The Project should commit to running daily shuttle services to Middletown (and Clearlake) that are available to members of the public, not just employees. The FEIR similarly states that "While it is possible Lake Transit might consider adding a stop on Butts Canyon Road in the future to serve project employees, it is our understanding that there is no funding available for it at this time." (Id.) The Project should commit to funding a Lake Transit stop and service along Butts Canyon Road to serve project employees and residents.
- Committing to a hard limit on the total number of available parking spots on site and committing a fixed minimum ratio (for example, at least one third) of those sites to being restricted to use by rideshare/carpool/EV vehicles. (See OPR Technical Advisory 2017, p. 23; see also CAPCOA 2010 p. 207 [measure 3.3.1 Limit Parking Supply].)
- Committing to other mitigation measures from the OPR Technical Manual (OPR Technical Manual 2017, pp. 22-23), including but not limited to:
  - Incorporating affordable housing into the project, and providing increased onsite workforce housing to reduce employee commuting. (See also CAPCOA 2010 p.

176 [measure 3.1.6 Integrate Affordable and Below Market Rate Housing].) The administrative draft TDM's proposed measure 1.3.1 ("Workforce Housing") is non-committal, stating only that the Project "will provide up to 35 housing units on-site" and "up to 50 housing units offsite."
    - Increasing the diversity of non-residential and commercial uses on site to include uses such as grocery stores, daycare, etc., within walking distance from residences within the Project area, which can allow Project residents to find desired handle daily shopping and service needs without leaving the project area. (See CARB 2017 at 76, urging mitigation that uses "community design" to reduce VMT.)
- Offsets as a mitigation measure of last resort (see additional discussion below).

Although the EIR and administrative draft TDM give lip service to a handful of these measures—they do not actually develop them in any detail, impose performance standards, ensure that they are enforceable, or attempt to quantify or otherwise evaluate their effectiveness. The County therefore cannot and does not evaluate their feasibility. The EIR's failure to adopt all feasible mitigation measures to reduce the Project's significant VMT-related GHG emissions violates CEQA. (See Pub. Res. Code § 21002.)

ii. The EIR's Mitigation for the Project's Non-Mobile Source Operational GHG Emissions Remains Inadequate and the EIR Fails to Adopt All Feasible Mitigation to Reduce or Avoid the Project's Significant Impacts

The text changes to MM 3. 7-1's provisions relating to the Project's non-mobile source operational GHG emissions do not remedy the deficiencies we identified in our comments on the DEIR.

Moreover, the Project fails to incorporate—and the EIR fails to consider—all feasible measures that could considerably reduce the Project's significant non mobile source GHG emissions. In particular, the County should consider the use of a legally adequate carbon offset program to offset the Project's unmitigated GHG emissions. Although any offset scheme must be carefully tailored to comply with CEQA's requirements (*see generally Golden Door Props. v. County of San Diego* (June 12, 2020, Nos. D075328, D075478, D075504) ___Cal.App.5th___ [2020 Cal. App. LEXIS 529]), carbon offsets should be considered as a last option for mitigation where no other options are available or feasible. The County appears not to have considered this option or determined whether it is feasible.

C. The Addition of a Transportation Demand Management Plan for the First Time After the Close of the Public Review Period for the Draft EIR Is Significant New Information Requiring Recirculation

The County included the administrative draft Transportation Demand Management Plan for the Project for the first time with its publication of the FEIR. It provided no reason or justification why this document was not disclosed earlier and made available for review with the DEIR so that the public could adequately comment on it. A lead agency is required to recirculate an EIR when significant new information is added to the EIR after the draft EIR is made available for public review. (CEQA Guidelines § 15088.5.) New information includes changes in the project or environmental setting as well as additional data or other information. (Id.) New information is significant where the EIR is changed in a way that deprives the public of a meaningful opportunity to comment. Here, the TDM is significant new information requiring recirculation and the opportunity for public comment. (*See Spring Valley Lake Association v. City of Victorville* (2016) 248 Cal.App.4th 91, 108 [recirculation required where stormwater management plan was redesigned and revisions analyzed the project's consistency with several general plan air quality policies and implementation measures].)

III. The FEIR Fails to Adequately Assess and Mitigate Impacts to Water Quality and Climate Change Resilience

As mentioned in the Center's previous comments, science has shown that implementing adequate buffers throughout the catchment or watershed in addition to around the reservoir(s) is an effective strategy to keep pollutants and sedimentation out of reservoirs (Norris 1993; Whipple Jr. 1993). Researchers suggest that to reduce sedimentation and pollution in drinking water supplies a minimum 300-foot buffer should be established around reservoirs, and larger buffer zones should be established around upstream channels and tributaries closer to pollution sources of sediment and other pollutants (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993). Yet the FEIR rejects this information because the Center's recommended setbacks, which are based on scientific studies, are "not based on local research near the Guenoc Valley Site or the wildlife species that may occur there" (FEIR at 3-50). This is dangerous and backwards logic that threatens safe drinking water for communities, basically assuming that the Project area is not similarly subject to physics, chemistry, or hydrogeomorphic processes that have shaped other riparian systems. Scientific evidence suggests that setbacks of 20 to 30 feet will not adequately protect water quality from degrading due to sediment, turbidity, and other types of pollution, such as excessive nutrients (nitrogen and phosphorous) and pesticides. Larger buffer zones at reservoirs and along streams and wetlands upstream of the reservoirs would provide more stream bank stabilization, water quality protection, groundwater recharge, and flood control both locally and throughout the watershed (Nieswand et al. 1990; Norris 1993; Whipple Jr. 1993; Sabater et al. 2000; Lovell and Sullivan 2006). They would also protect communities from impacts due to climate change by buffering them from storms, minimizing impacts of floods, and providing water storage during drought (Environmental Law Institute 2008). Thus, the FEIR should require a minimum 300-foot buffer around reservoirs with a minimum of 200-300-foot setbacks from streams and wetlands, depending on whether the habitat supports, has the potential to support, or historically supported special-status and/or sensitive species, or if it provides important habitat connectivity.

Other studies have shown that land use patterns at the watershed scale are correlated with water quality, carbon sequestration, and the level of species abundance and biodiversity (Pess et al. 2002; Opperman et al. 2005; Lohse et al. 2008; Padilla et al. 2010; Grantham et al. 2012). For example, higher levels of vineyard/agricultural conversion and exurban development within watersheds have been associated with increased fine sediment inputs to streams (Opperman et al. 2005; Lohse et al. 2008), reduced diversity of aquatic macroinvertebrates (Lawrence et al. 2011), reduced abundance and diversity of native fishes (Pess et al. 2002; Lohse et al. 2008), and reduced carbon sequestration (Padilla et al. 2010). Meanwhile, forest cover, which includes woodlands adjacent to aquatic resources, plays a critical role in maintaining important water resources for clean drinking water and agriculture. Reduced forest/woodland cover has been shown to result in increased runoff (*i.e*., pollutants such as pesticides and fertilizers flowing into groundwater and surface waterways), erosion, sedimentation, and water temperatures; changes in channel morphology; decreased soil retention and fertility; and decreased terrestrial and aquatic biodiversity (Brown and Krygier 1970; Pess et al. 2002; Dahlgren et al. 2003; Houlahan and Findlay 2004; Opperman et al. 2005; Lohse et al. 2008; Elliot 2010; Lawrence et al. 2011; Moyle et al. 2011; Zhang and Hiscock 2011; Jedlicka et al. 2014). In addition, forests and woodlands are an important carbon sink that can help moderate the impacts of climate change (Padilla et al. 2010; Pan et al. 2011), and some researchers argue that at a global scale, trees are linked to increased precipitation and water availability (Ellison et al., 2012). These studies indicate that land use planning needs to consider impacts at the watershed scale to implement effective environmental protections that actually safeguard important natural resources like water quality and erosion control. Again, by implementing insufficient setbacks of 20-30 ft for aquatic resources and providing insufficient mitigation for oak woodlands and other vegetation and natural communities that stabilize soils, maintain high water quality, and sequester carbon without considering the watershed-level impacts, the FEIR fails to adequately assess and mitigate impacts to aquatic resources, water quality, and climate change resilience.

IV. The FEIR's Water Supply Analysis is Inadequate

The FEIR's water supply analysis fails to clearly demonstrate to the public and decision-makers that there will be sufficient long-term supplies to service the Project. The Project will use surface water rights previously granted for the Project site, but the FEIR and Water Supply Assessment ("WSA") are internally inconsistent in the quantities of surface water available. Furthermore, the FEIR and WSA fail to discuss the viability of long-term appropriations under existing permits in light of climate change's current and future impacts on regional surface water supplies in the Putah creek watershed.

A. The FEIR Fails to Properly Assess the Impacts of Climate Change on the Project's Surface Water Supply

The FEIR fails to adequately consider the impacts of climate change on the availability of increasingly scarce water resources in the western U.S. during the lifespan of the Project. California law requires agencies to discuss and disclose a proposed project's long-term future water supply. (See *Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 430-432 (hereinafter "*Vineyard*"); Water Code § 10910.) The FEIR finds the Project will have less than a significant impact on water supply related to sufficiency of water supply. (FEIR at 3.14-15.) This finding is based on the WSA, which describes the surface water rights that will provide non-potable water to a significant portion of the Project site. (WSA at 22.) The WSA does not discuss how climate change will the attendant shifts in precipitation regimes will impact the amount of water ***actually available*** under the existing appropriative rights. This shortcoming undermines the accuracy of the water supply analysis, and the finding of no significant impact based thereon.

Significant for the State, as well as the Project area, is climate change's impact on water supply. The Intergovernmental Panel on Climate Change ("IPCC") specifically identified the

American West as vulnerable, warning, “Projected warming in the western mountains by the mid-21st century is very likely to cause large decreases in snowpack, earlier snow melt, more winter rain events, increased peak winter flows and flooding, and reduced summer flows . . . .” (IPCC 2007b.) Recently, researchers found that an increase in atmospheric greenhouse gases has contributed to a “coming crisis in water supply for the western United States. . . .” (Barnett 2008.) Using several climate models and comparing the results, the researchers found that “warmer temperatures accompany” decreases in snow pack and precipitation and the timing of runoff, impacting river flow and water levels. (Barnett 2008.) These researchers concluded with high confidence that up to 60 percent of the “climate related trends of river flow, winter air temperature and snow pack between 1950-1999” are human induced. (Barnett 2008.) This, the researchers wrote, is “not good news for those living in the western United States.” (Barnett 2008.)

The California Center on Climate Change has also recognized the problem climate change presents to the state’s water supply and predicts that if GHG emissions continue under the business-as-usual scenario, snowpack could decline up to 70-90 percent, affecting winter recreation, water supply and natural ecosystems. (Cayan 2007.) Climate change will affect snowpack and precipitation levels, and California will face significant impacts, as its ecosystems depend upon relatively constant precipitation levels and water resources are already under strain. (Cayan 2007.) The decrease in snowpack in the Sierra Nevada will lead to a decrease in California’s already “over-stretched” water supplies. (Cayan 2007.) It could also potentially reduce hydropower and lead to the loss of winter recreation. (Cayan 2007.) All of this means “major changes” in water management and allocation will have to be made. (Cayan 2007.) Thus, climate change may directly affect the ability to supply clean, affordable water to the residents, or change how the Project will utilize water, and it may also impact other activities outside the Project area, such as agriculture or offsite residential use.

B. The FEIR Fails to Demonstrate How Much Surface Water Will Actually be Available at Full Build-out of the Project

The FEIR and WSA base the analysis of surface water supplies on the assumption that the maximum amount that can be appropriated under existing permits will be available throughout the 20-year planning horizon. The future water supplies identified in an EIR “must bear a likelihood of actually proving available; speculative sources and unrealistic allocations (‘paper water’) are insufficient bases for decision-making under CEQA.” (*Vineyard*, 40 Cal.4th at 432.) The discussion of the impacts related to likely future supplies must include an analysis of the “circumstances affecting the likelihood of the water’s availability.” (*ibid*.) Here, the WSA states that 10,394.5 acre-feet per year (“AFY”)[5] are authorized for diversion and storage (WSA at 51), and 7,360 AFY are available to be withdrawn from storage (WSA at 52) in a normal year under current permits. While the WSA contains projections for available non-potable surface supply within the place of use (“POU”) in critical dry and multiple dry year scenarios, any decrease due to dry conditions is calculated based on the maximum permitted appropriation amount. (*id*.) The WSA does not clearly demonstrate the historic yearly diversions under the existing permits. Instead, the WSA provides a table accounting for usage and carryover storage

[5] This total amount also includes 560 AFY from riparian rights along Bucksnort creek.

from 2011 to 2018. (WSA at 37.) This table does not illustrate how much water was diverted from the Putah creek watershed in any of those years. Such information would demonstrate how much of the total appropriative rights are actually received, and how those amounts, and the resulting carryover storage, compare to projected demand for non-potable use within the POU. Without accurate accounting of likely future supplies, the supply-demand projections in the WSA (WSA at 57) are unverifiable, rendering the FEIR's conclusions about water supply unsupported by substantial evidence.

The FEIR's analysis of non-potable surface water supplies is further undermined by internal inconsistencies regarding how much water is lost from reservoirs each year due to seepage and evaporation. Factual inconsistencies render the FEIR inadequate as an informational document. (*Vineyard*, 40 Cal.4th at 439 ["Factual inconsistencies and lack of clarity in the FEIR leave the reader—and the decision makers—without substantial evidence for concluding that sufficient water is, in fact, likely to be available …"].) The WSA contains different data regarding how much water was lost from reservoir storage each year due to evaporation and seepage, then uses a projection that is significantly lower than observed rates of loss when calculating available supplies to be withdrawn each year during Project operation. (WSA a 37-39.) The WSA projects normal year supply of 7,360 AFY, which accounts for 1,770 AFY of evaporative losses. (WSA at 39.) But the WSA also notes that reservoir losses were observed to be 2,320 AFY from 2009-2013 and 2,700 AFY for 2014-2018. (WSA at 37.) Further muddying the waters, Table 4-5 demonstrates usage and carryover storage for Project site reservoirs between 2011 and 2018, and the average loss from evaporation and seepage during that period is approximately 2,827 AFY. (WSA at 38.) The WSA doesn't explain how the 1,770 AFY number was calculated, nor does it address how that number is significantly different from the actual losses observed for Project site reservoirs. This lack of clarity is significant, when considering the narrow supply and demand margins for non-potable surface water in the POU during single dry, and multiple dry water years. Specifically, the WSA assessment anticipates a non-potable surplus in the POU of 573 AF in a single dry year, and 973 AF in multiple dry years by 2040. (WSA at 58.) These surplus amounts vanish when accounting for how much evaporative/seepage loss actually occurred on the Project site between 2011 and 2018.[6] The inaccurate accounting of available non-potable surface supplies within the POU leads the WSA to report a surplus in drought years, when in fact, there would be a deficiency under those scenarios when using historic evaporative/seepage losses for reservoirs on the Project site. This undermines the conclusion that sufficient non-potable surface water exists to serve the Project's demand within the POU.

The shortcomings in the WSA's analysis of available non-potable surface supplies within the POU are not rectified by the potential availability of groundwater. As noted above, the EIR must demonstrate how it will supply the Project's water through the 20-year planning horizon, and if there is uncertainty about the availability of supply, alternatives must be discussed and the impacts of their provision disclosed. (See *Vineyard*, 40 Cal.4th at 432.) If the EIR plans to supplement non-potable demand within the POU with groundwater, that amount of groundwater must be quantified and disclosed to the public in the EIR. While the EIR concludes there is

[6] Using actual average evaporative/seepage losses of 2,827 AFY, instead of the unsupported 1,770 AFY projection, the available supplies would be 1,057 AFY less than projected in all water year categories.

sufficient groundwater to the serve the Project's demands, specifically all potable demand and non-potable outside the POU (WSA at 54-55), the amount that will be used is critical in long-term regional supply analysis. As the EIR points out, Lake County is not required to have a Groundwater Sustainability Plan ("GSP") in place under the Sustainable Groundwater Management Act ("SGMA"). (FEIR at 3.9-19.) Nevertheless, the Lake County Groundwater Management Plan ("GMP") seeks to implement "County-wide initiatives to better understand and manage groundwater." (FEIR at 3.9-19.) The County's ability to coordinate groundwater management within the groundwater basin(s) necessitates a clear and accurate description of how much groundwater the Project will use. Unfortunately, the inadequate surface water supply analysis creates uncertainty in the Project's future supplies, and the potential availability of groundwater supplements was not quantified nor assessed in the EIR.

V. The EIR Lacks an Adequate Analysis of the Project's Impacts Relating to Wildfire and Emergency Evacuation

The Center's comments on the DEIR identified numerous inadequacies and shortcomings in the County's analysis of the Project's impacts relating to wildfire and wildfire emergency evacuation. Among other things, the DEIR failed to acknowledge the likelihood that the Project would increase the chance of wildfires while simultaneously impairing evacuation routes for existing residents. Unfortunately, the FEIR's response to comments and minor changes to the EIR and Wildfire Prevention Plan do nothing to remedy these deficiencies. Tellingly, the Planning Commission's staff report for the Project acknowledges (pp. 16-17) that "[i]n 2015, Lake County suffered three separate wildfires that burned approximately 171,000 acres of wild land, forest, and residential property, and resulted in the cumulative loss of 1,329 homes and damage of over 70 commercial properties." As we explained in our previous comments, the extremely high risk of wildfire in the area and the past history of large-scale repeated burnings at the Project site make it especially imperative that the County prepare an EIR that adequately discloses and analyzes the Project's wildfire impacts, and considers mitigation and alternatives to reduce these impacts.

A. The EIR Continues to Ignore and Obscure the Increase in Fire Risk Resulting from the Project

The FEIR remains deficient because it fails to acknowledge or adequately analyze the increased risk of wildfire that results from development and increasing the intensity of use in undeveloped areas subject to wildfire. Indeed, the FEIR continues to downplay or ignore this effect, claiming, once more and without support, that the Project would *reduce* wildfire risk on the Project site. (FEIR at 3.16-10.) This conclusion is patently defective. The County cannot continue to ignore the abundant evidence in the record that locating homes in the wildland urban interface increases the risk of wildfire ignition.

In its comments on the DEIR, the Center submitted extensive evidence to the County, including numerous published, peer-reviewed studies by the nation's preeminent experts on wildfires, of the scientific consensus that housing and human infrastructure in fire-prone wildlands are the main drivers of fire ignitions and structure loss. (See, e.g., Syphard, et al. 2019.) The FEIR's Response to Comments does not address, discuss, or even acknowledge any of this evidence. Instead, the FEIR's Response to Comments states merely, "The risk of human ignition of wildfires is considered in Impact 3.16-5 and addressed in the Wildfire Prevention Plan (Appendix FIRE of the Draft EIR)." (FEIR at 3-57 [Response O10-27].) But the County's response does not address the Center's comments. Instead of responding to the comment, or even addressing the effect of development in the Wildland Urban Interface on fire ignition risk, the County merely points to its Wildfire Prevention Plan. (FEIR at 3-57 [Response O10-28].) While a project-specific Wildfire Prevention Plan can conceivably reduce a project's wildfire impacts as compared to a hypothetical project without any wildfire prevention measures, the Wildfire Prevention Plan does not address—and the EIR does not disclose—the Project's potential to increase wildfire ignitions *as compared to existing conditions on the Project site*.

The County cannot ignore away the overwhelming evidence that that growth in the wildland-urban interface "often results in more wildfire ignitions, putting more lives and houses at risk." (Radeloff et al. 2018.) Developing housing in locations in California that currently have low or no density—such as the current Project site—dramatically *increases* the number of fires and the amount of area burned. *See* Keeley 2005; *see also* Syphard et al. 2013; Syphard et al. 2007 [stating that ninety-five percent of California's fires are caused by human activity].) Common anthropogenic causes of fire include arson/incendiary, equipment use, debris burning, smoking, vehicles, fireworks, electricity, and outdoor cooking. Additionally, structure fires can spread and initiate wildland fires.[7]

Drs. Alexandra Syphard and Jon Keeley, wildfire ecology experts who have been studying California wildfires and the relationship between wildfire and human activity for decades and have published hundreds of studies on the topic collectively, reiterate in an April 20, 2020 email that 95% of fires in California have been caused by humans, and when ignitions align with severe weather conditions, impacts are the most severe. (Syphard 2020.) They also state "as humans move farther east and into wildlands the likelihood of ignitions moving into those areas also increases." (Id.) There is insurmountable evidence from numerous studies which find that placing more sprawl development in fire-prone landscapes increases wildfire risk. The FEIR fails to consider the available science to adequately assess and mitigate the increase in wildfire risk due to the Project.

As one California court recently put it when finding the County of San Diego's EIR for a residential development project inadequate on these very grounds:

> [T]here is no discussion in the EIR of whether or how adding 1400 new residents into the area will affect the likelihood of wildfires. Adding this many residents into the Harmony Grove Project area is bound to affect the likelihood of fire given that, according to one report, 95% of modern wildfires in California are started by people. . . .The EIR should have addressed the issue. Although the EIR discusses

[7] In addition to the human-ignited 2015 Valley Fire, which we discussed in our comments on the DEIR, Lake County's 2016 Clayton Fire, which burned nearly 4,000 acres and destroyed 300 structures, was also human-ignited, according to Cal Fire. (CAL FIRE 2016.)

> what will be done to deal with wildfires, it does not address how adding new residents will affect the potential for wildfires to start.

(*Elfin Forest Harmony Grove Town Council v. County of San Diego* San Diego Sup. Ct. Case No. 37-2018-00042927-CU-TT-CTL, minute order dated Feb. 20, 2020 [included as reference].) Similarly here the EIR fails to address how adding up to 4,000 new residents to this demonstrably wildfire-prone location will affect the potential for wildfires to start.

Because it fails to acknowledge the significant wildfire impacts from increased risk of human ignition as a result of the Project, the EIR also fatally fails to mitigate them or consider alternatives to the Project that would reduce these impacts.

B. The EIR's Mitigation for the Project's Wildfire Impacts is Inadequate

As with the DEIR, the FEIR proposes only a single mitigation measure—MM 3.16-2—to reduce the Project's operational wildfire impacts (a single additional measure purports to mitigate all wildfire impacts from Project construction). (DEIR at 3.16-15 to -16.) As the Center previously commented:

> The [EIR] relies on MM 3.16-2 ("Post Wildfire Emergency Response") as the sole mitigation measure to reduce Impacts 3.16-4 and 3.16-5, which involve exposure of people and structures to wildfire. Yet, the measure is toothless and virtually meaningless; it defers preparation of the plan to an uncertain date, contains no standards to guide its preparation, is not enforceable, and does not include any concrete measures that can be shown to actually reduce wildfire impacts. In short, it fails to comply with *any* of CEQA's requirements for mitigation in an EIR.

The County did not respond to the Center's comments about the inadequacy of MM 3.16-2, or the untenability of relying on measure provides for the future preparation of a *post-wildfire* impacts study to reduce the risk of exposure from wildfires. Nor did the County make any attempt to defend MM 3.16-2's adequacy. Instead, the County apparently disclaims it, stating "No mitigation is identified because the Wildfire Prevention Plan adequately reduces the impact." (FEIR RTC, Response O10-30 [stating also, "Mitigation Measures 3.16-1 and 3.6-2 . . . alone would not be adequate, as the commenter notes."].) It then deflects to the Wildfire Prevention Plan (which, for the reasons described below is inadequate). The County cannot ignore the shortcomings in its mitigation measure MM 3.16-2—upon which the EIR relies to find that the Project's wildfire impacts would be less than significant—simply by pointing to *other* mitigation in the EIR.

i. The EIR Fails to Demonstrate That its Wildfire Prevention Plan Will "Reduce Wildfire Risks" to Less Than Significant

Like the DEIR, the FEIR continues to rely on a revised Wildfire Prevention Plan to "reduce risks in the area." (FEIR at 3.16-10.) The revised plan is included as the FEIR's Appendix FIRE. In our comments on the DEIR, we pointed out the Wildfire Prevention Plan's numerous flaws including a lack of evidence showing that its mitigation measures would be effective; its vague, ill-defined, or improperly deferred measures; and the fact that most of its measures are not enforceable. In response, the plan was revised such that its property boundary fire breaks around homes will ostensibly be required prior to home construction and to make external sprinklers a requirement for some structures.

While commendable, these changes do not remedy the Wildfire Protection Plan's shortcomings. For example, the irrigated vineyards and grazing that make up two of the Wildfire Prevention Plan's three wildfire "prevention strategies" remain vague, ill-defined, and lack enforcement mechanisms or meaningful performance criteria to evaluate their effectiveness. (FEIR Appendix FIRE at p. 15.) And there are still no assurances that many of the measures will actually be implemented. For example, a substantial portion of the plan's projected irrigated "fire breaks" which it relies on to "reduc[e] the spread of wildfires throughout the site" are only "potential" vineyards. (FEIR Appendix FIRE at pp. 19, 2 [identifying "potential irrigated vineyards fire breaks" that will be leased and managed by third parties].)

The Wildfire Prevention Plan is also vague and aspirational at the level of individual residential units. We identified this shortcoming in our DEIR comments, pointing out for example that the plan states only that: "If a wildfire occurs, it poses a considerable risk to residential homes and their occupants. Homeowners *will be advised* to implement various wildfire prevention strategies." (FEIR Appendix FIRE at p. 23 [unchanged from the draft included with the DEIR].) The document then goes on to suggest "various [landscaping] strategies [that] can reduce wildfire risk where establishing a new landscape design." (*Id.* at p. 25.) Finally, the document notes that "residential buildings will abide by" state building codes (*id.* at p. 28) and suggests "interior strategies," such as smoke detectors, for reducing fire risk (*id.* at p. 29). But as Syphard and Keely explain, new construction built to state building codes "is not a panacea" and "MANY of the houses destroyed [in wildfires in California between 2013 and 2018] were newly built." (Syphard 2020.)

In response to the Center's concerns about the enforceability of measures to reduce wildfire risk, the FEIR claims that the mitigation measures imposed in the Wildfire Prevention Plan are enforceable because "Implementation of the Wildfire Prevention Plan (Revised Appendix FIRE of the Final EIR) will be made a condition of project approval, and therefore will be enforceable by the County." (FEIR RTC at 3-57.) First, this appears to be incorrect; the draft Conditions of Approval document published as Exhibit 15 to the Planning Commission's Staff Report for the Project is entirely silent as to the Wildfire Prevention Plan. Second, even if the Conditions of Approval did require "implementation" of the Wildfire Prevention Plan, the plan's measures themselves are largely optional or advisory and use aspirational, not mandatory, language.[8] (See FEIR Appendix FIRE at p. 28 [listing a "selection of strategies to prevent fires" none of which, except for exterior sprinklers, are required to be implemented by homeowners].) The EIR's failure to include enforceable, concrete mitigation with measurable performance standards violates CEQA. (*City of Santee v. Cnty. of San Diego* (1989) 214 Cal.App.3d 1438, 1454-55.)

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[8] As we mentioned in our comments on the DEIR, oversight of the [Wildfire Prevention Plan's] management, operations, and enforcement will be in the hands and at the discretion of the future Homeowner's Association; this remains true of the revised Wildfire Prevention Plan (FEIR Appendix FIRE at p. 3), and the FEIR's Response to Comments did not address this comment.

Moreover, as the Center explained in its comments on the DEIR, the Wildfire Prevention Plan contains no data or analysis to support the EIR's conclusions that implementing the plan will reduce wildfire risk in any meaningful way. Instead, it provides only vague discussions of the measures that it claims can ameliorate wildfire risk, without making any attempt to quantify these assertions or support them with evidence. (The problem is compounded by the lack of any modeling of current or post-project wildfire behavior on the Project site, described in more detail below.) The FEIR makes no attempt to rectify this shortcoming or supply the missing evidence. Bare conclusions, even if true, are insufficient to fulfill the informational purpose of an EIR. (*Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 736.) The EIR's error is only compounded by the Wildfire Prevention Plan's failure to address or acknowledge the increase in wildfire risk that will result from the Project's increased potential for human ignitions.

C. The EIR Fails to Analyze the Impact to Biological Resources from Increased Fire Risk Resulting from the Project

The FEIR fails to account for the impact to biological resources from increased fire risk from the Project. As the Center pointed out in its comments on the DEIR, wildfires can be disastrous for plant and animal life. If native habitat fire regimes are disrupted, the habitats they provide can become degraded and when fires occur too frequently, type conversion occurs and the native shrublands are replaced by non-native grasses and forbs that burn more frequently and more easily, ultimately eliminating native habitats and biodiversity while increasing fire threat over time. The FEIR completely ignores the evidence submitted by the Center, including numerous peer-reviewed journal articles, that demonstrates the harms to wildlife, habitat, and connectivity from wildfires.

Instead, in its Response to Comments, the FEIR states that "Effects of changes in wildfire frequency and intensity on biological resources, including habitat, are acknowledged in the discussion of effects related to climate change on page 3.7-3 of the Draft EIR." (FEIR RTC at 3-57 [Response O10-29].) It goes on to claim that because the EIR finds "the Proposed Project would not result in significant impacts associated with wildfire ignition, additional discussion regarding the indirect consequences of wildfire on biological habitats is not warranted." (*Id*.) But merely acknowledging that climate change will likely result in wildfire frequency and intensity and stating that it may have an effect on biological resources is not a substitute for evaluating the impact that the Project's increased risk of wildfire ignitions will have on wildlife and habitat. The EIR should be revised to include this analysis and recirculated.

D. The EIR's Description of Existing Wildfire Conditions on the Project Site is Inadequate

The Wildfire Prevention Plan and EIR fail to adequately describe the existing wildfire conditions on the Project site. It is standard practice when preparing an EIR for a residential development project of this size and scope for experts to use modeling software, such as the industry-standard FlamMap, BehavePlus, or similar programs, to provide fire behavior modeling for the Project site. The analysis typically includes descriptions of the Project's site's topography, fuel loads, and wind patterns, and uses those inputs to anticipate wildfire conditions under various scenarios. For example, the Wildfire Protection Plan for the 2,135-home, 1,985-

acre Newland Sierra housing development in San Diego County, used both FlamMap and BehavePlus to estimate fire spread rate, flame length, and ember "spotting" distance. (Dudek 2018a. at p. 35; see also Dudek 2018b. [Fire Protection Plan for Otay Village 14 residential development in San Diego County, using BehavePlus modeling])[9]

In sharp contrast, the FEIR's Wildfire Prevention Plan is strikingly devoid of detail. Although it contains generalized descriptions of the site's vegetation, wind patterns and topography (FEIR Appendix FIRE at pp. 10-14), *it makes no attempt to use this information to model likely fire conditions on the project site*. This is industry standard, critical information and, again, frequently and typically performed by agencies conducting environmental review for housing developments of this size and scope. The County should withhold approval of the project until it performs this critical analysis—including fire spread rates, fire direction, flame-length, and ember "spotting" distance under various scenarios on the Project site—and discloses it to the public in a recirculated EIR. The County has no excuse for failing to supply this analysis.

E. The EIR Fails to Analyze the Project's Impacts to Community Safety During a Wildfire Evacuation

In response to the Center's request that the County prepare a project-specific wildfire evacuation analysis and plan that addresses the Project's impacts on wildfire evacuation safety and times for Project residents and existing nearby residents, the County merely brushed off the Center's concerns, pointing again to the Wildfire Prevention Plan. However, that plan is *entirely silent* on the issue of evacuation and evacuation routes in the event of a wildfire. A mere four pages of the Wildfire Prevention Plan (consisting mostly of graphics) are devoted to "Wildfire Emergency Response," but these four pages focus entirely on fire suppression and response activities and *do not address resident evacuation at all*. (FEIR Appendix FIRE at 31-35.) We remain deeply concerned that the EIR makes no effort to calculate or disclose how adding a permanent population of 4,000 residents, plus additional thousands of visitors, will affect evacuation times and effectiveness for *new and existing residents* in, and in the vicinity of, the Project site.

As Dr. Thomas Cova is a leading expert on environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling, whose work has been cited in EIRs for large scale residential development projects in California. Dr. Cova reviewed the FEIR for the Project (including Appendix FIRE) and provided comments in its evacuation analysis in a report attached as Exhibit 1 ("Cova Report"). As the Cova Report explains:

> Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only

[9] The Center provides this documentation only to demonstrate that performing this type of analysis of fire conditions is not only possible—it is typical. The Center does not contend that this document's analysis is accurate or adequate. The Newland Sierra project was rejected by voter referendum in March 2020, in large part due to public concerns over fire safety.

> possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

(Exhibit 1 at 3 [stating also that "it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios."].)

Notwithstanding the EIR's failure to analyze the Project's impacts to community safety in the event of a wildfire, it is clear that the impacts will be significant. (Exhibit 1 at pp. 3-4.) As expert Dr. Cova explained, "there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site" and "there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety." (*Id.* at pp. 4-5.) This is compounded by the fact that the Project site's evacuees must all travel through the bottleneck of Butts Canyon Rd., after leaving the Project site, providing "very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project ." (Exhibit 1 at p. 2.) It is unconscionable that despite this evidence of significant impacts to public safety if the Project is built, the FEIR does not disclose the effect on on evacuation times from adding thousands of additional residents to the Project area.

Furthermore, the FEIR's Responses to Comments failed to squarely address the concerns the Center raised regarding wildfires and community safety. Instead, the Response to Comments side-stepped or ignored our comments. In particular, in our comments on the DEIR we asked (underlined):

<u>What are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site?</u> The County responded by stating that "While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables." (FEIR RTC O20-31.) The fact that there are a "number of variables" does not excuse the County from performing this critical analysis. As the Cova Report explained, lead agencies frequently undertake this type of analysis for large scale residential development projects. For example, the EIR for the 2,135-home, 1,985-acre Newland Sierra housing development in San Diego County included a project-specific evacuation plan that, *inter alia*, estimated the total number of vehicles on the project site, estimated the time required to evacuate everyone from the project site, and estimated the roadway capacity in the event of an evacuation. (Dudek 2017.)[10] The County cannot simply throw up its hands and declare that this routine analysis is not possible here. The public has a right to know how the Project will affect evacuation times for Project residents and existing residents in the vicinity.

<u>What will the Level of Service be for emergency egress routes from the Project vicinity in the event a wildfire-driven evacuation becomes necessary?</u> The County's response stated that the Level of Service "would not be likely to be relevant in a rural area during a wildfire emergency,

[10] Again, the Center provides this document only to demonstrate that this performing this type of project-specific evacuation analysis is both possible and typical. The Center does not contend that this document's analysis is accurate or adequate.

as shown on these tables, levels of service at project intersections on evacuation routes would generally be acceptable." (FEIR RTC O20-31.) This is patently incorrect. The tables referenced by the County's response indicate that the intersection at Butts Canyon Rd. and Hwy 29 will drop from current peak-hour levels to an "F" rated[11] Level of Service, with 50-minute delays. Given that Butts Canyon Rd. is the *only* egress road for the Project, in the event of a wildfire evacuation requiring project residents (and other nearby residents using Butts Canyon Rd. east of Hwy 29) to evacuate westward, several thousand residents will need to pass through this intersection. If such an evacuation event were to occur during peak-hour times, 50 additional minutes' worth of delay at this intersection would have a significant impact on evacuee safety. The EIR does not disclose this impact or attempt to mitigate it.

<u>What, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable?</u> The County's response provides a link to the Lake County Evacuation Map (which shows no alternative evacuation routes for the Project site), and states, "[t]his map shows all of the existing and potential evacuation routes serving the county and the project site." In so doing, the County entirely sidesteps the question and—like the EIR—fails to disclose that there is no alternative evacuation route in the event that Butts Canyon Rd. becomes impassable due to gridlock, vehicle collisions, being overtaken by wildfire, or other reasons.[12] As the Cova Report explains: "[I]n the event of a wildfire, *all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway*. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable." (Cova Report at 2 [emphasis in original].) Accordingly, the County has failed in its obligation to consider alternatives to the Project to mitigate the Project's significant impacts community safety.

<u>What effect will resident evacuation on Butts Canyon Rd. and/or Hwy 29 or 175 have on the ability and timing for first responders who are responding to wildfire in the vicinity of the Project?</u> The County simply stated: "evacuation in the event of a wildfire is managed by the Lake County Sheriff's Department in coordination with other emergency responders through the Emergency Services agency." This statement of jurisdictional responsibility does not even attempt to answer the Center's question about the *impact* that traffic from the Project site will have on response times for first responders attempting to provide fire suppression or medical assistance.

Finally, in response to our request for project specific analysis, the County's Response to Comments refers readers to a hyperlink to a webpage with the Lake County Community Wildfire Prevention Plan. (FEIR RTC at 3-59.) But as we explained in our previous comments, this plan was prepared in August 2009, prior to the Project, and does not anticipate or address the Project in any way nor account for the thousands of additional evacuees and vehicles *from this Project* that will flood the region in the event of a wildfire in the vicinity of the Project. It does not and cannot substitute for the project-specific analysis that CEQA requires. As with the EIR found

[11] An "F" rated Level of Service means that the intersection suffers from "extreme congestion, with very high delays and long queues unacceptable to most drivers." (FEIR at 3.13-12 [Table 3.13-3].)
[12] As the Camp Fire and Tubbs Fire recently demonstrated, vehicle-clogged roadways overtaken by fire in an evacuation is an especially dangerous scenario. (Arthur 2019, Diskin 2019.)

deficient in *California Clean Energy Commission v. County of Placer* (Dec. 22, 2015, No. C072680) ___Cal.App.5th___ [2015 Cal. App. Unpub. LEXIS 9360, at *1, *78] the FEIR still says "nothing about the impact of the increased population density created by the Project on emergency evacuations in the event a wildfire does occur, nothing about the effect of such evacuations on access for emergency responders and suggested no mitigation measures to address any such concerns."

The public—including future residents of the Project, and existing residents nearby who will be relying on Butts Canyon Rd. for evacuation—have a right to know the full extent of the Project's impacts on wildfire evacuation. The County's failure to analyze or disclose these impacts prejudicially impedes informed decision-making and informed public participation. (*See Sierra Club v. County of Fresno*, (2018) 6 Cal.5th 502, 515.)

F. The EIR Fails to Adequately Evaluate the Project's Cumulative Wildfire Impacts

As we pointed out in our comments on the DEIR, the EIR provides only a single, conclusory paragraph dismissing cumulative wildfire impacts with virtually no analysis. The FEIR acknowledges that "Development of these [other planned] projects [in the near vicinity] would introduce new people and infrastructure to the area. Increased development could potentially add more opportunities for igniting fires, more fuel, and make emergency response operations more complex." (FEIR at 3.16-15.) Then, it concludes, without further analysis and in reliance on its own Wildfire Prevention Plan and two mitigation measures that cumulative wildfire impacts from the Project will be less than significant. (Id.) The FEIR's Response to Comments essentially concedes that its cumulative analysis adds nothing to its analysis of the Project's individual. Quoting the FEIR, the Response to Comments states, "[b]ecause of the discussed factors, the Proposed Project in combination with future projects in the region will not create a significant impact." (FEIR RTC Response O10-32.) But the "discussed factors" is merely a reference to the EIR's analysis of the Project's individual impacts. Merely mentioning two other projects in the vicinity and concluding that there can be no cumulative wildfire impacts is no substitute for the analysis that CEQA and the CEQA guidelines require. The EIR should be revised and recirculated to correct this deficiency.

VI. Conclusion

Thank you for the opportunity to submit comments on the Final Environmental Impact Report for the Guenoc Valley Mixed-Use Planned Development Project. The Center urges the Board not to approve this Project, and at the very least to delay its consideration of the Project until the public has had adequate time to review and comment on the voluminous FEIR and other documents.

Given the possibility that the Center will be required to pursue legal remedies in order to ensure that the County complies with its legal obligations including those arising under CEQA, we would like to remind the County of its duty to maintain and preserve all documents and communications that may constitute part of the "administrative record" of this proceeding. The administrative record encompasses any and all documents and communications that relate to any and all actions taken by the County with respect to the Project, and includes "pretty much everything that ever came near a proposed [project] or [] the agency's compliance with CEQA . . . ." (*County of Orange v. Superior Court* (2003) 113 Cal.App.4th 1, 8.) The administrative record further includes all correspondence, emails, and text messages sent to or received by the County's representatives or employees, that relate to the Project, including any correspondence, emails, and text messages sent between the County's representatives or employees and the Applicant's representatives or employees. Maintenance and preservation of the administrative record requires that, *inter alia*, the County (1) suspend all data destruction policies; and (2) preserve all relevant hardware unless an exact replica of each file is made.

Please do not hesitate to contact the Center with any questions at the number or email listed below.

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Exhibit 1

Cova Report

Prepared by Thomas J. Cova, Ph.D., Evacuation Consultant, Salt Lake City, UT

Dated: July 2, 2020

Subject: Evacuation analysis and planning for the proposed Guenoc Valley Mixed Use Planned Development Project in Lake County, CA

SUMMARY

I have reviewed the Environmental Impact Report (EIR) and Wildfire Prevention Plan for the Guenoc Valley project. The Guenoc Valley project site is in a very high fire hazard area evidenced by recent fast-moving, intense wildfires in the Project vicinity that caused loss of life. The project is large and proposes to add thousands of people to a very sparsely populated area with a limited transportation network. The EIR does not evaluate or disclose the wildfire evacuation risks associated with introducing this many people and vehicles to the project area and does not include a detailed wildfire evacuation plan to protect the safety of the residents. Prior to approving the project, the County should prepare a project-specific evacuation plan that addresses, at a bare minimum: 1) the possible range of evacuation times for residents and visitors, 2) the possible range of lead times available to act in an urgent wildfire, 3) the pattern of evacuation road traffic on primary access roads from the site to major evacuation routes in the Countywide evacuation plan, and 3) detailed alternative plans for protecting residents and visitors when roads become impassible or the time required to evacuate is greater than the time available.

ANALYSIS

The Project Configuration Allows Only One Evacuation Route for Several Thousand Residents

The Guenoc Valley Site consists of 16,000 acres in southwest Lake County, California. The project will include 400 hotel rooms, 450 guest resort residential units, 1400 residential estates, and 500 workforce co-housing units. The EIR proposes 753 total parking spaces for Phase 1 but does not mention how many there might be when the project is complete or how many vehicles are likely to be on the project site, on average, after the project is complete. However, given the number of proposed units (and conservatively assuming one vehicle per unit when California's average number of vehicles per household is two), the site is likely to house at least 2750 vehicles on site when it is completed (i.e. 400 + 450 + 1400 + 500). While some of these units may have no vehicles, and others may have 2 or more, a range of at least two to three thousand vehicles is a reasonable starting assumption for evacuation planning for this project.

Access to the project site is via Butts Canyon Road from Middletown (7 miles to the west), although Butts Canyon Road continues south from the project site to Pope Valley (12 miles to its south). There are no alternative routes in or out of the project site. The Final EIR's Response to Comments O10-31 references the Lake County Evacuation map and states:

> *Regarding the commenter's question "what, if any, alternative evacuation routes will be available for residents and nearby community members in the event that Proposed Project-generated evacuation traffic makes Butts Canyon Rd. and/or Hwy 29 or 175 impassable", as noted on page 3.16-7 of the Draft EIR, the Lake County Wildfire Protection Plan provides an evacuation route map (URL in figure 1). This map shows all of the existing*

and potential evacuation routes serving the county and the project site. The Wildfire Prevention Plan for the Proposed Project includes plans for determining whether evacuation routes are unsafe, and designated meeting locations.

An excerpt of this map around the project site is provided in Figure 1. The map shows that the initial evacuation route is Butts Canyon Road north (and then to SR-29 North or South or SR-175 north), or south to Pope Valley (not shown on map because it's in Napa County). There are no evacuation routes to the east or north of the project site, so evacuees would have to travel southwest to Butts Canyon Road and then either northwest to Middletown or southeast to Pope Valley. This is very limited directional egress for a community of this size given the wide range of locations and directions that a wildfire might approach the project.

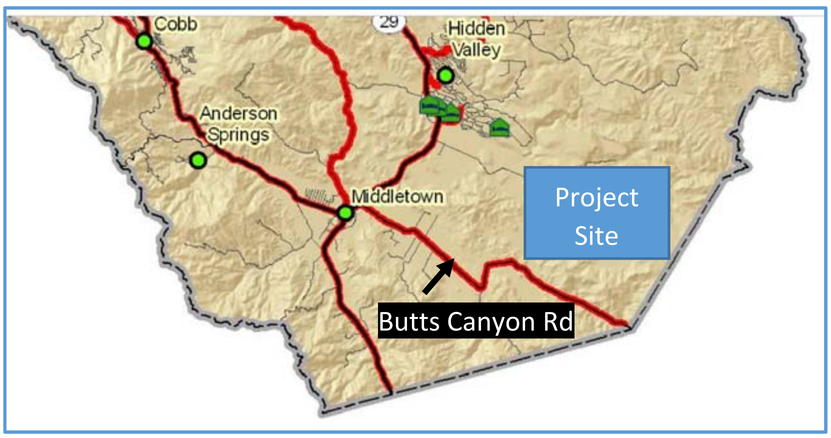

Figure 1. An excerpt taken from the Lake County evacuation map does not show an evacuation route in the project area. (URL: http://www.lakecountyca.gov/Assets/County+Site/Fire+Safe+Council/cwpp/Evacuation.jpg).

In other words, in the event of a wildfire, all evacuation traffic from the project site must flow through Butts Canyon Road, a two lane rural highway. This is a significant bottleneck and there are no alternative evacuation routes in the event that Butts Canyon Road becomes impassable.

The EIR Does Not Analyze the Project's Wildfire Evacuation Impacts

The project configuration presents an immediate concern due to the limited evacuation egress for project residents and workers trying to reach Butts Canyon Road in an urgent evacuation. Given this concern, and the history of wildfires on the project site, it is critical that the County perform a project-specific wildfire evacuation analysis that includes available lead times and evacuation times under a variety of scenarios.

As noted in the Final EIR Response to Comments O10-31, the time necessary to safely clear the project site can vary according to a number of factors:

Regarding the commenter's question "what are the pre- and post-Project expected evacuation times for residents (both Project residents and nearby affected existing residents) fleeing wildfire in the vicinity of the Project site," evacuation times would vary

> *based on a large number of factors, including day of the week, time of day, the fire's location, behavior, winds, and terrain. While the County has performed extensive planning for wildfire safety and evacuation, it has not projected evacuation times, due to the number of variables.*

Although the County is correct that there are numerous variables that inform estimates of evacuation times, this does not justify the decision to not perform an evacuation analysis. Project-specific evacuation analysis and modeling is not only possible, agencies frequently perform it, especially for largescale residential and mixed-use development projects similar to the Guenoc Valley project.

The Project's Wildfire Evacuation Impacts Are Significant

There are two key variables that determine the success of an evacuation in getting residents to safety: the time available to protect people (lead time) and the time it takes to protect them (evacuation time). Some of the variables mentioned by the County above (e.g. fire location, behavior, winds and terrain) are important inputs for estimating the lead time that would be available to protect residents. A fire that ignites near the project site (location) and spreads rapidly towards it (winds, behavior, terrain, direction) may offer little time for emergency managers to conduct an orderly evacuation of the site. Similarly, the day-of-week and time-of-day are variables affecting the evacuation time. For example, the number of evacuees (residents and visitors) and vehicles that might be on the project site due to weekends, holidays, or events (e.g. sports, music, weddings) will affect the evacuation time.

Wildfire safety hazards arise when the lead time is less than the evacuation time, and the difference between the two is a primary cause of fatalities in evacuations. For example, in the 2018 Camp Fire in Paradise, the city evacuation plan called for 2 to 3 hours to safely evacuate the town (evacuation time), but the fire only offered 1.5 hours from its ignition to its impact on structures on the east side of Paradise (lead time). Because of the large number of residents and vehicles that will be added to the area by the project and the recent history of intense, fast-moving wildfires (see the Wildfire Prevention Plan), it is critical that the County evaluate lead time and evacuation time for the Guenoc Valley project under a range of likely scenarios.

Gross estimates for evacuation time can be calculated using simple assumptions about warning time, response time, vehicle loading, and road capacity. Figure 2 shows the proposed transportation network on the south end of the project that would provide emergency access to Butts Canyon Road (the evacuation route from the project to Middletown or Pope Valley). Note that there are three access points to the project site along Butts Canyon Road (BCR) labeled *Primary Entrance Option 1 (PE1), Primary Entrance Option 2 (PE2), and Secondary Entrance (SE).* Although PE1 and PE2 provide two access points, they quickly merge into one access road to the northeast which create a bottleneck for evacuation purposes. This means that there are effectively two means of egress to Butts Canyon Road from the project: the Primary Exit (PE), which splits and leads to two access points, and the Secondary Exit (SE).

Assuming that the PE and SE both have one traffic lane out each (leaving one lane for emergency vehicle ingress, as is typical), and assuming that each exiting lane can serve a range of 600 to 1200 vehicles per hour (vph) depending on many factors (e.g. merging, intersection control, car-following behavior), then the total egress from the site to BCR could range from 1200 to a high of 2400 vph. In supply-demand terms, this would be an estimate of the "supply" available to serve the evacuees as they leave the site.

As noted above, there could be a range of 2000-3000 vehicles on the project site depending on the time of day, day of week, or special events, and this would be the "demand" in an evacuation. Dividing the vehicle demand by the exit road supply, the minimum time to evacuate this site could range from an ideal case of lower demand and higher capacity (2000 vehicles / 2400 vph = 0.83 hours) to a much worse case of higher demand and lower capacity (3000 vehicles / 1200 vph = 2.5 hours).

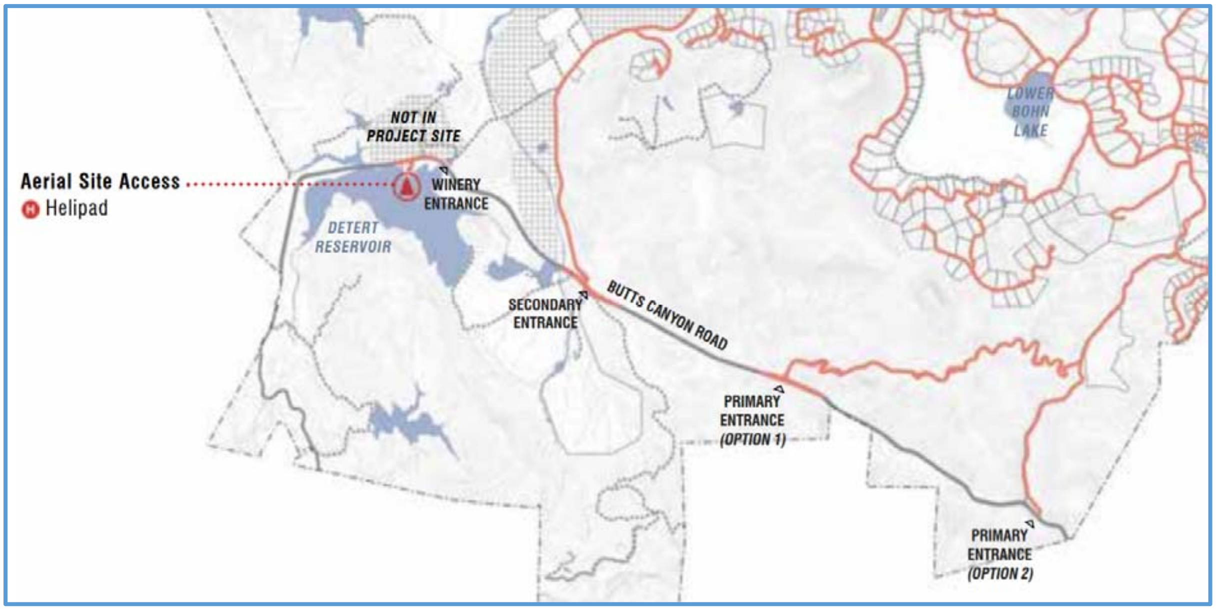

Figure 2. The transportation network that will connect the project site to Butts Canyon Road.

As noted above the second factor that influences the outcome of a wildfire evacuation is the lead time. The question becomes one of whether a wildfire in the vicinity of the project site might offer less than the time to evacuate the community (1 to 2.5 hours), leaving some evacuees at risk of being caught in-transit when the wildfire overtakes the community. This presents an extremely high safety threat. When persons are in vehicles on a road when fire is burning in the immediate area, visibility conditions may become so poor that the vehicles drive off the road or crash into other vehicles and/or flames and heat may overcome the occupants. On-road fatalities occurred, for example, during the 2003 Cedar Fire in San Diego County and the 2018 Camp Fire originating in Paradise. The EIR and Wildfire Prevention Plan provide little detail and no modeling regarding wildfire behavior and spread rate. However, based on the wildfire history of this region as detailed in the EIR and Wildfire Prevention Plan, there are numerous possible wildfire scenarios in this area under which emergency managers and evacuees would have less than the time it would take to evacuate the Guenoc Valley site.

Additionally, the 2.5 hour evacuation time could be much longer if warning time is prolonged or key intersections are not controlled by law enforcement. These intersections include the two PE's and the SE, as well as the point where BCR intersects with Highway 29. If traffic flow problems occur at any of these locations due to adverse events (e.g. wildfire blocking an exit, abandoned vehicles, or gridlock),

the evacuation could lead to fatalities similar to the 2018 Camp Fire in Paradise or the 2017 Tubbs Fire in Santa Rosa.

In short, the County did not perform a project-specific wildfire evacuation analysis. Even in the absence of such analysis, there is strong evidence that evacuation times could exceed lead times for the project, which could pose a serious threat to public safety.

The EIR's Description of Shelter-in-Place Strategies Is Inadequate

As scenarios can be identified where not everyone in the project site would be able to get out in time, the Final EIR (p. 3.16-9) mentions six designated shelter-in-place meeting and staging areas as a back-up option:

> *"The Community Wildfire Protection Plan identifies evacuation routes in the County. Butts Canyon Road is identified as an emergency evacuation route. Depending on where the fire is located, people at the Guenoc Valley Site would be directed to exit the site via the primary roadways to Butts Canyon Road or as a last resort would shelter in place at the six Designated Meeting and Staging Areas. As shown on Figure 2-10, the Proposed Project includes an extensive circulation system with roadways large enough for emergency access vehicles. In addition, these roadways would typically have 50 feet of defensible space cleared on each side of the roadway for a total fire break of 150 feet. Impacts to adopted emergency response or evacuation plans would be less-than-significant. Impacts related to traffic and emergency routes are addressed in Section 3.13 Transportation and Traffic.*
>
> *Depending on the circumstances of a wildfire emergency, it may be difficult to evacuate. In this situation, residents, visitors, and employees will be directed to gather at designated meeting & staging areas where they will be provided information and assistance.*

These six designated meeting and staging areas (DMSA) are shown in Figure 2-10 in the EIR but the locations are vague and the capacities are not given. In order to be effective, these DMSAs would need to be easily accessible (including for disabled people and pedestrians) and provide enough protection for residents to survive a wildfire with an intensity in line with recent past wildfires. Additionally, it is critical that the location of, and access routes to, DMSAs are well publicized and made clear to residents and visitors to the project site through education, signage, and other means. The lack of adequate description in the EIR or Wildfire Prevention Plan of the DMSAs' location, capacity, and protection level is a significant shortcoming; these should be addressed in detail in a project-specific evacuation analysis and plan.

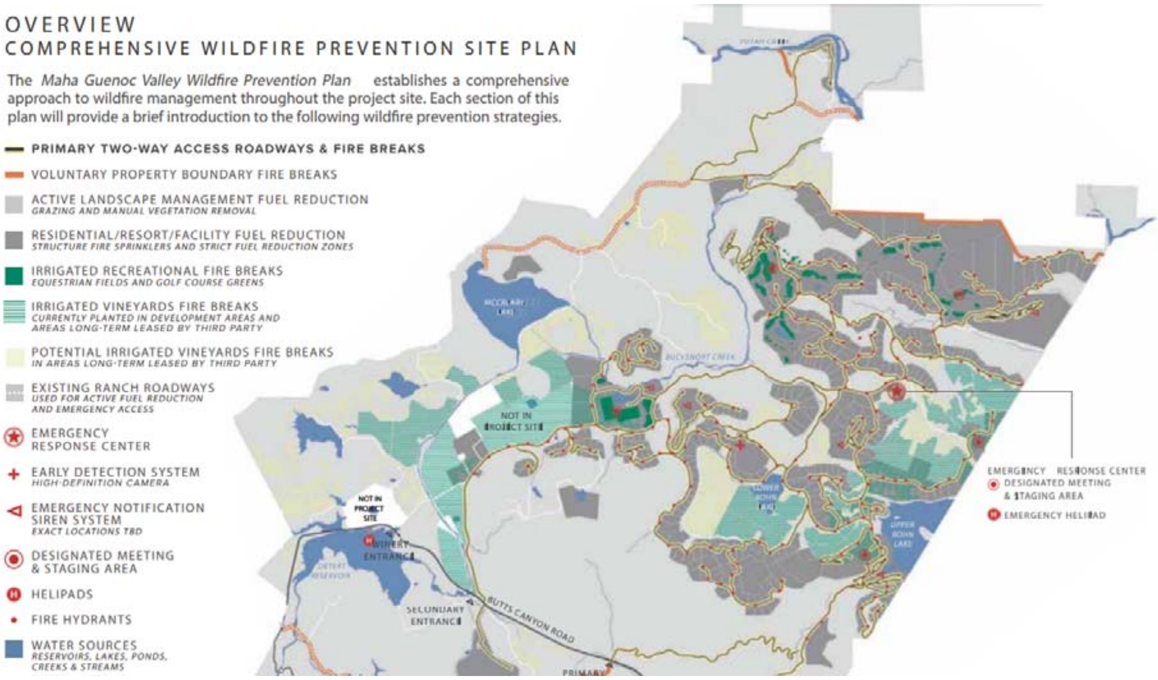

Figure 3. The designated meeting and staging areas are not very visible or easy to assess.

CONCLUSION

The Guenoc Valley project anticipates housing thousands of residents and visitors on a Project site historically susceptible to fire and in a region where large-scale wildfire evacuations have recently been necessary. The project offers only two primary means of egress to Butts Canyon Road, which only offers one direction for evacuees to escape (southwest) from the project site, and then only two directions to travel from there (northwest or southeast on Butts Canyon Road). The evacuation vehicle capacity offered by these roads is relatively low, and a rough estimate is that they could serve 1200 to 2400 vehicles departing per hour. On a given summer weekend day, it's not unlikely that it could take a few hours to evacuate this project site, and there are numerous plausible wildfire scenarios where this much time might not be available. Shelter-in-place is likely to be used in some scenarios where not everyone can evacuate in time, but it is not taken very seriously in the EIR or Wildfire Prevention Plan, which do not describe the access, capacity, and protection level that the various staging areas would offer. I strongly recommend that the County prepare a detailed and comprehensive evacuation plan for this project.

Thomas J. Cova, Ph.D.

CREDENTIALS

I received a Doctor of Philosophy (Ph.D.) degree from the University of California Santa Barbara in 1999 in the field of Geography; a Masters of Science (M.S.) degree from the same university in 1995; and a Bachelor's of Science (B.S.) degree in Computer and Information Science from the University of Oregon in 1986. I am currently a Professor of Geography and the University of Utah. My expertise is in environmental hazards, transportation, and geographic information systems with a particular focus on wildfire evacuation planning, analysis, and modeling. I proposed a set of standards for transportation egress (exit capability) in wildfire areas that was adopted by the National Fire Protection Agency in 2008 in their Standards for the Protection of Life and Property in Wildfires. I received research grants from the National Science Foundation to study: 1) the 2003 Southern California Wildfires, 2) Protective Action Decision Making in regards to evacuation versus shelter-in-place, and 3) Protective Action Triggers (decision points regarding when to order an evacuation). In 2017 I published an article with my collaborators on warning triggers in environmental hazards that described the issues that arise in deciding when to order an evacuation or other protective action.[1] In 2013, along with my collaborators, I analyzed community egress in fire-prone areas of the western U.S. to identify those that might face difficulty evacuating due to traffic congestion.[2] In 2011, I developed a decision model with my collaborators to aid in deciding whether evacuation or shelter-in-place is the best decision in a wildfire.[3] My work has been cited in fire evacuation plans prepared in conjunction with Environmental Impact Reports in California.

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1999	Ph.D., Geography, University of California Santa Barbara. Dissertation: *A general framework for optimal site search*.
1995	M.A., Geography, University of California Santa Barbara. Thesis: *A spatial search for neighborhoods that may be difficult to evacuate.*
1986	B.S., Computer and Information Science, University of Oregon. Minor in math; emphasis in software engineering.

Research and Teaching Interests

Environmental Hazards, Emergency Management, Geographic Information Science, Transportation, Sustainability, Coupled Natural-Human Systems.

Professional Experience

2012 –	Professor, Department of Geography, University of Utah.
2005 – 2012	Associate Professor, Department of Geography, U. of Utah.
1999 – 2005	Assistant Professor, Department of Geography, U. of Utah.
1993 – 1996	Research Assistant, National Center for Geographic Information and Analysis (NCGIA), UC Santa Barbara.
1992 – 1997	Teaching Assistant, Department of Geography, UCSB.
1987 – 1992	Systems Analyst, Matthew Bender & Co., Oakland, California.

Other Professional Activities

2014 – 2018	Director, *Certificate in Environmental Hazards & Emergency Management*, Department of Geography, University of Utah.
2003 – 2018	Director, *Center for Natural & Technological Hazards*, Department of Geography, University of Utah.

2001 – 2016	Director, Certificate in Geographic Information Science, Department of Geography, University of Utah.
2011 – 2013	Chair, Hazards, Disasters & Risk Specialty Group, Association of American Geographers, Washington, D.C.
2007 – 2008	Program Chair, 5th International Conference in Geographic Information Science (GIScience 2008), Park City, Utah.
2005 – 2008	Chair (Vice Chair, Past Chair), GIS Specialty Group, Association of American Geographers, Washington, D.C.
2005 – 2008	Chair, Research Projects Committee, University Consortium for Geographic Information Science (UCGIS).
2004 – 2006	Secretary/Treasurer, GIS Specialty Group, Association of American Geographers, Washington, D.C.
2001 – 2003	Academic Councilor, GIS Specialty Group, Association of American Geographers, Washington, D.C.
1999 – 2003	Associate Director for Research, Center for Natural & Technological Hazards, Department of Geography, U of Utah.

Editorial Board Memberships

2020 –	*International Journal of Geographical Information Science*
2018 –	*Journal of Applied Geography*
2011 –	*Journal of Geography & Natural Disasters*.
2011 – 2014	*Journal of Spatial Science*
2009 – 2011	*Professional Geographer*
2001 – 2004	*Computers, Environment & Urban Systems*

Professional Honors and Awards

2016	Excellence in Mentoring Award, College of Social & Behavioral Science (CSBS), University of Utah.
2014 – 2016	Advisor, *Enabling the Next Generation of Hazards Researchers*, D. Thomas, S. Brody, & B. Gerber (PIs), National Science Foundation, CMMI-IMEE.

2008 – 2010 Mentor, *Enabling the Next Generation of Hazards Researchers*, Tom Birkland (PI), National Science Foundation, CMMI-IMEE.

2005 John I. Davidson Award for Practical Papers, American Society for Photogrammetry & Remote Sensing – with P. Sutton and D. Theobald.

2005 Leica Geosystems Award for Best Scientific Paper in Remote Sensing, American Society for Photogrammetry & Remote Sensing (ASPRS) – with P. Sutton and D. Theobald.

2003 – 2005 Fellow, *Enabling the Next Generation of Hazards Researchers*, Raymond Burby (PI), National Science Foundation, CMMI-IMEE.

2003 University Consortium for Geographic Information Science (UCGIS) Young Scholar's Award.

1996 – 1999 Dwight D. Eisenhower Doctoral Fellowship, National Highway Institute, Federal Highway Admin., Dept. of Transportation.

1995 International Geographic Information Foundation (IGIF) Award for Best Student Paper, GIS/LIS '95, Nashville, TN.

1995 Outstanding Student in Transportation, UC Santa Barbara, Western Coal Transportation Association.

RESEARCH AND SCHOLARSHIP

Edited volumes and special issues

2017 Cova, T.J. and Tsou, M., *GIS Methods and Techniques*. Vol 1. in *Comprehensive Geographic Information Systems, B. Huang (EIC).* Oxford:Elsevier.

2011 Cova, T.J. and Miles, S.B. (Eds). *Disaster Risk Reduction and Sustainable Development*, Sustainability (ISSN 2071-1050).

2008 Cova, T.J., Miller, H., Beard, K., Frank, A., Goodchild, M. (Eds.), *Geographic Information Science: 5th International Conference (GIScience 2008),* Park City, Utah. Lecture Notes in Computer Science 5266, Springer-Verlag, Berlin.

Journal articles

(Student advisees underlined)

2019	Li, D., Cova, T.J., Dennison, P.E. Why do we need a national address point database to improve wildfire public safety in the US? *International Journal of Disaster Risk Reduction, https://doi.org/10.1016/j.ijdrr.2019.101237*
2018	Li, D., Cova, T.J., Dennison, P.E. Setting wildfire evacuation triggers by coupling fire and traffic simulation models: a spatio-temporal GIS approach. *Fire Technology, 55: 617-642*.
2017	Li, D., Cova, T.J., Dennison, P.E. Setting wildfire evacuation triggers using reverse geocoding. *Applied Geography*, 84: 14-27.
2017	Cova, T.J., Dennison, P.E., Li, D., Drews, F.A., Siebeneck, L.K., Lindell, M.K., Warning triggers in environmental hazards: who should be warned to do what and when? *Risk Analysis*, 37(4): 601-611.
2016	Nicoll, K.A., Cova, T.J., Siebeneck, L.K., Martineau, E. Assessing “preparedness elevated”: seismic risk perception and household adjustment in Salt Lake City, Utah. *Journal of Geography & Natural Disasters, 6: 168.*
2015	Li, D., Cova, T.J., Dennison, P.E., A household-level approach to staging wildfire evacuation warnings using trigger modeling. *Computers, Environment, & Urban Systems,* 54:56-67.
2015	Drews, F.A., Siebeneck, L.K., Cova, T.J., Information search and decision making in computer based wildfire simulations. *Journal of Cognitive Engineering and Decision Making*. 9(3): 229-240.
2015	Hile, R. and Cova, T.J. (2015) Exploratory testing of an artificial neural network classification for enhancement of the social vulnerability index. *ISPRS International Journal of Geo-Information,* 4(4): 1774-1790.
2014	Drews, F.A., Musters, A., Siebeneck, L.K., and Cova, T.J. Environmental factors that affect wildfire protective-action recommendations. *International Journal of Emergency Management,* 10(2): 153-168.

2014	Siebeneck, L.K., and Cova, T.J. Risk communication after disaster: re-entry following the 2008 Cedar River Flood. *Natural Hazards Review,* 15: 158-166.
2014	Dennison, P.E., Fryer, G.K., and Cova, T.J., Identification of fire fighter safety zones using lidar, *Environmental Modelling and Software*, 59: 91-97.
2013	Fryer, G., Dennison, P.E. and Cova, T.J. Wildland firefighter entrapment avoidance: modeling evacuation triggers. *International Journal of Wildland Fire,* 22(7): 883-893.
2013	Cova, T.J., Theobald, D.M, Norman, J., and Siebeneck, L.K., Mapping wildfire evacuation vulnerability in the western US: the limits of infrastructure. *Geojournal*, 78(2): 273-285.
2012	Siebeneck, L.K. and Cova, T.J., Spatial and temporal variation in evacuee risk perception throughout the evacuation and return-entry process. *Risk Analysis*, 32(9), 1468-1480.
2011	Cova, T.J., Dennison, P.E., Drews, F.A., Modeling evacuate versus shelter-in-place decisions in wildfires. *Sustainability,* 3(10): 1662-1687.
2011	Cao, L., Cova, T.J., Dennison, P.E., and Dearing, M.D., Using MODIS imagery to predict hantavirus risk. *Global Ecology and Biogeography,* 20: 620-629.
2011	Kobayashi, T., Medina, R., and Cova, T.J., Visualizing diurnal population change in urban areas for emergency management. *Professional Geographer*, 63: 113-130.
2011	Larsen, J.C., Dennison, P.E., Cova, T.J., Jones, C. Evaluating dynamic wildfire evacuation trigger buffers using the 2003 Cedar Fire. *Applied Geography,* 3: 12-19.
2010	Pultar, E., Cova, T.J., Yuan, M., and Goodchild, M.F., EDGIS: a dynamic GIS based on space-time points. *International Journal of Geographical Information Science*, 24: 329-346.
2010	Moffatt, S.F. and Cova, T.J., Parcel-scale earthquake loss estimation with HAZUS: a case-study in Salt Lake County, Utah. *Cartography and Geographic Information Science*, 37: 17-29.
2010	Anguelova, Z., Stow, D.A., Kaiser, J., Dennison, P.E., Cova, T.J., Integrating fire behavior and pedestrian mobility models

to assess potential risk to humans from wildfires within the US-Mexico border zone. *Professional Geographer*, 62: 230-247.

2009 Cova, T.J., Drews, F.A., Siebeneck, L.K. and Musters, A., Protective actions in wildfires: evacuate or shelter-in-place? *Natural Hazards Review*, 10(4): 151-162.

2009 Pultar, E., Raubal, M., Cova, T.J., Goodchild, M.F. Dynamic GIS case studies: wildfire evacuation and volunteered geographic information. *Transactions in GIS*, 13: 84-104.

2008 Siebeneck, L.K., and Cova, T.J., An assessment of the return-entry process for Hurricane Rita 2005. *International Journal of Mass Emergencies and Disasters*, 26(2): 91-111.

2007 Goodchild, M.F., Yuan, M., and Cova, T.J., Towards a theory of geographic representation. *International Journal of Geographical Information Science*, 21(3): 239-260.

2007 Kim, T.H., and Cova, T.J., Tweening grammars: deformation rules for representing change between discrete geographic entities. *Computers, Environment & Urban Systems,* 31(3): 317-336.

2007 Dennison, P.E., Cova, T.J., and Moritz, M.A., WUIVAC: A wildfire evacuation trigger model applied in strategic scenarios. *Natural Hazards*, 40, 181-199.

2007 VanLooy, J. and Cova, T.J., A GIS-based index for comparing airline flight path vulnerability to volcanoes. *Professional Geographer*, 59(1): 74-86.

2006 Sutton, P.C., Cova, T.J., Elvidge, C., Mapping "Exurbia" in the conterminous U.S. using nighttime satellite imagery. *Geocarto International*, 21(2): 39-45.

2006 Kim, T.H., Cova, T.J., and Brunelle, A., Exploratory map animation for post-event analysis of wildfire protective action recommendations. *Natural Hazards Review*, 7(1): 1-11.

2005 Cova, T.J., Dennison, P.E., Kim, T.H., and Moritz, M.A., Setting wildfire evacuation trigger-points using fire spread modeling and GIS. *Transactions in GIS*, 9(4): 603-617.

2005 Cova, T.J., Public safety in the urban-wildland interface: Should fire-prone communities have a maximum occupancy? *Natural Hazards Review*, 6(3): 99-108.

2004 Cova, T.J., Sutton, P.A, Theobald, D.M., Exurban change detection in fire-prone areas with nighttime satellite imagery. *Photogrammetric Engineering & Remote Sensing,* 70: 1249-1257.

2003 Cova, T.J., and Johnson, J.P., A network flow model for lane-based evacuation routing. *Transportation Research Part A: Policy and Practice*, 37: 579-604.

2002 Cova, T.J. and Johnson, J.P., Microsimulation of neighborhood evacuations in the urban-wildland interface. *Environment and Planning A,* 34: 2211-2229.

2002 Cova, T.J. and Goodchild, M.F., Extending geographic representation to include fields of spatial objects. *International Journal of Geographic Information Science,* 16: 509-532.

2000 Cova, T.J., and Church, R.L., Contiguity constraints for single-region site search problems. *Geographical Analysis*, 32: 306-329.

2000 Church, R.L., and Cova, T.J., Mapping evacuation risk on transportation networks with a spatial optimization model. *Transportation Research Part C: Emerging Technologies*, 8: 321-336.

2000 Cova, T.J., and Church, R.L., Exploratory spatial optimization in site search: a neighborhood operator approach. *Computers, Environment, & Urban Systems*, 24: 401-419.

2000 Radke, J., Cova, T.J., Sheridan, M.F., Troy, A., Lan, M., and Johnson, R., Application challenges for GIScience: implications for research, education, and policy for risk assessment, emergency preparedness and response, *Urban and Regional Information Systems Association (URISA) Journal*, 12: 15-30.

1997 Cova, T.J., and Church, R.L., Modeling community evacuation vulnerability using GIS. *International Journal of Geographical Information Science*, 8: *763-784.*

Book Chapters and Sections

2019 Cova, T.J., *Evacuation*. Encyclopedia of Wildfires and Wildland-Urban Interface (WUI) Fires.

2017 Cova, T.J., Data model: o-fields and f-objects. The International Encyclopedia of Geography, 1-5.

2016 Cova, T.J., Evacuation Planning, in *Encyclopedia of Transportation*, SAGE Publications, M. Garrett (ed.), pp.

2004 Cova, T.J., and Conger, S., Transportation hazards, in *Handbook of Transportation Engineering*, M. Kutz (ed.), pp. 17.1-17.24.

1999 Cova, T.J., GIS in emergency management. In *Geographic Information Systems: Principles, Techniques, Applications, and Management*, Longley, P., Goodchild, M.F., Maguire D., Rhind D. (eds), pp. 845-858.

Conference Papers and Posters

2019 Cova, T.J., Geosimulating hazard warning triggers: geometry, dynamics, and timing. *GeoCompuation '19*, September 19, Queenstown, New Zealand.

2015 Li, D., Cova, T.J., Dennison, P.E., An open-source software system for setting wildfire evacuation triggers. ACM SIGSPATIAL EM-GIS'15, November 3, 2015, Seattle, WA.

2013 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers: Modeling and Analysis. *Natural Hazards Workshop*, University of Colorado, Boulder, July (poster).

2012 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers. *Natural Hazards Workshop*, University of Colorado, Boulder, July (poster).

2012 Cova, T.J., Dennison, P.E., and Drews, F.A. Protective-action Triggers. National Science Foundation-CMMI Innovation Conference, Boston, July (poster).

2009 Siebeneck, L.K. and Cova, T.J. Current Research at the Center for Natural and Technological Hazards. *Natural Hazards Workshop*, U. of Colorado, Boulder, July (poster).

2008	Cova, T.J. et al., Protective actions in wildfire: the incident commander perspective. *Pacific Coast Fire Conference*, San Diego, November (poster).
2005	Yuan, M., Goodchild, M.F., Cova, T.J., Towards a general theory of geographic representation in GIS (poster*). Conference on Spatial Information Theory (COSIT) 2005*, Ellicottville, New York, September (poster).
2005	Kim, T.H., and Cova, T.J., Tweening Grammars: Deformation Rules for Representing Change between Discrete Geographic Entities*. Geocomputation 2005,* Ann Arbor, MI, August*.*
2001	Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.
2001	Hepner, G.F., Cova, T.J., Forster, R.R., and Miller, H.J., Use of remote sensing and geospatial analysis for transportation hazard assessment: an integrated university, government and private sector consortium, *IEEE/ISPRS Joint Workshop on Remote Sensing and Data Fusion over Urban Areas Proceedings*, IEEE-01EX482,Rome, Italy, pp.241-244.
2000	Atwood, G., and Cova, T.J., Using GIS and linear referencing to analyze the 1980s shorelines of Great Salt Lake, Utah, USA. *4th International Conference on Integrating GIS and Environmental Modeling (GIS/EM4): Problems, Prospects and Research Needs*. Banff, Alberta, Canada, September 2-8.
1997	Cova, T.J., and Church, R.L., An algorithm for identifying nodal clusters in a transportation network. *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, Maine, June 15-21.
1995	Cova, T.J., and Church, R.L., A spatial search for neighborhoods that may be difficult to evacuate, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 203-212.
1995	Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS, *Proceedings GIS/LIS '95*, ACSM/ASPRS, Nashville, TN, vol. 1, 354-364.
1994	Cova, T.J. and Goodchild, M.F., Spatially distributed navigable databases for intelligent vehicle highway systems, *Proceedings GIS/LIS '94*, ACSM, Phoenix, AZ, 191-200.

Other Publications

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Evaluating and enhancing public transit systems for operational efficiency and access equity.* TREC Final Report, NITC-RR-1024.

2018 Wei, R., Golub, A., Wang, L., Cova, T.J. *Integrated performance measures: transit equity & efficiency*. TREC Final Report, NITC-RR-1024.

2008 Siebeneck, L.K. and Cova, T.J. Risk perception associated with the evacuation and return-entry process of the Cedar Rapids, Iowa flood. Quick Response Research Report, Natural Hazards Center, University of Colorado, Boulder.

2006 Cova, T.J., *Concerning Stonegate and Public Safety*. North County Times, San Diego, California, Nov. 3.

2002 Cova, T.J., Like a bat out of hell: simulating wildfire evacuations in the urban interface, *Wildland Firefighter Magazine*, November, 24-29.

2000 Cova, T.J., When all hell breaks loose: firestorm evacuation analysis and planning with GIS, *GIS Visions Newsletter*, August, The GIS Cafe.

2000 Cova, T.J. (2000) Wildfire evacuation. *New York Times letter to the Editor*, June 6.

1996 Church, R., Cova, T., Gerges, R., Goodchild, M., Conference on object orientation and navigable databases: report of the meeting. *NCGIA Technical Report 96-9.*

1994 Church, R., Coughlan, D., Cova, T., Goodchild, M., Gottsegen, J., Lemberg, D., Gerges, R., Caltrans Agreement 65T155, Final Report, *NCGIA Technical Report 94-6*.

Invited Lectures, Presentations and Participation

2019 “Public safety in the wildland-urban interface.” Department of Geography, University of Alabama, Tuscaloosa, November.

2019 “Public safety in the wildland-urban interface.” Department of Geography, Texas A&M (TAMU), College Station, February.

2018 “ESRI Science Symposium.” Panelist, ESRI Conference, San Diego, July.

2018	“Public safety in the wildland-urban interface.” Living with Fire in California’s Coast Ranges, Sonoma, May.
2017	“Improving situational awareness in wildfire evacuations with volunteered geographic information.” NSF IBSS/IMEE Summer Workshop, San Diego, August.
2014	“Modeling adaptive warnings with geographic trigger points.” Department of Geography, SDSU, San Diego, CA, April 18.
2013	“Wildfires and geo-targeted warnings.” Geo-targeted Alerts and Warnings Workshop. *National Academy of Sciences*, Washington DC, February 21-22.
2012	“Evacuation planning in the wildland-urban interface.” California Joint Fire Science Program, Webinar Speakers Series, September.
2010	“Evacuating threatened populations in disasters: space, time & information.” University of Minnesota, Spatial Speakers Series (Geography/CS/CE), April.
2009	“The art and science of evacuation modeling.” Utah Governor’s Conf. in Emergency Management, Provo, May.
2008	“GIScience and public safety.” Brigham Young University, November.
2007	“Fire, climate and insurance.” Panel Discussion. Leonardo Museum, Salt Lake City, November.
2007	“GIScience and public safety.” University of Northern Iowa, April.
2006	“Evacuation and/or Shelter in Place.” Panel Discussion, Firewise Conference: Backyards & Beyond, Denver, CO, Nov.
2006	“Evacuation modeling and planning.” Colorado Springs Fire Department, Colorado Springs, CO, October.
2006	“Evacuation modeling and planning.” Sante Fe Complexity Institute, Sante Fe, NM, August.
2006	“Evacuation modeling and planning.” Colorado Wildfire Conference. Vail, CO, April, $1000.
2006	“Dynamic GIS: in search of the killer app.” Center for Geocomputation, National U. of Ireland, Maynooth, April.

2006	“Setting wildfire evacuation trigger points with GIS.” University Consortium for Geographic Information Science, Winter meeting, Washington, DC.
2005	“Setting wildfire evacuation trigger points with GIS.” Pennsylvania State University, State College, PA, November.
2004	“The role of scale in ecological modeling,” NSF PI meeting for Ecology of Infectious Diseases, Washington D.C., September.
2004	“The 2003 Southern California wildfires: Evacuate and/or or shelter-in-place,” Natural Hazards Workshop, Boulder, CO.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of Denver, February.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” Colorado Governor’s Conference and Colorado Emergency Management Association (CEMA) Conference, Boulder, CO, February.
2004	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Department of Geography, University of California Los Angeles, February.
2003	“When all hell breaks loose: new methods for wildfire evacuation planning,” colloquium, Natural Resources Ecology Lab (NREL), Colorado State University, April.
2003	“When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, University of Arizona, January.
2002	“When all hell breaks loose: new methods for wildfire evacuation planning,” Departmental colloquium, Department of Geography, Western Michigan University, November.
2001	"Regional evacuation analysis in fire-prone areas with limited egress," Departmental colloquium, Department of Geography, University of Denver, May.
2000	“Integrating Site Search Models and GIS,” Colloquium, Department of Geography, Arizona State University, Feb.
1999	“Site Search Problems and GIS,” Colloquium, Department of Geography, University of Utah.

1996	"A spatial search for neighborhoods that may be difficult to evacuate," Colloquium, Department of Geography, UC Santa Barbara.
1995	"A spatial search for neighborhoods that may be difficult to evacuate," Regional Research Lab, Bhopal, India.
1995	"A spatial search for neighborhoods that may be difficult to evacuate," Indian Institute of Technology, Bombay. India.

Papers Presented at Professional Conferences

2018	Cova, T.J., GIScience & Emergency Management: where do we go from here? Association of American Geographers Annual Meeting, New Orleans, LA, April.
2017	Cova, T.J., Simulating warning triggers. Association of American Geographers Annual Meeting, Boston, MA, CA, April.
2016	Cova, T.J., Spatio-temporal representation in modeling evacuation warning triggers. Association of American Geographers Annual Meeting, San Francisco, CA, March.
2015	Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. Association of American Geographers Annual Meeting, Chicago, IL, April.
2014	Cova, T.J. and Jankowski, P., Spatial uncertainty in object-fields: the case of site suitability. International Conference on Geographic Information Science (GIScience '14), Vienna, Austria, September.
2013	Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers: modeling and analysis. *Association of American Geographers Annual Meeting*, Los Angeles, CA, April.
2012	Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the Natural Hazards Workshop, University of Colorado, Boulder, July.
2012	Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers. Poster presented at the NSF CMMI Innovation Conference, Boston, July.

2012 Cova, T.J., Dennison, P.E. and Drews, F.A., Protective-action triggers, *Association of American Geographers Annual Meeting,* New York, NY, February.

2011 Cova, T.J., Modeling stay-or-go decisions in wildfires, *Association of American Geographers Annual Meeting,* Seattle, WA, April.

2010 Cova, T.J., Theobald, D.M. and Norman, III, J., Mapping wildfire evacuation vulnerability in the West, *Association of American Geographers Annual Meeting,* Wash. D.C., April.

2010 Cova, T.J., and Van Drimmelen, M.N., Family gathering in evacuations: the 2007 Angora Wildfire as a case study. *National Evacuation Conference*, New Orleans, February.

2010 Siebeneck, L.K., Cova, T.J., Drews, F.A., and Musters, A. Evacuation and shelter-in-place in wildfires: The incident commander perspective. *Great Basin Incident Command Team Meetings*, Reno, April.

2009 Cova, T.J. et al., Protective action decision making in wildfires: the incident commander perspective. *Association of American Geographers Annual Meeting,* Las Vegas, March.

2009 Siebeneck, L.K. and Cova, T.J. Using GIS to explore evacuee behavior before, during and after the 2008 Cedar Rapids Flood. *Association of American Geographers Annual Meeting*, Las Vegas, March.

2009 Lindell, M.K., Prater, C.S., Siebeneck, L.K. and Cova, T.J. Hurricane Ike Reentry. *National Hurricane Conference*, Austin, March.

2008 Cova, T.J., Simulating evacuation shadows, *Association of American Geographers Annual Meeting,* Boston, April.

2007 Cova, T.J., An agent-based approach to modeling warning diffusion in emergencies, *Association of American Geographers Annual Meeting,* San Francisco, March.

2006 Cova, T.J., New GIS-based measures of wildfire evacuation vulnerability and associated algorithms. *Association of American Geographers Annual Meeting,* Denver, March.

2005 Cova, T.J., Dennison, P.E., Kim, T.H., and Moritz, M.A., Setting wildfire evacuation trigger-points using fire spread modeling and GIS. *Association of American Geographers Annual Meeting,* Denver, March.

2004 Cova, T.J., Sutton, P.C., and Theobald, D.M. Light my fire proneness: residential change detection in the urban-wildland interface with nighttime satellite imagery, *Association of American Geographers Annual Meeting*, Philadelphia, March.

2004 Cova, T.J. and Johnson, J.P., A network flow model for lane-based evacuation routing. *Transportation Research Board (TRB) Annual Conference*, Washington, D.C., January.

2003 Cova, T.J. Lane-based evacuation routing, *Association of American Geographers Annual Meeting*, New Orleans, March.

2002 Cova, T.J., Extending geographic representation to include fields of spatial objects, *GIScience 2002*, Boulder, September.

2002 Husdal, J. and Cova, T.J., A spatial framework for modeling hazards to transportation systems, *Association of American GeographersAnnual Meeting,* Los Angeles, March.

2001 Cova, T.J. and Johnson, J.P., Evacuation analysis and planning tools inspired by the East Bay Hills Fire, *California's 2001 Wildfire Conference: 10 years after the 1991 East Bay Hills Fire*, Oakland, October.

2001 Cova, T.J., Husdal, J., Miller, H.J., A spatial framework for modeling hazards to transportation networks, *Geographic Information Systems for Transportation Conference (GIS-T 2001*), Washington DC, April.

2001 Cova, T.J., Miller, H.J., Husdal, J., A spatial framework for modeling hazards to transportation systems, *Association of American Geographers Annual Meeting*, New York, New York, February.

2000 Cova, T.J., Church, R.L., Goodchild, M.F., Extending geographic representation to include fields of spatial objects, *GIScience 2000,* Savannah, Georgia, November.

2000 Cova, T.J. Microscopic simulation in regional evacuation: an experimental perspective, *Association of American Geographers Annual Meeting*, Pittsburgh, Pennsylvania, March.

1999 Cova, T.J., and Church, R.L., “Exploratory spatial optimization and site search: a neighborhood operator approach,” *Geocomputation ’99*, Mary Washington College, Fredricksburg, Virginia.

1999 Cova, T.J., and Church, R.L., “Integrating models for optimal site selection with GIS: problems and prospects,” *Association of American Geographer Annual Meeting*, Honolulu, Hawaii, March 29.

1998 Cova, T.J., and Church, R.L., “A spatial analytic approach to modeling neighborhood evacuation egress,” *Association of American Geographers Annual Meeting,* Boston, Massachusetts.

1997 Church, R.L., and Cova, T.J., “Location search strategies and GIS: a case example applied to identifying difficult to evacuate neighborhoods,” *Regional Science Association Annual Meeting*, November, Buffalo.

1997 Cova, T.J. and Church, R.L., “An algorithm for identifying nodal clusters in a transportation network,” *University Consortium for Geographic Information Science (UCGIS) Summer Retreat*, Bar Harbor, June.

1996 Cova, T.J., Church, R.L., “A spatial search for difficult neighborhoods to evacuate using GIS,” *GIS and Hazards Session*, *Association of American Geographers Annual Meeting*, Charlotte, April.

1995 Cova, T.J., Church, R.L., “A spatial search for neighborhoods that may be difficult to evacuate,” *GIS/LIS ’95*, Nashville, November.

1995 Goodchild, M.F., Cova, T.J. and Ehlschlaeger, C., “Mean geographic objects: extending the concept of central tendency to complex spatial objects in GIS,” *GIS/LIS ‘95*, Nashville, November.

1994 Cova, T.J. and Goodchild, M.F., “Spatially distributed navigable databases for intelligent vehicle highway systems,” *GIS/LIS ’94*, Phoenix, November.

Grants

Externally funded

2019 –	Cova, T.J. (PI), Collins, T.W., Grineski, S.E., Norton, T., *Enabling the Next Generation of Hazards Researchers*. National Science Foundation. Division of Civil, Mechanical & Manufacturing Innovation (CMMI): Humans, Disasters & the Built Environment (HDBE), $480,634.
2018 –	Smith, K. (PI), Cova, T.J., Waitzman, N., Perlich, P., Kowaleski-Jones, L. Research Data Center: Wasatch Front Research Data Center. National Science Foundation, Division of Social Economic Sciences, $298,625.
2017 – 2019	Shoaf, K. (PI) and Cova, T.J. *RAPID: Evacuation Decision-making process of Hospital Administrators in Hurricane Harvey*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $49,301.
2011 – 2015	Cova, T.J. (PI), Dennison, P.E. and Drews, F.A., *Protective action triggers*. National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $419,784.
2012 – 2014	Cova, T.J. (PI), *State Hazard Mitigation Mapping II.* Utah Division of Emergency Management, $51,608.
2011 – 2012	Cova, T.J. (PI), *State Hazard Mitigation Mapping.* Utah Division of Emergency Management, $51,608.
2007 – 2010	Cova, T.J. (PI) and Drews, F.A. *Protective-action decision making in wildfires.* National Science Foundation, Civil Mechanical and Manufacturing Innovation – Infrastructure Management and Extreme Events, $288,438.
2004– 2006	Yuan, M. (PI), Goodchild, M.F., and Cova, T.J. *Integration of geographic complexity and dynamics into geographic information systems,* National Science Foundation, Social and Behavioral Science—Geography and Spatial Sci., $250,000.
2003– 2004	Cova, T.J. (PI) *Mapping the 2003 Southern California Wildfire Evacuations*, National Science Foundation, Small Grants for Exploratory Research (SGER), CMMI-IMEE, $14,950.
2003 –2008	Dearing, M.D. (PI), Adler, F.R., Cova, T.J., and St. Joer, S. *The effect of anthropogenic disturbance on the dynamics of*

	Sin Nombre, National Science Foundation and NIH, Ecology of Infectious Diseases, $1,933,943.
2000–2004	Hepner, G.F. (PI), Miller, H.J., Forster, R.R., and Cova, T.J. *National Consortium for Remote Sensing in Transportation: Hazards (NCRST-H),* U.S. Department of Transportation, $437,659.
2000–2001	Cova, T.J. (PI) *Modeling human vulnerability to environmental hazards*, Salt Lake City and Federal Emergency Management Agency (FEMA)*,* $20,000.

Internally funded

2004	Cova, T.J. (PI) and Sobek, A. *DIGIT Lab GPS Support*, U. of Utah Technology Instrumentation Grant, $15,000.
2003	Cova, T.J. (PI) *New methods for wildfire evacuation analysis*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.
1999	Cova, T.J. (PI) *Microscopic traffic simulation of regional evacuations: computational experiments in a controlled environment*, Faculty Research Grant (FRG), University Research Committee, University of Utah, $5980.
1999	Cova, T.J. (PI) *Regional evacuation analysis in fire prone areas with limited egress*, Proposal Initiative Grant, College of Social and Behavioral Science, University of Utah, $4000.

Media Outreach

2019	Krieger, L., "Camp Fire: when survival means shelter." *San Jose Mercury News*, Feb. 3.
2018	Romero, S., Arango, T., and Fuller, T. "A frantic call, a neighbor's knock, but few official alerts as wildfire closed in." *New York Times*, Nov. 21.
2018	Serna, J., St. John, P., Lin, R-G. "Disaster after disaster, California keeps falling short on evacuating people from harm's way." *Los Angeles Times*, Nov. 28.
2018	Simon, M. "How California needs to adapt to survive future fires." *Wired Magazine*, Nov. 15.
2018	O'Neill, S. "Year-round wildfire season means always living evacuation ready." Morning Addition, *National Public Radio*, Sep. 25.
2017	Mortensen, M. "System used for Amber Alerts can also warn of other emergencies." Utah Public Radio, Dec. 19.

2013	Ryman, A. and Hotstege, S. "Yarnell evacuation flawed and chaotic, experts say." *Arizona Republic and USA Today*, Nov.
2013	Bryson, D., and Campoy, A. "Quick fire response pays off: Colorado credits early alerts with limiting deaths from state's worst-ever blaze." *The Wall Street Journal*, June 17.
2013	Beri, A. "Due to the sequester: people are going to be unsafe, homes are going to burn." *Tampa Bay Times*, Feb.
2012	Zaffos, J. "What the High Park Fire can teach us about protecting homes." *High Country News*, July.
2012	Meyer, J.P. and Olinger, D., "Tapes show Waldo Canyon fire evacuations delayed two hours." *The Denver Post*. July.
2011	Siegel L, and Rogers, N. "Monitoring killer mice from space." *USA Today*, *SLTribune, Fox 13 News, KCPW*, Feb. 15.
2010	Cowan, J., "Esplin defends stay or go policy." *Australian Broadcast Corporation (ABC)*, April 30.
2010	Bachelard, M., "Should the fire-threatened stay or go? That is still the question." *The Age*, Australia, May 2.
2008	Boxall, B., "A Santa Barbara area canyon's residents are among many Californian's living in harm's way in fire-prone areas." *Los Angeles Times*, July 31.
2007	Welch, W.M. et al., "Staggering numbers flee among fear and uncertainty." *USA Today*, Oct. 24.
2007	Krasny, M., "Angora Wildfire Panel Discussion." *KQED Radio*, San Francisco, June 27.
2004	Wimmer, N., "Growing number of communities pose fire hazard." *KSL Channel 5,* Salt Lake City, July 22.
2004	Disaster News Network, "The face of evacuation procedures might be changing as a result of lessons learned from last year's fierce wildfires in California."
2004	Perkins, S., "Night space images show development." *Science News*, Week of April 3rd, 165 (14): 222.
2003	Keahey, J., "Canyon fire trap feared." *SL Tribune*, June.

TEACHING AND MENTORING

Undergraduate Courses

Geoprogramming (~30 students)
Introduction to Geographic Information Systems (~60 students).
Human Geography (~40 students).
Geography of Disasters and Emergency Management (~20 students).
Methods in GIS (~40 students).

Graduate Courses

GIS & Python (~20 students)
Spatial Databases (~30 students)
Seminars: Hazards Geography, Transportation, Vulnerability, GIScience.

Graduate Student Advising

Chaired Ph.D. Committees

2017-	Coleman, A.	Geographic data fusion for disaster management
2016	Li, D.	Modeling wildfire evacuation triggers as a coupled natural-human system (Asst. Professor South Dakota State University)
2010	Siebeneck, L.	Examining the geographic dimensions of risk perception, communication and response during the evacuation and return-entry process. (Assoc. Professor, U. of North Texas)
2010	Cao, L.	Anthropogenic habitat disturbance and the dynamics of hantavirus using remote sensing, GIS, and a spatially explicit agent-based model. (Postdoc, Kelly Lab, UC Berkeley)

Chaired M.S. committees

2019-	Riyadh, A.	Flood resilience in Dhaka, Bangladesh
2018-	Huang, Z.	Autonomous vehicles in hurricane evacuation.
2019	Kar, A.	Optimal vehicle routing in disasters
2017	Yi, Y.	A web-GIS application for house loss notification in wildfires
2017	Latham, P.	Evaluating the effects of snowstorm frequency and depth on skier behavior in Big Cottonwood Canyon, Utah
2016	Bishop, S.	Spatial access and local demand for emergency medical services in Utah
2015	Hile, R.	Exploratory testing of an artificial network classification for enhancement of a social vulnerability index
2015	Unger, C.	Creating spatial data infrastructure to facilitate the collection and dissemination of geospatial data to aid in disaster management
2014	Klein, K.	Tracking a wildfire in areas of high relief using volunteered geographic information: a viewshed application
2012	Amussen, F.	Greek island social networks and the maritime shipping dominance they created (technical report)
2012	Martineau, E.	Earthquake risk perception in Salt Lake City, Utah
2010	Smith, K.	Developing emergency preparedness indices for local government

2010	VanDrimmelen, M.	Family gathering in emergencies: the 2007 Angora Wildfire as a case study
2007	Pultar, E.	GISED: a dynamic GIS based on space-time points
2007	Siebeneck, L.	An assessment of the return-entry process for Hurricane Rita, 2005
2007	Johnson, J.	Microsimulation of neighborhood-scale evacuations
2004	Chang, W.	An activity-based approach to modeling wildfire evacuations

Membership on Ph.D Committees

2017	Campbell, M.	Wildland firefighter travel times
2016	Zhang, L.	Economic geography of China
2015	Huang, H.	Spatial analysis and economic geography
2014	Lao, H.	Spatial analysis, GIS, and economic geography
2013	Burgess, A.	Hydrologic implications of dust in snow in the Upper Colorado River Basin
2012	Davis, J.	
2012	Li, Y.	
2011	Hadley, H.	Transit sources of salinity loading in the San Rafael River, Upper Colorado River Basin, Utah
2009	Medina, R.	Use of complexity theory to understand the geographical dynamics of terrorist networks
2008	McNeally, P.	Holistic geographical visualization of spatial data with applications in avalanche forecasting
2008	Sobek, A.	Generating synthetic space-time paths using a cloning algorithm on activity behavior data
2007	Clay, C.	Biology
2006	Backus, V.	Assessing connectivity among grizzly bear populations near the U.S.-Canada border
2006	Atwood, G.	Shoreline superelevation: evidence of coastal processes of Great Salt Lake, Utah
2006	White, D.	Chronic technological hazard: the case of agricultural pesticides in the Imperial Valley, California
2005	Ahmed, N.	Time-space transformations of geographic space to explore, analyze and communicate transportation systems
2004	Shoukrey, N.	Using remote sensing and GIS for monitoring settlement growth expansion in the eastern part of the Nile Delta Governorates in Egypt (1975-1998)
2004	Hernandez, M.	A Procedural Model for Developing a GIS-Based Multiple Natural Hazard Assessment: Case Study-Southern Davis County, Utah
2003	Wu, Y-H.	Dynamic models of space-time accessibility

2003	Hung, M.	Using the V-I-S model to analyze urban environments from TM imagery
2002	Baumgrass, L.	Initiation of snowmelt on the North Slope of Alaska as observed with spaceborne passive microwave data

Membership on M.S. Committees

2015	Farnham, D.	Food security and drought in Ghana
2015	Fu, L.	Analyzing route choice of bicyclists in Salt Lake City
2014	Li, X.	Spatial representation in the social interaction potential metric: an analysis of scale and parameter sensitivity
2013	Johnson, D.	Parks, Recreation & Tourism
2012	Fryer, G.	Wildland firefighter entrapment avoidance: developing evacuation trigger points utilizing the WUIVAC fire spread model.
2011	Groeneveld, J.	An agent-based model of bicyclists accessing light-rail in Salt Lake City
2011	Matheson, D.S.	Evaluating the effects of spatial resolution on hyperspectral fire detection and temperature retrieval
2010	Larsen, J.	Analysis of wildfire evacuation trigger-buffer modeling from the 2003 Cedar Fire, California.
2010	Smith, G.	Development of a flash flood potential index using physiographic data sets within a geographic information system
2010	Song, Y.	Visual exploration of a large traffic database using traffic cubes
2010	Evans, J.	Parks, Recreation & Tourism
2008	Naisbitt, W.	Avalanche frequency and magnitude: using power-law exponents to investigate snow-avalanche size proportions through time and space.
2008	Kim, H.C.	Civil Engineering
2007	Gilman, T.	Evaluating transportation alternatives using a time geographic accessibility measure
2004	Baurah, A.	An integration of active microwave remote sensing and a snowmelt runoff model for stream flow prediction in the Kuparak Watershed, Arctic Alaska
2004	Bosler, J.	A Development Response to Santaquin City's Natural Disasters.
2004	Bridwell, S.	Space-time masking techniques for privacy protection in location-based services

2004	Deeb, E.	Monitoring Snowpack Evolution Using Interferometric Synthetic Aperture Radar (InSAR) on the North Slope of Alaska, USA
2004	Sobek, A.	Access-U: a web-based navigation tool for disabled students at the University of Utah
2003	Barney, C.	Locating hierarchical urban service centers along the Wasatch Front using GIS location-allocation algorithms
2002	Koenig, L.	Evaluation of passive microwave snow water equivalent algorithms in the depth hoar dominated snowpack of the Kuparuk River Watershed, Alaska, USA
2002	Larsen, C.	Family & Consumer Studies
2002	Krokoski, J.	Geology & Geophysics
2000	Granberg, B.	Automated routing and permitting system for Utah Department of Transportation
2000	Bohn, A.	An integrated analysis of the Tijuana River Watershed: application of the BASINS model to an under-monitored binational watershed

Graduate student awards

2015	R. Hile., M.A. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2015	D. Li, Ph.D. Geography: Jeanne X. Kasperson Award, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2012	K. Klein, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards, Risk & Disasters Specialty Group, Association of American Geographers.
2010	L. Cao, Ph.D. Geography: *Student Paper Award*, Spatial Analysis and Modeling (SAM) Specialty Group, Association of American Geographers.
2008	L. Siebeneck, M.A. Geography: *Jeanne X. Kasperson Award*, Hazards Specialty Group, Association of American Geographers.
2007	E. Pultar, M.A. Geography: *Best Paper*, GIS Specialty Group, Association of American Geographers.
2006	J. VanLooy (not primary advisor): *Best Paper*, Rocky Mountain Regional Meeting, Association of American Geographers.

Undergraduate Mentoring and Advising

2015	Mentor, Marli Stevens, Undergraduate Research Opportunity Program: “Margin of Licensed Dog and Cat Populations and Adoptions from Animal Shelters in Utah in 2013-2014.”

2015—	Advisor, Undergraduate Hazards & Emergency Management Certificate students (~10 students so far).
2006—2010	Advisor, Stewart Moffat, Honor's B.S. in Undergraduate Studies: Disaster Management (published journal article).
2005—2007	Advisor, Brian Williams, B.S. in Undergraduate Studies: Comprehensive Emergency Management.
2001—	Advisor, Undergraduate GIS Certificate Students (> 100 students).

Junior Faculty Mentoring

2017—	Andrew Linke, Department of Geography, University of Utah
2014—2017	Ran Wei, Department of Geography, University of Utah
2011—2014	Steven Farber, Department of Geography, University of Utah
2009—2011	Scott Miles, Dept. of Geography, Western Washington U.
2009—2011	Timothy W. Collins, Department of Sociology, UT El Paso

SERVICE

Referee Duties

Journals
Applied Geography
Annals of the Association of American Geographers
Cartographica
Computers Environment & Urban Systems
Disasters
Environmental Hazards: Policy and Practice
Geographical Analysis
Geoinformatica
International Journal of Geographical Information Science
Journal of Geographical Systems
Journal of Transport Geography
Natural Hazards
Natural Hazards Review
Networks and Spatial Economics
Photogrammetric Engineering and Remote Sensing
Professional Geographer
Society & Natural Resources
Transportation Research A: Policy & Practice
Transportation Research B: Methodological
Transportation Research C: Emerging Technologies
Transactions in GIS

National Science Foundation Panels
Decision Risk and Uncertainty (1)
Geography and Spatial Science, Doctoral Dissertation Improvement Grant (4)
Civil & Mech. Systems – Infrastructure Management and Extreme Events (2)
Civil & Mech. Systems - Rural Resiliency (1)
NSF and NIH: Big Data (1)
Hazards SEES: Type 2 (1)

Proposals
Center for Disaster Management & Humanitarian Assistance
Faculty Research Grants, University of Utah (3)

External Promotional Reviews
Full Professor (5), Associate Professor (12)

Activities at Professional Conferences

2000 – 2018	**Paper session co-organizer, chair,** "Hazards, GIS and Remote Sensing" session, Annual Meeting of the Association of American Geographers.
2002 – 2003	**Paper session organizer, chair, and judge, "**GIS Specialty Group Student Paper Competition," Association of American Geographers Annual Meeting.
1999	**Paper session organizer**, "Location Modeling and GIS," Annual Meeting of the Association of American Geographers, Honolulu, Hawaii, March.

University Service

2019 –	RPT Standards Committee, Office of the AVP for Faculty
2014 – 2017	Member, Academic Senate
2014 – 2017	Member, University Promotion & Tenure Advisory Committee (UPTAC)
2011 –	Member, Social Science General Education Committee
1999 – 2009	Delegate, University Consortium for GIScience
2013	Member, Graduate Research Fellowship (GRF) Committee
2010 – 2012	Member Student Evaluations Committee, Undergrad. Studies
2009 – 2012	Member, Graduate Council, College of Soc. and Beh. Science
2003 – 2004	Member, Instit. Review Board (IRB) Protocol Committee
2001 – 2004	Member, Social Science General Education Committee

College Service: Social & Behavioral Science

2014 –	Chair, Review, Promotion & Tenure Committee
2012 – 2014	Member, College Review, Promotion, & Tenure Committee
2015	Member, Superior Teaching Committee
2011 – 2012	Chair, Superior Teaching Committee

2007	Member, Search Committee, Inst. of Public and Intern Affairs
2005, 2006	Member, Superior Research Committee
2002, 2004	Member, Superior Teaching Committee

Departmental Service: Geography

2015 –	Member, Undergraduate Committee
2014 –2017	Representative, University Academic Senate
2014 –	Director, Certificate in Hazards & Emergency Management
2014	Author, Proposal for Cert. in Hazards & Emergency Manage.
2012 –	Chair, Review, Promotion & Tenure Committee
2013	Chair, Search Committee for GIScience Position
2012	Co-author, Proposal for MS in GIScience
2011 – 2012	Director of Graduate Studies
2010	Search Committee Chair, Human Geography Position
2004 – 2015	Member, Graduate Admissions Committee
2004 – 2008	Member, Colloquium Committee
2000 –	Chair, Geographic Information Science Area Committee

Public Safety in the Urban–Wildland Interface: Should Fire-Prone Communities Have a Maximum Occupancy?

Thomas J. Cova[1]

Abstract: Residential development in fire-prone wildlands is a growing problem for land-use and emergency planners. In many areas housing is increasing without commensurate improvement in the primary road network. This compromises public safety, as minimum evacuation times are climbing in tandem with vegetation and structural fuels. Current evacuation codes for fire-prone communities require a minimum number of exits regardless of the number of households. This is not as sophisticated as building egress codes which link the maximum occupancy in an enclosed space with the required number, capacity, and arrangement of exits. This paper applies concepts from building codes to fire-prone areas to highlight limitations in existing community egress systems. Preliminary recommendations for improved community evacuation codes are also presented.

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CE Database subject headings: Fire hazards; Evacuation; Access roads; Traffic capacity; Transportation safety; Codes; Public safety; Transportation engineering.

Introduction

Residential development in fire-prone wildlands is a growing problem for land-use and emergency planners. Easy access to recreation, panoramic scenery, and lower property costs are enticing people to build homes in areas that would otherwise be considered wildlands. This development steadily increased in the United States from the mid 1940s, although local growth rates varied according to economic, demographic, and amenity factors (Davis 1990). At the same time, decades of fire suppression has resulted in a record abundance of fuel in and around many developments (Pyne 1997). This led the Forest Service to recently identify thousands of communities near federal lands as "at risk" to large conflagrations (U.S. Forest Service 2001).

The area where residential structures and fire-prone wildlands intermix is called the urban–wildland interface or wildland–urban interface (Cortner et al. 1990; Ewert 1993; Fried et al. 1999). In much of this area, homes are being added as the primary road network remains nearly unchanged. This is not surprising, as interface communities are often nestled in a topographic context that prohibits the construction of more than a few exiting roads. It is generally too expensive to build a road into a canyon, or onto a hillside, from every direction. Also, residents prefer less access because it reduces nonresident traffic. A common road-network addition is a culdesac that branches off an existing road to add more homes.

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Note. Discussion open until January 1, 2006. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on October 7, 2004; approved on February 15, 2005. This paper is part of the ***Natural Hazards Review***, Vol. 6, No. 3, August 1, 2005. ©ASCE, ISSN 1527-6988/2005/3-99–108/$25.00.

Incremental planning in fire-prone areas has a number of adverse impacts (e.g., wildfire effects, open space decline), but the focus in this paper is evacuation egress. "Egress" is defined as a means of exiting, and it can be viewed as accessibility out of an area in an evacuation. When a wildfire threatens a community, residents generally evacuate in a condensed time either voluntarily or by order. In past urban wildfires with short warning time, limited egress has proven to be a problem ("Charing cross bottleneck was a big killer" 1991; Office of Emergency Services 1992). Sheltering-in-place is a competitive protective action when there is not enough time to escape or a homeowner wishes to remain behind to protect property, but it is much less tested than evacuation in wildfires. However given increasing housing densities in fire-prone areas without commensurate improvements in the primary road network, the case for sheltering-in-place is gaining ground. This leads to an important question: "How many households is too many?" Or alternatively, "What is the maximum occupancy of a fire-prone community?"

Maximum occupancies are well defined and enforced in building safety, and it is common to see the maximum number of people allowed in an assembly hall posted clearly on the wall. This concept has not been applied to community development in fire-prone areas, although the broader terms of "access" and "egress" appear in contemporary codes (National Fire Protection Association 2002; International Fire Codes Institute 2003). Egress standards are currently defined in terms of minimum exit-road widths, or a minimum number of exits, without regard to how many people might rely on the exits. This is less sophisticated than building egress codes which link the maximum expected occupancy of an enclosed space with the required number, capacity, and arrangement of exits (Coté and Harrington 2003). Building egress codes have been hard earned over nearly a century of research, refinement, and loss of life (Richardson 2003).

The purpose of this paper is to apply egress concepts drawn from building fire safety to community egress in fire-prone areas. Although these concepts and codes were originally developed for

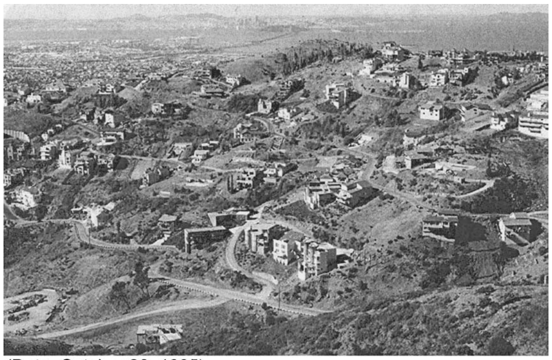

Fig. 1. Looking west at narrow roads surrounding 1991 Oakland–Berkeley fire origin

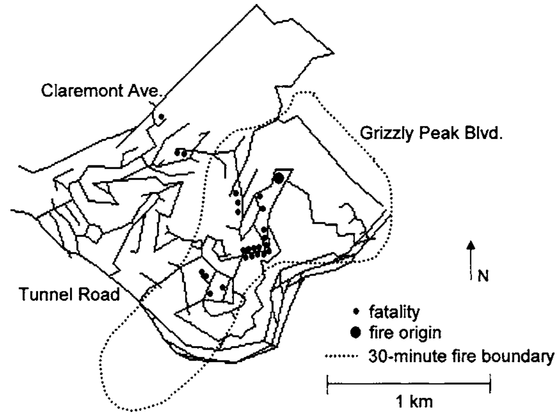

Fig. 2. Fatalities, fire origin, and approximate 30 min fire boundary in 1991 Oakland–Berkeley fire

small-scale, indoor spaces, they have potential utility in fire-prone communities. The first section reviews background on the growing urban–wildland egress problem. The next section reviews basic means-of-egress concepts defined in building codes. A method is presented to compare community egress systems based on concepts and standards from building safety that includes preliminary recommendations for new community egress codes. The paper concludes with a discussion of improvements that can be made to community egress systems.

Growing Urban–Wildland Egress Problem

Representative Communities

There are literally thousands of fire-prone communities in the West with a static road network and steadily increasing housing stock. This section briefly examines 2 representative examples. To date, the dominant focus of planners and residents in these communities has been structure protection with much less attention focused on egress issues. This may be due to the fact that property loss in wildfires is much more common than loss of life. Poor egress in interface communities is generally the result of narrow roads, irregular intersections, and few exits. In most of these areas the likelihood of an extreme fire is increasing in tandem with the vulnerability created by steadily climbing minimum evacuation times. Without fire to rejuvenate the ecological system, vegetation advances toward its fire recurrence interval as home construction adds additional fuel, residents, and vulnerability (Rodrigue 1993; Radke 1995; Cohen 2000; Cutter 2003).

Buckingham, Oakland, Calif.

Fig. 1 shows the neighborhood at the origin of the 1991 Oakland–Berkeley Fire 4 years after the fire. Without vegetation to obscure the view, it is clear that the road network is a maze of narrow streets. The photo was taken during the initial rebuilding process when hazard abatement procedures were being considered. At the time of the fire there were 337 homes in this neighborhood with four exits. The fire blocked the two primary exits in its first 1/2 h (Tunnel Road east and west), leaving the remaining residents two narrow, uphill exits. Most of these residents chose to leave on Charing Cross Road, a 13 ft wide afterthought that was not designed to handle this volume. Many of the fatalities (Fig. 2) were residents caught in or near their cars at the end of a traffic queue when the fire passed.

Mission Canyon, Santa Barbara, Calif.

Mission Canyon is a community just northwest of downtown Santa Barbara, Calif. that is adjacent to a chaparral ecosystem. The basic road network geometry was established in the 1930s and has changed little since (Fig. 3). In 1938 there were four households in the upper canyon using two exits (shown in white), but by 1990 there were more than 400 households relying on the same two exits. All households north the two exits (above) must use one of these two exits to leave, but households south of these exits (below) have more exiting options. The area was originally grasslands, but today it contains a significant amount of flammable, non-native vegetation (e.g., Eucalyptus) intermixed with wood structures. Prior evacuation studies have concluded that

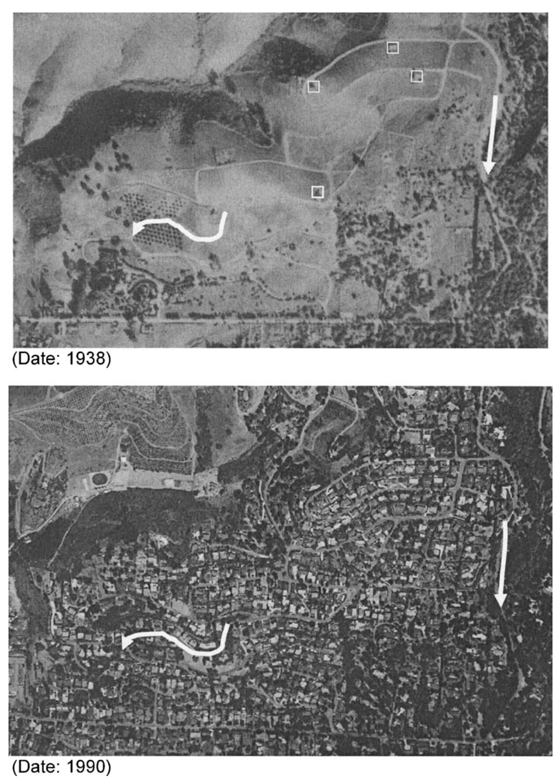

Fig. 3. Mission Canyon in 1938 (4 homes, 2 exits in white) and 1990 (400+homes, same 2 exits in white)

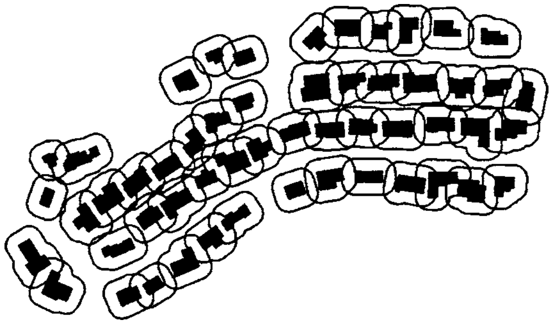

Fig. 4. Overlapping home ignition zones in fire-prone neighborhood (30 ft defensible-space buffer)

clearing upper Mission Canyon in the event of a wildfire would be relatively difficult (Cova and Church 1997; Law 1997; Church and Sexton 2002).

Protective Actions in Wildfires

Protective actions in a wildfire differ from a building fire in that sheltering-in-place in a structure, water body or safe zone (e.g., parking lot or golf course) is possible. This distinction is important because it means that evacuating a community may not be the best protective action in some cases (Krusel and Petris 1992). However, these cases can be difficult to assess during an event. Given more than enough time to evacuate, this is generally the best option for protecting life. If there is little to no time to evacuate, sheltering-in-place is likely the best option because evacuees risk being overcome by the fire in transit with much less protection than offered by a shelter. In the middle lies a gray area where evacuating may be the best option. As strongly as many experts feel about this issue (Wilson and Ferguson 1984; Decker 1995; Packman 1995; Oaks 2000), the uncertainty associated with a scenario can be too great to definitively state the best protective action. It depends on the quality of a shelter, road network geometry, fire intensity, wind speed and direction, visibility, travel demand, water availability and many other factors that are difficult to assess and synthesize under pressure.

A key hurdle in advising people to shelter-in-place in their homes is that not all structures are defensible. A defensible structure offers its occupants sufficient protection to withstand a passing wildfire. This is embodied in the concept of a "home ignition zone," or the area immediately surrounding a structure where ignition is feasible (Cohen 2000). Structures are not defensible if their ignition zones contain substantial fuel, adjacent ignition zones overlap, or both. If ignition zones overlap, then creating a defensible space would require homeowners to clear their neighbors' vegetation (Fig. 4). In other words, the wood structures in this figure are not defensible and an ignition chain reaction is possible. In cases where structures are sufficiently spaced, vegetation and other fuel within the home ignition zone can also render a structure indefensible. This is common because residents in these areas generally embrace trees and the amenities they provide. In dense, residential areas with wood structures, overlapping ignition zones and few viable shelters or safe zones, providing residents with sufficient egress is a critical issue.

Building Egress Codes

Early History

The concept of a maximum occupancy originated in an area of study called "means of egress." A means-of-egress is defined as, "… a continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of three distinct parts: the exit access, exit, and exit discharge (Coté and Harrington 2003, p. 99)." Means-of-egress studies and associated codes incorporate all aspects of evacuating a building from stairway capacities and known crowd behavior under varying density to the proper illumination of exit signs. In setting standards for an enclosed space, an analyst can either examine the number, capacity, and arrangement of exits and calculate a maximum occupancy or, alternatively, examine the expected maximum occupancy and construct the required minimum egress. In either case, state-of-the-art egress standards and methods link occupancy to the number, capacity, and arrangement of exits.

Building egress standards can be traced to an occupancy–density study conducted by Rudolph Miller around 1910 in Manhattan (Nelson 2003). Miller's objective was to tabulate the density of workers per floor in 500 workshops and factories. This resulted in a wide range of densities from 19 to 500 ft^2 per person with the average for all floors at 107 ft^2 per person. In 1913 the National Fire Protection Association established the "Committee on Safety to Life" to study egress and formulate standards with a particular focus on advancing the principle of apportioning means-of-egress to the number of occupants in a building. One of the first egress standards was set by the New York Department of Labor in 1914 which limited the occupancy on each floor to 14 persons for every 22 in. of stair width. In 1935 the National Bureau of Standards published, "Design and construction of building exits," an important work in the history of building egress codes. One finding was that egress codes varied widely in regards to how many exits are needed, where they should be, and their required characteristics. Five different methods were discovered for determining required exits widths, and the report concluded with a new method that required stairwells have sufficient capacity to handle an evacuation of the most populated floor, the current method used in North American codes (Nelson 2003).

Modern Building Egress Codes

Contemporary methods for calculating a maximum occupancy for a building, floor, or meeting room are simple, but the number of possible building space uses and exit types is extensive (Coté and Harrington 2003). For example, the 2003 Life Safety Code© includes detailed exit-capacity adjustments (in persons) for stairways based on the presence, size and positioning of handrails, as well as ramp-capacity adjustments that incorporate ascending or descending slope (National Fire Protection Association 2003). In general, occupant load and building geometry determine the required number, location, and capacity of exits. An important aspect of a means-of-egress is that, "it is only as good as its most constricting component." Furthermore, a good design principle for an egress system is balance among exits because one or more might be lost in a fire.

A central concept in determining building egress is that of an occupant load factor. Occupant load factors are upper limits on density that vary with the use of the space. In other words, the nature of the use of a space determines its allowable density. For example, a "residential apartment building use" is allowed a gross

Table 1. Occupant Load Factors from Life Safety Code®[a]

Use	m^2 per person	ft^2 per person
Assembly use		
Concentrated, without fixed seating	0.65 net	7 net
Less concentrated, without fixed seating	1.4 net	15 net
Educational use		
Classrooms	1.9 net	20 net
Shops, laboratories, vocational rooms	4.6 net	50 net
Day Care use	3.3 net	35 net
Residential use		
Hotels and dorms	18.6 gross	200 gross
Apartment buildings	18.6 gross	200 gross
Industrial use		
General and high hazard	9.3 gross	100 gross

density of 200 ft^2 per person while a "concentrated assembly (without fixed seating) use" allows a much higher net density of 7 ft^2 per person (Table 1). "Net" density refers to rooms, and "gross" density refers to floors or an entire building. Defining the maximum density for an indoor space based on its use is valuable because it bypasses the need to conduct an empirical occupancy study for every building. Occupant load factors derived from the table are then used in conjunction with the area of a meeting room or floor to design the means-of-egress system and also to trigger provisions like the need for a sprinkler system.

The required number, capacity, and arrangement of exits are determined using the occupancy load, the use of the space, and simple geometric rules. The required number of exits for each story is determined with a step function based on the use of the space and the occupancy load. Stories with less than 500 occupants require a minimum of two exits, those with between 500 and 1,000 require at least three exits, and more than 1,000 occupants requires at least four. A capacity-factor table specifies the minimum width for stairways and horizontal exits based on the use of the space. Most indoor activities require stairwells to have 0.3 in. of width for each person on the floor with the greatest number of occupants, but areas with hazardous contents require 0.7 in. per person, a much greater capacity (Table 2).

The linear relationship between the maximum number of occupants and exit widths was originally proposed by Pauls (1974) and widely adopted in North America. For example, a stairwell 44 in. wide has a capacity of (44 in./0.3 in. per person) = 147 persons for most floor uses (Table 2). If the occupancy of the floor is expected to exceed 147, then the stairwell capacity is insufficient and the maximum occupancy must be lowered or the stairwell egress capacity must be increased. The arrangement of the exits is determined using a simple geometric rule called the "one-half diagonal rule" that states that two exits shall not be located closer than one half the length of the maximum diagonal dimension of the area served (Fig. 5). This requires exits to be sufficiently remote so as to prevent a fire from blocking more than one. For example, if the maximum diagonal distance across a room with two exits is 60 ft., then the exits must be at least 30 ft. apart. Finally, an arbitrary distance cutoff is used to ensure that no building occupant is too far from an exit.

Table 2. Capacity Factors from Life Safety Code®[a]

	Stairwells (width per person)		Level components and ramps (width per person)	
Area	(mm)	(in.)	(mm)	(in.)
Board and care	10	0.4	5	0.2
Board and care, sprinklered	7.6	0.3	5	0.2
Health care, nonsprinklered	15	0.6	13	0.5
High hazard contents	18	0.7	10	0.4
All others	7.6	0.3	5	0.2

Community Egress Codes

Despite the tremendous fire hazard in many interface communities, few studies have been done on residential densities in fire-prone areas (Theobald 2001; Schmidt et al. 2002; Cova et al. 2004). There is certainly nothing as complete as Nelson's (2003) longitudinal study of Washington D.C. federal building occupancy densities from 1927 to 1969. Second, there are no road-capacity studies for fire-prone communities on par with Pauls' (1974) extensive research on doorway and stairwell capacities. Roads in interface communities can be very narrow, intersect at odd angles, and vary in width. The capacity of this type of road network in dense smoke is difficult to quantify but would likely be very low. Third, existing egress codes for fire-prone communities are very general and do not provide the elegant methods for comparing and testing egress systems found in the building safety codes. The following codes serve as representative examples of contemporary community egress codes (National Fire Protection Association 2002):

1. 5.1.2 Roads shall be designed and constructed to allow evacuation simultaneously with emergency response vehicles.
2. 5.1.3 Roads shall be not less than 6.1 m (20 ft) of unobstructed width with a 4.1 m (13.5 ft) vertical clearance.

While the intent of the codes is clear, they do not link the occupant load with the required minimum number, capacity, and arrangement of exits. Current codes also tend to overlook the furthest distance a household is from its closest exit as well as vulnerability owed to dense fuel along the exits. In general, standards for interface community access focus more on maintaining fire-fighter ingress than resident egress (International Fire Code Institute 2003). Given that it is easy to find growing interface communities with miles of tangled narrow roads, many residents, and few exits, improved egress codes are a growing need.

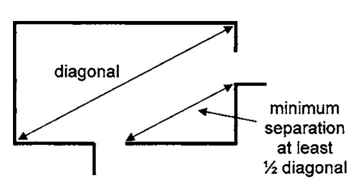

Fig. 5. One-half diagonal rule in building egress codes ensures that exits are sufficiently remote from one another

Differences in Community and Building Means-of-Egress Systems

Although there are many similarities between building and community egress systems, there are also significant differences. First, notification systems vary across communities (Sorensen 2000), whereas warning is generally issued with a siren, flashing lights, and a public address system in a building. For this reason, warning is nearly instantaneous and uniform in modern buildings, where it can take minutes to hours to warn all residents in a community, depending on the area, population density, and notification modes (e.g., reverse 911 or door to door). This has egress implications because the most constraining component in a community's egress system may simply be information, a vital yet scarce resource in most emergencies (Alexander 2002). However, slow notification can have benefits (if it is not too slow), as it can dampen household departure rates which reduces the likelihood of a traffic jam from a sudden burst of travel demand in a wildfire. Sudden bursts of travel demand are rare in evacuations but can lead to extreme stress when egress is constricted (Quarantelli et al. 1980; Chertkoff and Kushigian 1999), as in the case of the 1991 Oakland Fire.

Emergency manager behavior, population mobility, and human response are also important elements of an egress system. Emergency manager behavior is important because an incident commander generally decides who should evacuate and when they should leave (Lindell and Perry 1992). Mobility in a community context refers to the proportion of available drivers and vehicles in a population, whereas building evacuees are generally on foot or in a wheelchair. A glaring example of this constricting factor exists in many developing countries where mobility can be so low as to render regional evacuation infeasible (e.g., cyclones in Bangladesh). However, mobility can also cause problems if a highly mobile population leaves in a condensed amount of time and overloads an egress system.

Human response is also important, and evacuee behavior can be very different in wildfires than buildings. In building fires, occupants generally proceed directly out of the building or facility given sufficient egress, knowledge of the floor plan, and clear directions. In wildfires, there are family members, pets, horses, and livestock to evacuate, property to protect, and sheltering-in-place is always an option. These factors can dampen sudden spikes in egress demand but are more often a drawback in clearing an area quickly. In a building evacuation, the "walk, don't run" rule is used to dampen demand spikes and to reduce the likelihood of panic. Unfortunately, there are very few studies on wildfire evacuation behavior, but analogies can be drawn to evacuation behavior in other hazards that have been studied in greater depth (Perry 1985; Mileti and Sorensen 1990; Zelinsky and Kosinski 1991; Vogt and Sorensen 1992; Drabek 1996; Dow and Cutter 2002).

Perhaps the most obvious difference between building and community egress systems is the engineered components. Buildings have stairways, elevators, escalators, ramps, doors, handrails, and hallways, where communities have driveways, roads, intersections, stop signs, and traffic signals. Although these differences are significant, general concepts drawn from building codes may have value in a community context. One approach is to modify and extend building egress codes to achieve codes of comparable quality for communities.

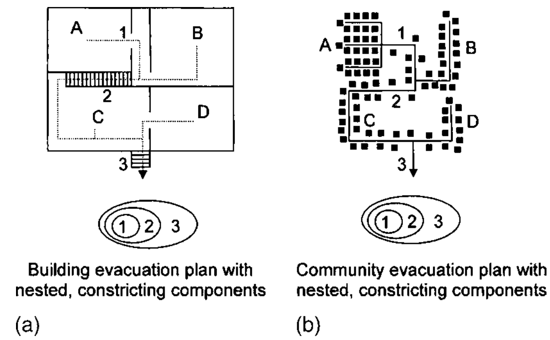

Fig. 6. Comparing nested, constricting components in building egress system with similar ones in community

What is a Community "Exit"?

An initial geographic problem in designing codes for communities might be deemed "the community exit problem." In a building context, exits have a component referred to as the discharge that leads people to a public way outside the building. In other words, safety is defined as "outside" the room or building. Inside and outside are ambiguous concepts in a community context and difficult to specify. If a predefined emergency planning zone (EPZ) is centered on a known hazard like a nuclear power plant or chemical stockpile site (Sorensen et al. 1992), then safety can be defined as outside the EPZ. In wildfires the zone to evacuate is defined on-the-fly at the time of the event and may expand in any direction as the fire progresses. For this reason, setting egress codes in advance that relate occupancy load to exit capacities requires searching the set of all potential evacuation zones.

An insight drawn from building studies can aid in addressing this problem. As noted, "A means of egress is only as good as its most constricting component." In a road-network context, this is referred to as a "bottleneck." A bottleneck can be used to define the inside and outside of a community, as traversing one is similar to clearing an exit discharge in a building (Cova and Church 1997). In other words, once a vehicle has successfully traversed a bottleneck, it is no longer a constraint on travel. This means that the community exit problem can be viewed as a search for potential roadway bottlenecks. In a sense, this is the approach adopted by interface codes that require at least two exits, as this precipitates a search for communities with only one exit, a potential bottleneck.

One problem with requiring that communities have more than one exit is that a bottleneck can still exist. In short, more than one exit does not ensure that an egress system is sufficient. It depends on the number of occupants, the arrangement and capacity of the exits, and the concentration of travel demand in space and time. Adding to this problem, bottlenecks can be nested in communities as they can in buildings. Fig. 6 compares nested constricting components in a building egress system with similar constricting components in a community context. Neighborhood A is nested within bottlenecks 1, 2, and 3. A building's outer wall is the point at which nested constraining components terminate, but in a community context, components nest from a street segment to a neighborhood, city, region, and so on. This can be addressed by terminating the search for egress bottlenecks when the area constrained is larger than that likely to be evacuated in a wildfire.

Table 3. Proposed Load Factors for Interface Communities

Use	Road length per household (m)	Road length per vehicle (m)
Residential[a]		
Low wildfire hazard	12.5	6.3
Moderate wildfire hazard	16.7	8.3
High+ wildfire hazard	20.0	10.0
Residential and tourism[b]		
Low wildfire hazard	12.5	4.2
Moderate wildfire hazard	16.7	5.6
High+ wildfire hazard	20.0	6.7

[a]2 vehicles per household.

[b]3 vehicles per household.

Table 5. Proposed Capacity Factors for Interface Communities

Use	Minimum total exit capacity (vph per household)	Minimum evacuation time (h)
Residential[a]		
Low wildfire hazard	1	2
Medium wildfire hazard	2	1
High+wildfire hazard	4	0.5
Residential and tourism[b]		
Low wildfire hazard	1.5	2
Medium wildfire hazard	3	1
High+wildfire hazard	6	0.5

[a]2 vehicles per household.

[b]3 vehicles per household.

Improving Community Egress Codes

Methods

The focus in a community context is therefore on identifying constricting components in a means-of-egress system. Furthermore, to achieve a comprehensive code and associated methods, the most constricting component should be defined in terms of the expected maximum occupancy as well as the number, capacity, and arrangement of exits. This is accomplished in a building context with look-up tables and simple geometric rules like the one-half-diagonal rule. In this section, preliminary analogues for interface communities are proposed. Agreed-upon community egress tables and codes will take significant cooperation among planners, and this represents a more formidable hurdle in terms of code development and compliance than the technical concepts discussed here (Burby et al. 1998).

Tables 3–5 represent community look-up tables for residential loading factors and the minimum number and capacity of exits. Table 3 depicts preliminary recommendations for community-based load factors expressed in road length per household, where communities with a greater fire hazard are required to have a lower density. In other words, as fire hazard increases the maximum allowable household density along roads should decline (Fig. 7). This is analogous to building codes which require a lower occupant density for buildings that contain hazardous materials (Table 1). To avoid delimiting a community's boundary, which is very subjective, "density" was defined as the average length of road (e.g., street centerline) per household in kilometers. This can be viewed as the average number of driveways per unit length of road. This calculation requires two easily acquired inputs that can be objectively measured: the number of households and total road length in the community.

Table 4 represents the minimum number of exits required for a community, which is a step function of the number of households. Allowing communities with only one exit to have up to 50 households avoids classifying all culdesacs as noncompliant with a two-exit minimum code. Table 5 represents the required minimum (total) exit capacity expressed in vehicles per hour (vph) per household. This is analogous to the linear relationship between persons and stairwell width in North American building egress codes (Table 2). The basis for the minimum required vph per household is a desired minimum evacuation time. For example, if a community has a high fire hazard (or greater), then the minimum evacuation time should be at most 30 min (0.5 h). Assuming two registered drivers per household, this requires that the exits have a minimum capacity of 4 vph per household. So a community with 100 households would need a total exit capacity of at least 400 vph to allow the estimated 200 vehicles to leave in 1/2 h (200 vehicles/0.5 h=400 vph). This coarse approach to estimating minimum evacuation time can be better tested for a given community with a traffic simulation model (Cova and Johnson 2002).

In most fire-prone communities, the "use" of the space is residential, but in larger communities there may be businesses, schools, churches, community centers, and tourist attractions (e.g., lakes, botanical gardens, hiking trails). Facilities and attractions above and beyond residences are important because community occupancy may vary significantly when tourists and tran-

Table 4. Proposed Minimum-Exits Table for Interface Communities

Number of households	Minimum number of exiting roads	Maximum households per exit
1–50	1	50
51–300	2	150
301–600	3	200
601+	4	

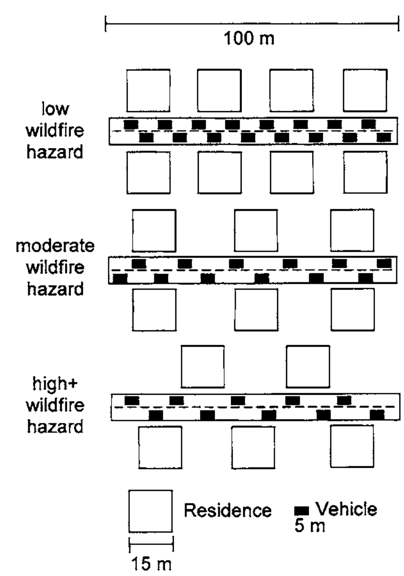

Fig. 7. Visual depiction of loading factor table for "residential use" assuming average of 2 registered drivers per home

sients are drawn (Drabek 1996). Furthermore, transient knowledge of the environment (e.g., evacuation routes) can be very poor. A community with a high degree of transients is analogous to an "assembly use" in building egress codes because occupants are generally unfamiliar with their environment. Table 5 requires a minimum capacity of 6 vph per household for high fire-hazard communities with tourism. So a community with 100 households and tourists would need a total exit capacity of at least 600 vph to allow the estimated 300 vehicles to leave in 1/2 h (300 vehicles/0.5 h=600 vph). The assumed mean number of vehicles per household can be adjusted, but standards should be set using the maximum probable occupancy in an area rather than the residents (and thus vehicles) recorded by the census.

Using Tables 3–5 in conjunction with a diagonal rule, a maximum-distance threshold and an exit-vulnerability rule, it is relatively straightforward to develop preliminary codes and compare community egress systems. For example:

1. Occupant load factor (density). The density of homes along the roads in any fire-prone community or portion thereof should not exceed that specified in Table 3.
2. Number of exits. The number of means-of-egress from any fire-prone community or portion thereof shall meet the minimum specified in Table 4.
3. Exit capacity. The total egress capacity from a fire-prone community or portion thereof shall meet the factors specified in Table 5.
4. Exit arrangement. The closest distance between any two points along any of the *n* exits from a fire-prone community must be at least 1/*n* the maximum diagonal distance across the community. The maximum diagonal of a community is defined as the greatest Euclidean distance between any two households that rely on the same exit set, and the minimum distance between exits is defined as the shortest Euclidean distance between any two points along two exiting roads.
5. Maximum exit distance. No household in a fire-prone community shall be further than 3 km by road from its closest exit. The maximum exit distance for a community is defined as the household with the greatest shortest-path distance on the road network to an exit discharge in the most constraining bottleneck set (i.e., the end of one of the exiting roads from the community).
6. Exit vulnerability (distance to fuel). Exits in a fire-prone community shall have a 30 ft buffer on each side that is clear of fuel.

An important aspect of this approach is that each recommended code is an independent test. This means that a community can meet or fail any subset of the codes. For example, a community might meet the density and minimum-number-of-exits codes but fall short of the exit-capacity code. The advantage of independent tests is that distinct limitations in a community's egress system can be highlighted separately. Fig. 8 depicts the proposed characteristics measured for Mission Canyon.

Table 5 provides the important link between expected maximum occupancy and required minimum exit capacity. An interesting aspect of this table is that it can be applied in reverse to calculate a community's maximum occupancy. For example, if a high-fire-hazard residential community (i.e., minimum evacuation time no greater than 30 min) has a total exit capacity of 1,000 vph in the most constraining bottleneck set, then from Table 5 the maximum occupancy would be (1,000 vph/4 vph *per household*)=250 households.

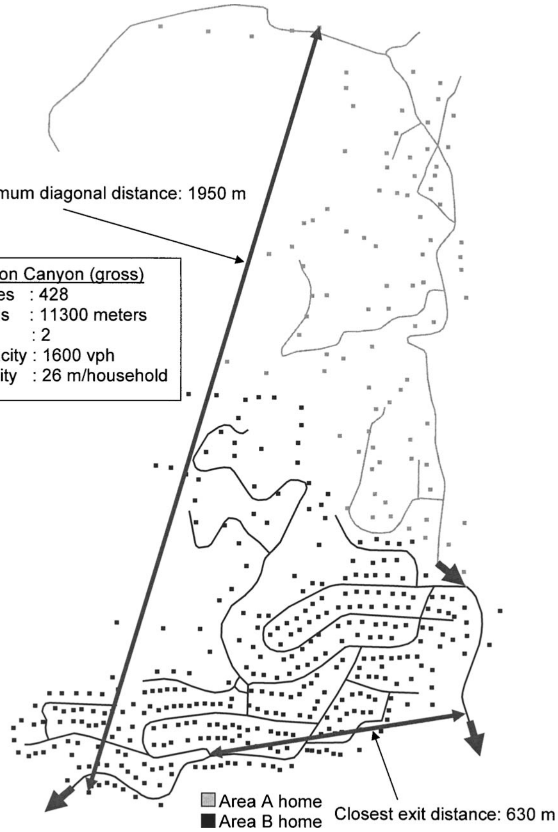

Fig. 8. Example (gross) egress calculations for Mission Canyon

Comparing Interface Communities

This section applies the proposed method to sample interface communities with high wildfire hazard, relatively low egress, and residential land use. A community with residential land use simplifies the estimation of occupant load by eliminating commercial, educational, and tourism activities. The inside (and outside) of each community is defined by the most constraining road-network bottleneck set. For example, if a community's most constraining bottleneck set is two exits, the calculations are for the households that would need to traverse one of these exits in an evacuation.

Perhaps the most involved calculation is for road capacity. This was crudely estimated using Eq. 8-3 in the *1997 highway capacity manual* (Transportation Research Board 1997):

$$\mathrm{SF}i = 2{,}800(v/c)_i f_d f_w f_g f_{\mathrm{HV}} \tag{1}$$

This equation states that a road's service flow rate (SF_i) in vehicles per hour (vph) is the product of the volume-to-capacity ratio for level-of-service i $(v/c)_i$ and a set of adjustment factors for directional traffic distribution f_d, lane and shoulder width f_w, grade f_g, and the presence of heavy vehicles f_{HV}. A narrow, mountainous road operating at level-of-service E (0.78) (maximum capacity) is assumed (for this analysis) with 100% of the traffic in one direction (0.71) on a 9 ft wide lane and 2 ft shoulder (0.70) heading downhill (1) with the possible 3% presence of large recreational vehicles (0.75) for an estimate of capacity per exit in clear visibility conditions with moderate demand rates of 814 vph (rounded to 800). In communities with uphill exits, wider roads or no recreational vehicles, this can be adjusted. Concentrated demand could greatly degrade this flow rate to level of service *F* where capacity can no longer be reliably estimated. Also, it should be noted that this number is very optimistic be-

Table 6. Data for Comparing Interface Community Egress Systems

Community	Homes	Exits	Road length (m)	Density (m per home)	Exit capacity (vph)	Max. diam. (m)	Exit separ. (m)	Max. dist. (m)	Exit fuel buffer
Buckingham[a]	337	4	5,293	16	3,200	1,040	85	430	No
Emigration Oaks	250	2	11,820	47	1,600	3,212	1,589	2,550	No
Summit Park	446	2	18,960	43	1,600	2,230	395	4,700	No
Mission Canyon	428	2	11,300	26	1,600	1,950	630	2,300	No
Area A (net)	60	1	4,576	76	800	1,520	NA[b]	1,750	No
Area B (net)	368	3	6,724	18	2,400	1,250	630	1,900	No

[a]1991 data.

[b]Not applicable.

cause it does not consider driveways along a road or other merge points that may create flow turbulence.

Table 6 shows the raw data for the communities in the comparison which all have "high+" wildfire hazard during the fire season. Community fire hazard was grossly assigned based on the predominant vegetation and residential construction type. A community of wood structures intermixed with a combination of highly flammable vegetation (e.g., Gambel Oak or Eucalyptus) was assigned a "high+" wildfire hazard. Table 7 is derived from Table 6 and the recommended codes presented in the prior section by determining which aspects of each community are "compliant" (C) or "noncompliant" (N).

An interesting result of this comparison is that the neighborhood at the origin of the 1991 Oakland–Berkeley fire is compliant for three of the six egress tests. The number and total capacity of the exits, as well as the furthest distance from any home to its nearest exit were reasonable. The problem appears to have been the relatively high residential density, the close proximity of exits 1 and 3 (Fig. 9), and the tremendous amount of fuel along the exits. The neighborhood had been built to urban density with only 16 m of road per household (i.e., street centerline length), the most densely developed neighborhood in the comparison (Table 6). This means that in 1991 the neighborhood had a driveway, on average, every 16 m. This is very dense development for an area with extremely high fire hazard. The arrangement of the exits was also not ideal, as exits 1 and 3 were closer than 1/4 the maximum diagonal distance between the furthest two households relying on the exits. In 1991, exits 1 and 2 were blocked by the fire in its first 1/2 h, and most of the remaining residents chose exit 3 (Charing Cross Road). However, from the point of view of a wildfire, exits 1 and 3 are too close to one another to be considered genuinely separate means-of-egress, so a fire that blocks exit 1 is almost certain to block exit 3 which is just uphill, and this is what happened in 1991. Finally, there was a substantial amount of fuel along the exits, and this is what led exits 1 and 2 to be blocked by the fire so early in the event. However, all told, if this neighborhood had less than four exits the number of fatalities would likely have been much higher.

In regards to the other neighborhoods in comparison, it is easy to identify canyon and hillside neighborhoods in the West with relatively poor egress systems to varying degrees. Emigration Oaks is a neighborhood just East of Salt Lake City, Utah that has a reasonably good egress system, but it is an elongated community and the two exits are less than 1/2 its maximum diagonal distance (Cova and Johnson 2002). This resulted in the community being noncompliant in regards to exit arrangement. The community also has a substantial amount of highly flammable Gambel Oak lining the exit-road shoulders. Summit Park is a community on the Wasatch Mountain ridgeline between Salt Lake City and Park City. This neighborhood did very poorly, as it currently has 446 homes relying on two proximal exits that are lined with conifers. Mission Canyon in Santa Barbara, Calf. also scored poorly for the same reasons. To provide one example of "net" egress calculations for a community, Mission Canyon is divided into areas A (upper canyon) and B (lower canyon). Area A is not compliant in regards to the number of exits because it has 60 homes and only one exit, where Area B is too dense and does not

Table 7. Comparing Interface Communities Against Egress Standards[a]

Community	Density	Number of exits	Exit capacity	Exit arrange	Maximum exit distance	Exit fuel buffer
Buckingham, Oakland, Calif.[b]	N	C	C	N	C	N
Emigration Oaks, Utah	C	C	C	N	C	N
Summit Park, Utah	C	C	N	N	N	N
Mission Canyon, Calif.	C	N	N	N	N	N
Area A (net)	C	N	N	N	N	N
Area B (net)	N	C	N	C	N	N

[a]C=compliant, N=noncompliant.

[b]1991 data.

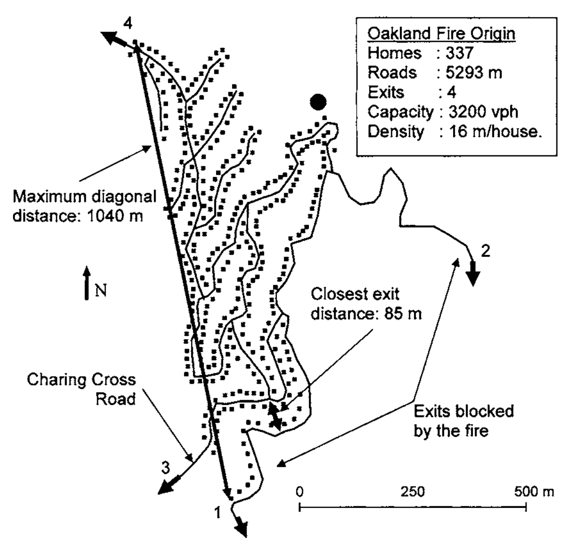

Fig. 9. Neighborhood at origin of Oakland–Berkeley fire in 1991

have sufficient exit capacity to serve its households. The main point with Tables 6 and 7 is simply that it is easy to identify neighborhoods with equal or greater fire hazard than the 1991 Oakland–Berkeley fire case and a more constrained egress system.

Urban and Emergency Planning Implications

The primary implication of developing a method comparable to building egress codes is that it is easy to identify fire-prone communities with relatively poor egress. The focus for urban and emergency planners should then turn to implementing new codes and improving egress systems. The proposed codes in the prior section can serve as a starting point and would need to be adjusted (or expanded) to work for a given locality. Also, despite the obvious limitations of the egress systems in the prior section, there are many actions that communities can take to improve their overall system (Plevel 1997). If a community has relatively poor egress, there are both demand-side and supply-side improvements (or adjustments) that can be implemented with varying cost (Burton et al. 1993). The focus in demand-side adjustments is reducing the concentration of vehicles in an evacuation in space and time to alleviate the need for egress capacity (e.g., supply). Example demand-side options include limiting the construction of new homes or businesses, limiting renters, constructing wildfire shelters, and identifying internal safe zones. Another demand-side adjustment is to require that structures be defensible so that residents can shelter-in-place. If a community can demonstrate that enough structures are defensible or there is sufficient public wildfire shelter or safe areas provided within the community, then the loading and capacity calculations could be adjusted to recognize that all not all residents will need to evacuate in a wildfire. This means that the following statement might be appended to each of the prior preliminary recommended codes:

"… unless a sufficient number and capacity of defensible structures, public shelters, or safe areas exist in the community for residents to shelter-in-place during a wildfire."

Supply-side adjustments to improve a community's egress system are also an option. This includes detailed evacuation route planning (i.e., Who will go where?) as well as reversing lanes and restricting turns at intersections to improve exit capacities (Wolshon 2001; Cova and Johnson 2003). Communities should also maintain their egress system. On-street parking restrictions can prevent low-capacity roads from becoming even lower, and clearing vegetation and other fuel along evacuation routes can minimize the loss of important exits during a wildfire. In cases where the egress system is severely substandard, widening roads or building new roads may be needed if more households are to be added.

Conclusion

Residential development in fire-prone areas is continuing without commensurate improvements to community-based transportation egress systems. This is only a small part of a much larger policy problem in fire-prone areas (Busenberg 2004), but it is an important one in protecting life. The codes presented in this paper would need to be integrated into a community's comprehensive hazard mitigation plan (Burby et al. 2000; Prater and Lindell 2000). However, the methods presented in this paper should help an analyst or planner in comparing community egress systems and possibly formulating codes. This may lead to improved community egress codes comparable to the higher-quality ones already in place for buildings. Limiting residential construction in low-egress, fire-prone areas with a "maximum occupancy" is not currently practiced but may be needed in some communities. If very few homes in a low-egress community are defensible and there is no safe zone or other public shelter, then limiting occupancy is one approach to maintaining public safety.

Economic pressure is strongly toward developing fire-prone communities to a density beyond which the egress system can safely handle in an urgent wildfire evacuation. The beneficiaries of new home development include new residents, developers, construction companies, and property tax collectors among many others. The parties that stand to lose include the residents who may perish in a wildfire, insurance companies, and the emergency managers challenged with the increasingly difficult task of protecting life and property in these rapidly growing areas. Thus, for political and economic reasons the methods presented in this paper may only find application in evacuation planning and comparing community egress systems. In the longer term, it is up to engineers and planners to ensure public safety in the urban–wildland interface by providing sufficient egress (or shelter) and educating residents on protective actions.

Acknowledgments

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From:	Deborah Eppstein
To:	Cannabis
Cc:	Crystal Acker
Subject:	Cannabis Scoping Fwd: Exclusion Zone Request for Los Alamos Rd area
Date:	Monday, March 13, 2023 7:59:06 AM
Attachments:	Exclusion Zone Proposal for Los Alamos Road 3-13-23.docx

EXTERNAL

Begin forwarded message:

From: Deborah Eppstein <deppstein@gmail.com>
Subject: Exclusion Zone Request for Los Alamos Rd area
Date: March 12, 2023 at 7:41:26 PM PDT
To: Crystal Acker <crystal.acker@sonoma-county.org>

Crystal, Please include the attached request for Cannabis Exclusion Zone for the upcoming draft cannabis EIR and subsequent new ordinance.

Thank you.

Deborah Eppstein
deppstein@gmail.com

Deborah Eppstein
deppstein@gmail.com

Cannabis Exclusion Zone Request for Los Alamos Road

We request that Los Alamos Road, and all roads accessed by it, be listed as an Exclusion Zone for Cannabis Cultivation and Processing. The reasons include:

1) Los Alamos Rd is a dead-end long, winding and dangerous mountain road, traversing through high and very high fire hazard severity zones according to CalFire designations. It all burned in the 2020 Glass Fire, with dangerous and slow evacuation for residents. The 2017 Nuns Fire reached the end of Los Alamos Rd and top of Cougar Lane.
2) This is a remote location, which sheriff response times far greater than 20 minutes. It takes 20 minutes alone just to drive up Los Alamos Rd.
3) This is a class 4 water scarce zone.
4) It would negatively impact the scenic character.
5) It would negatively impact the residents due to increased traffic and increased evacuation hazard, as well as increased risk of new ignitions due to increased traffic and employees.
6) Los Alamos Rd does not meet the minimum requirements of the Title 14 State Fire Safe Regulations which apply to public roads as it is 6 miles dead-end with steep drop-offs and cliffs on either side and narrows to one lane for the upper portions. No exceptions can be applied to public roads under the fire safe regulations, and the only mitigation for a dead-end road is a second access meeting the road requirements of the fire safe regulations (i.e., 20 ft wide, improved surface, grade limits, etc). That second acess/egress does not exist. Thus no new development, which includes cannabis operations, can occur accessed by Los Alamos Rd.

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	CANNABIS UPDATE EIR - SCOPING -ZONE CHANGES
Date:	Monday, March 13, 2023 12:28:03 PM

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR

3/13/23

Scoping – Zone Changes

Evaluate and analyze the consistency or inconsistency of the currently allowed existing land uses in Rural Residential (RR) and Agricultural Residential (AR) with a new use allowing cannabis cultivation at any level other than the six plants allowed for personal use. Use specific example from the Code below. Evaluate and analyze consistency or inconsistency with other allowed and unallowed uses from the Code.

Table 8-1 identifies the allowed uses and permit requirements in the residential zones.

- **Sec. 26-08-030. - Allowed land uses.**

C. Craft and Garage Sales. In the AR and RR zones, craft sales and garage sales not exceeding two (2) sales days per calendar year provided that prior notification is given to the California Highway Patrol and that adequate off-street parking is provided. Craft sales and garage sales involving three (3) or four (4) sales days per year require a use permit.

(Ord. No. 6386 , § IV, 8-2-2022; Ord. No. 6335 , § III(Exh. A), 2-9-2021)

From: Nancy and Brantly Richardson

From:	Neighborhood Coalition
To:	Crystal Acker; Cannabis
Cc:	Craig Harrison
Subject:	Scoping for Cannabis Ordinance— Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited
Date:	Monday, March 13, 2023 11:33:12 AM
Attachments:	Scoping BVCA Exclusion Zone.pdf BVAP highlighted.pdf

Bennett Valley Community Association

P.O. Box 2666, Santa Rosa, CA 95405
http://bennettvalley.org

March 20, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org)
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance—**
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited

Dear Crystal Acker,

The Bennett Valley Community Association (BVCA) was founded in 1971 and is a § 501(c) (3) organization. The BVCA represents the residents of unincorporated Bennett Valley within the boundaries of the Bennett Valley Area Plan (BVAP). With respect to the Notice of Preparation for the Comprehensive Cannabis Program Update, we request that the Cannabis Environmental Impact Report (EIR) research, evaluate and identify both "inclusion zones" and "exclusion zones," the former where commercial cannabis is permitted to be grown and the later where cannabis activities are forbidden. Since the board of supervisors adopted the BVAP in 1979, this area has been a planning unit that readily lends itself to designation as an exclusion zone.

As outlined in the BVAP, which the BVCA Board of Directors is charged with protecting on behalf of our residents, multiple policies are violated by allowing any commercial cannabis operations within the BVAP boundaries.

On behalf of the residents of Bennett Valley within the boundaries of the BVAP, the Board of Directors of the BVCA urge that the EIR to study the environmental effects of designating this area to be an exclusion zone where commercial cannabis operations are prohibited so that the Supervisors can include such a designation for Bennett Valley in the revised ordinance.

We propose this Exclusion Zone designation based on the following considerations and request this be further assessed in the upcoming EIR:

1) Analyze the adequacy of Bennett Valley's unique water resource conditions and constraints (a class 3 area, and possibility of class 4 at valley floor with updated data), including impacts on the Matanzas Creek Riparian Zone as a significant aquifer recharger for the entire valley. Include sensitive biotic and other natural resources that require special protections, including numerous state and federally-designated endangered or threatened species; and

2) Analyze the nine development policy guidelines as approved by the County in 1979 in the BVAP and enforced continuously since, and ALL environmental impacts associated with this development policy framework, including but not limited to: 1) Land Use; 2) Housing; 3) Conservation of Resources; 4) Open Space; 5) Public Safety; 6) Circulation; 7) Scenic Corridor; 8) Public Services; 9) Transportation. Please see the attached highlighted BVAP for reference of these nine development policy guidelines and associated environmental protections; and

3) Assess the impact of commercial cannabis operations on the health of the Matanzas Creek Riparian Zone, its multiple sensitive biotic resources and its critical role as wildlife corridor, especially in regards to the corridors integration with critical protected habitats and parks surrounding Bennett Valley, including: Taylor Mountain, Sonoma Mountain Open Space, Annadel State Park and Jack London State Park; and

4) Assess the impact of commercial cannabis operations on the health of the Matanzas Creek Riparian Zone specific to its 100-year floodwater assessment and the 2023 Matanzas Creek Dam Restoration Project; and

5) Analyze the impacts of commercial cannabis operations in regards to the scenic character and protected view shed status for Bennett Valley as described in the BVAP, with special attention to aesthetic incompatibilities and violations of the visual natural resources protected as part of the view shed protections in the BVAP and adjacent parks; and

6) Analyze the impacts of commercial cannabis operations on roads in Bennett Valley, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time; and

7) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to fire safety, including the designation of much of Bennett Valley as a high fire severity zone by various public agencies; and

8) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to the slow lead times for law enforcement to respond to emergencies; and

9) Take into consideration the overwhelming support for an exclusion zone status and the strong resistance to commercial cannabis activity throughout the community as evidenced by hundreds of petition signatures by the residents, urging the County designate the BVAP area as an exclusion zone, multiple community organization letters of support, and many hundreds of resident emails, phone calls and meetings with officials urging exclusion zone status for Bennett Valley.

Therefore, the BVCA Board of Directors urges the County to study the many unique environmental conditions in Bennett Valley as part of the EIR with a specific assessment of its requested exclusion zone status.

Approved by BVCA Board of Directors

Attachment: Bennett Valley Area Plan (highlighted), including BVAP Map

BENNETT VALLEY
AREA PLAN

Adopted by Resolution No. 63206A
February 27, 1979

Modified by Resolution No. 93-0337
March 9, 1993

Modified by Resolution No. 08-0808
September 23, 2008

Modified by Resolution No. 11-0461
September 30, 2011

ACKNOWLEDGMENTS

BENNETT VALLEY SPECIFIC PLAN

DUANE BUTLER, DIRECTOR OF PLANNING
PRANAB CHAKRAWARTI, FORMER DIRECTOR OF PLANNING
TOBY ROSS, Chief, Comprehensive Planning Section
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REVISED BENNETT VALLEY AREA PLAN

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REVISED BENNETT VALLEY AREA PLAN 2008

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DARCY REINIER, Mapping

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MAPS

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CHARTS

INTRODUCTION

In 1979, the County adopted the Bennett Valley Specific Plan, a planning document prepared under specific requirements of State law and intended to provide an intermediate level of detail between the 1978 General Plan and site development plans submitted to the County for approval. The 1978 General Plan focused on policies of county-wide significance and utilized generalized graphics to illustrate land use, open space and other elements.

In 1989, the County adopted an update of the 1978 General Plan. The General Plan update provided parcel-specific information concerning land use and open space. The General Plan update also included "area policies" in an attempt to focus particular attention on a specific area or parcel. Because of this level of specificity in the general plan update, the Board of Supervisors determined that several of the specific plans, including the Bennett Valley Specific Plan, were either duplicative or conflicted with the updated General Plan. The Board of Supervisors further determined that to the extent the specific plans provided policy guidance beyond that provided by the General Plan update, that such plans should be reviewed and revised to focus on such policies, and readopted as "area plans." The General Plan includes a discussion of these specific plans in Land Use Element Section 2.1.1., under Policy LU-1a.

The document was prepared pursuant to General Plan Policy LU-1a.

In keeping with the above intent, the 1993 revisions of the Bennett Valley Area Plan did not include exhaustive evaluation or reconsideration of the policies or designations contained in this plan. The scope of the revisions was limited to that necessary to achieve General Plan consistency.

In addition, during this process much of the original background language was deleted. This deletion should not be interpreted as diminishing or reducing the significance of the content of the language to the original plan. Should there be any future questions regarding the intent or basis of the policies in the revised plan, the Planning Department shall keep copies of the original plan on file for reference.

SUMMARY

Located on the southeastern border of the City of Santa Rosa, the 15,500 acre Bennett Valley Study district was established by the Board of Supervisors in 1977 in response to local resident concern about the impacts of residential development.

The eleven-person Citizens Committee, appointed by the Board of Supervisors to provide a policy framework for the 1978 plan, set as its goals provision of residential opportunities and the protection of agriculture while retaining the rural character in Bennett Valley.

The Bennett Valley Area Plan is guided by goals, objectives and policy framework of the adopted Sonoma County General Plan. Four major land use categories are used in the Bennett Valley Plan to achieve the desired balance of residential and agricultural use:

(1) Rural Residential acknowledges residential development as the primary land use, but supports the retention of open space through density regulation, primarily to minimize public hazards.

(2) Diverse Agriculture encourages the use of the land for agriculture by retaining larger parcels and clustering residential units on smaller parcels.

(3) Land Intensive Agriculture recognizes agriculture as the primary land use. Dwellings are permitted to support the agricultural operation.

(4) The Resources and Rural Development category supports agricultural and conservation uses and recognizes public safety hazards.

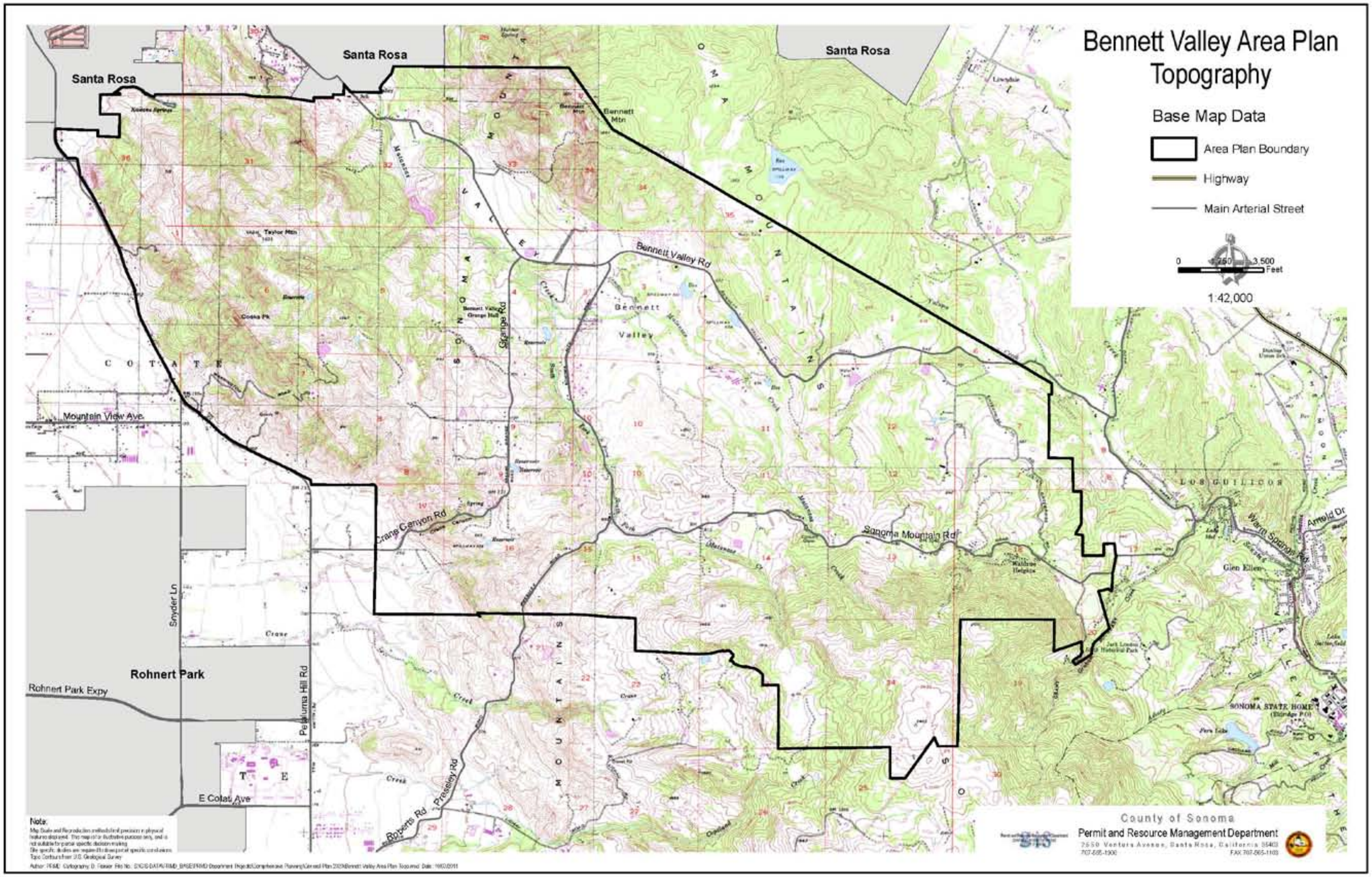
With the Land Use Map, the Bennett Valley Area Plan integrates a Critical Open Space Plan, a set of Development Guidelines, and implementation tools. The Critical Open Space Plan establishes visual and riparian corridors within which the development is prohibited except in special cases. The Critical Open Space Plan also designates scenic landscape units, unique biotic features and critical habitats. The Development Guidelines establish a policy of design review for all new structures in the Plan Area and recommend building and planting materials compatible with the landscape units of Bennett Valley. Other recommended implementation techniques include trust funds, assessment districts, open space easements and trusts, and special studies.

DESCRIPTION OF BENNETT VALLEY

Bennett Valley is located just southeast of the city of Santa Rosa in the County of Sonoma, known as the North Bay Region (see Location Map). Between the mountain backdrops and the valley floors lie rolling upland hills: Taylor Mountain, Bennett Mountain and the Sonoma Mountains ring the triangular shaped valley, which is drained by Matanzas Creek, a tributary of Santa Rosa Creek (see Topography Map).

Map - Location Map

Map 3 Bennett Valley Area Plan Topography



GOALS AND POLICIES

Two major goals define the Bennett Valley Area Plan: (1) to retain and enhance the rural character, and (2) to reflect the environmental and economic constraints, suitabilities and sensitivities of the area in the determination of the location and intensity of development. The following policies were endorsed by the committee to achieve these goals:

I. LAND USE

Low density is important to maintain the rural character of Bennett Valley.

(1) Residential densities shall reflect the extent of constraints, suitabilities and sensitivities of the area.

(2) Commercial development is not considered appropriate to the rural character of Bennett Valley.

(3) Development shall be coordinated with the public's ability to provide schools, fire, police and other needed services.

(4) To minimize environmental disruption, the County Subdivision Ordinance shall be the minimum standards applied for grading, road construction, drainage, driveway construction, siting, landscaping and energy. Where development standards included in Bennett Valley Plan exceed County Subdivision Standards, the Bennett Valley Standards shall apply.

(5) New development throughout Bennett Valley shall be reviewed for site design and consistency with Bennett Valley development guidelines.

(6) Cluster development should be encouraged.

II. HOUSING

(1) When methods of on-site sewage disposal permit the accommodation of multiple-family dwellings, such dwellings should be considered to satisfy the need for lower cost housing. Multiple-family dwellings should be designed to appear to be single-family dwellings and surrounded by open space.

(2) Agricultural employee housing should be encouraged.

III. CONSERVATION (Resources)

(1) Agriculture is a vital component of the rural character and shall be encouraged and protected.

a. Parcel sizes and future land division shall be consistent with economic productivity of potential and existing agriculture.

b. Board of Supervisors should reassess County policies implementing the Land Conservation Act to assure that they meet current needs of farmers.

(2) Unique scenic, visually and environmentally sensitive, and historic resources are important to the character of Bennett Valley and shall be protected.

(3) Water is a valuable and necessary resource which should be protected.

a. Residential densities shall reflect net safe yield of groundwater.

b. County Subdivision standards for areas designated as Marginal Water Availability (Groundwater Availability Map) shall be followed in Bennett Valley.

c. Mutual water systems should be authorized for major subdivisions only where supplies are adequate to serve existing and projected growth for the life of the system.

d. On existing but undeveloped lots, proof of water shall be required prior to issuance of a building permit.

IV. OPEN SPACE

A feeling of Open Space is a vital component of rural character in Bennett Valley. Where the standards below are less restrictive than the General Plan standards, compliance with the General Plan standards is required.

(1) Open vistas shall be protected.

(2) Development patterns and specific development shall be in harmony with natural surroundings, including, but not limited to topography and vegetation.

a. Skyline development shall be prohibited.

b. Planting of native vegetation should be encouraged to screen existing development from the road.

(3) A scenic corridor shall be established to protect views from the road and the community should be encouraged to undertake tree-planting programs where appropriate along scenic corridors.

V. PUBLIC SAFETY

(1) Residential development shall occur in the least constrained, most suitable areas.

a. Parcels within the Alquist-Priolo Zone or in geologically unstable areas shall be developed only at very low densities. Siting and foundation design of all structures in these areas shall comply with the General Plan Public Safety Element.

b. Structures shall be located outside of the flood inundation area.

(2) Understanding that fire could destroy the rural character of Bennett Valley and present hazard of life and property.

a. New dwellings should utilize fire-resistant materials.

b. Roof overhangs shall be designed for fire resistance.

c. Densities should be reflective of degree or fire hazard as determined by fire department response time.

d. Site landscaping shall be managed to limit fire hazard around structures.

VI. CIRCULATION

The character of the road system is a vital component of rural character of Bennett Valley.

(1) The character of the existing public road system shall be retained. Improvements should be made in the interest of safety.

(2) Development shall be sited with minimum impact on the view from the road.

(3) Intensity of land use shall reflect the conditions character and capacity of roads.

VII. SCENIC CORRIDORS

The scenic quality of all transportation routes within Bennett Valley is a vital component of the rural character, and shall be protected.

VIII. PUBLIC SERVICES

(1) Trust funds shall be considered to finance road construction and maintenance for public roads which are determined to be inadequate for proposed development.

(2) School impact fees shall be considered to finance school construction and/or classroom construction when public schools are determined to be inadequate for proposed development.

IX. TRANSPORTATION

Petaluma Hill Road, Bennett Valley Road and Grange/Crane Canyon Roads are two lane rural scenic roadways. Sonoma Mountain Road, Pressley and Enterprise Road, which complete the internal circulation system within Bennett Valley, are one lane rural scenic byways. Petaluma Hill Road is classified as a Rural Minor Arterial; Bennett Valley Road and Grange/Crane Canyon Roads as Rural Major Collectors; and Sonoma Mountain, Pressley and Enterprise Roads as Local Roads. The guiding priority is to retain their basic rural character. The following recommendations from the General Plan Circulation and Transit Element are standards for the roads in Bennett Valley:

(1) All roads should receive maintenance and hazard correction as the need arises.

(2) All roads may in some case need to be upgraded because of safety or structural deficiencies. Proposals for major safety upgrades should be thoroughly reviewed before specific projects are undertaken, including citizen review.

(3) All roads should be retained in their basic rural character.

(4) Petaluma Hill Road is designated for 3 lanes where necessary to provide access from side streets, driveways, etc.

LAND USE AND CRITICAL OPEN SPACE PLAN

The Bennett Valley Area Plan is consistent with the County General Plan. It was the intention of the General Plan to assign densities to properties in this plan area which allowed the same number of residences as provided by the "PA Table" zoning in the 1979 plan.

Rural Residential (5 acre) category is characterized by residential development which precludes commercial agriculture, resource production or commercial development.

Diverse Agriculture describes the category where preservation of agriculture and agriculture potential is the highest priority but is complicated by the number of smaller residential parcels.

Land Intensive Agriculture is a category which reflects the existing and potential intensive agricultural land use. Residential development is related to the agricultural economy and can include farm labor housing as well as single-family residences. Residential density is low in this area.

Resources and Rural Development category is characterized by low level of human activity. It includes mountainous areas and other open space and agriculture.

The Bennett Valley Area Plan contains a Land Use Plan Map and Critical Open Space Plan Map.

MITIGATION MEASURES

The following section of this report discusses the rationale for the Land Use designations in this plan. While the Zoning Ordinance provides a tool for implementing land use decisions, additional tools are needed to mitigate adverse impacts that might occur with the proposed land use. The list below gives mitigation measures which respond to specific impacts. At the conclusion of each subarea analysis, the pertinent mitigating measures have been noted.

A. FOR GEOLOGIC HAZARDS

(1) Retain very low density.

(2) Site structure and design foundation in accord with recommendations of an engineering geologist.

B. FOR FLOOD HAZARDS

(1) Prohibit residential structures within designated inundation area as mapped on Critical Open Space Plan.

C. FOR WATER AVAILABILITY

(1) Encourage Board of Supervisors to authorize a monitoring of groundwater supplies in Bennett Valley.

(2) Encourage Mutual Water Systems only when consistent with Policy PF-1h of the General Plan.

D. FOR FIRE HAZARD

(1) Retain low densities.

(2) Encourage major subdivisions with mutual water systems and require adequate access for fire suppression equipment.

(3) Where minor subdivision occurs, encourage cluster development with adequate water supply and access for fire suppression.

(4) Clear wildland grass and brush near associated structures

E. TO MAINTAIN VISUAL AMENITY

The Critical Open Space Plan Map shows designated open space areas. Where the following standards are less restrictive than General Plan standards, compliance with General Plan standards is required.

(1) Avoid skyline development.

(2) Site and design structures in harmony with natural surroundings.

(3) Prohibit structures in visual/scenic corridors as mapped on the Critical Open Space Plan.

(4) Prohibit structures in visual corridors as mapped on the Critical Open Space Plan.

(5) Apply the Bennett Valley Design Guidelines.

(6) Development in scenic landscape units shall comply with the General Plan and Zoning Ordinance.

F. TO MAINTAIN VALUABLE OPEN SPACE

The Critical Open Space Plan Map shows designated open space areas. Where the above standards are less restrictive than General Plan standards, compliance with General Plan standards is required.

(1) Prohibit structures in riparian corridors and unique biotic features as mapped in the Critical Open Space Plan.

(2) Site and design structures in harmony with natural surroundings.

G. TO PRESERVE AND PROTECT AGRICULTURE

(1) Encourage utilization of Land Conservation Act of 1965 as amended.

(2) Retain appropriately low densities.

H. TO AVOID INCREASING HAZARD ON INADEQUATE ROADS

(1) Retain low density until road upgraded.

(2) Encourage road trust funds to maintain establishment of and improve roads consistent with the transportation policy.

I. TO ASSESS IMPACTS OF PROJECTS ON PUBLIC SERVICES

(1) To assess adequately the cumulative impact of individual projects on the public services of the area, plans for any major or minor subdivision or rezoning should reflect the ultimate potential buildout of that project.

SUBAREA MITIGATION MEASURES

To facilitate the analysis of a large and variable study district, the Bennett Valley area is divided into fifteen subareas as shown on the Subareas Map. Each subarea below is followed by a list of mitigation measures applicable therein.

A. Kawana Springs Road: C-1, 2; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; I-1

B. Taylor Mountain: A-1, 2; B-1; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

C. Petaluma Hill Road/Warrington Road Area: A-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; I-1

D. Crane Canyon/Alta Monte Area: A-1, 2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; I-1

E. Grange Road below Bennett Valley Road to Perracca and including Guenza: D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; H-1, 2; I-1

F. Sonoma Mountain Road, North-South Alignment: C-1, 2; E-1, 2, 3, 4, 5, 6, 7; I-1

G. Bennett Valley Road Adjacent to Matanzas Dam: A-2; B-1; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1; I-1

H. Valley Floor, Bennett Road: E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

I. Bennett Mountain: A-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

J. Jamison Road Extension: A-1, 2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1, 2; H-1, 2; I-1

K. Lower Grange Road, Pressley Road and Sonoma Mountain East-West Alignment: A-1, 2; C-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

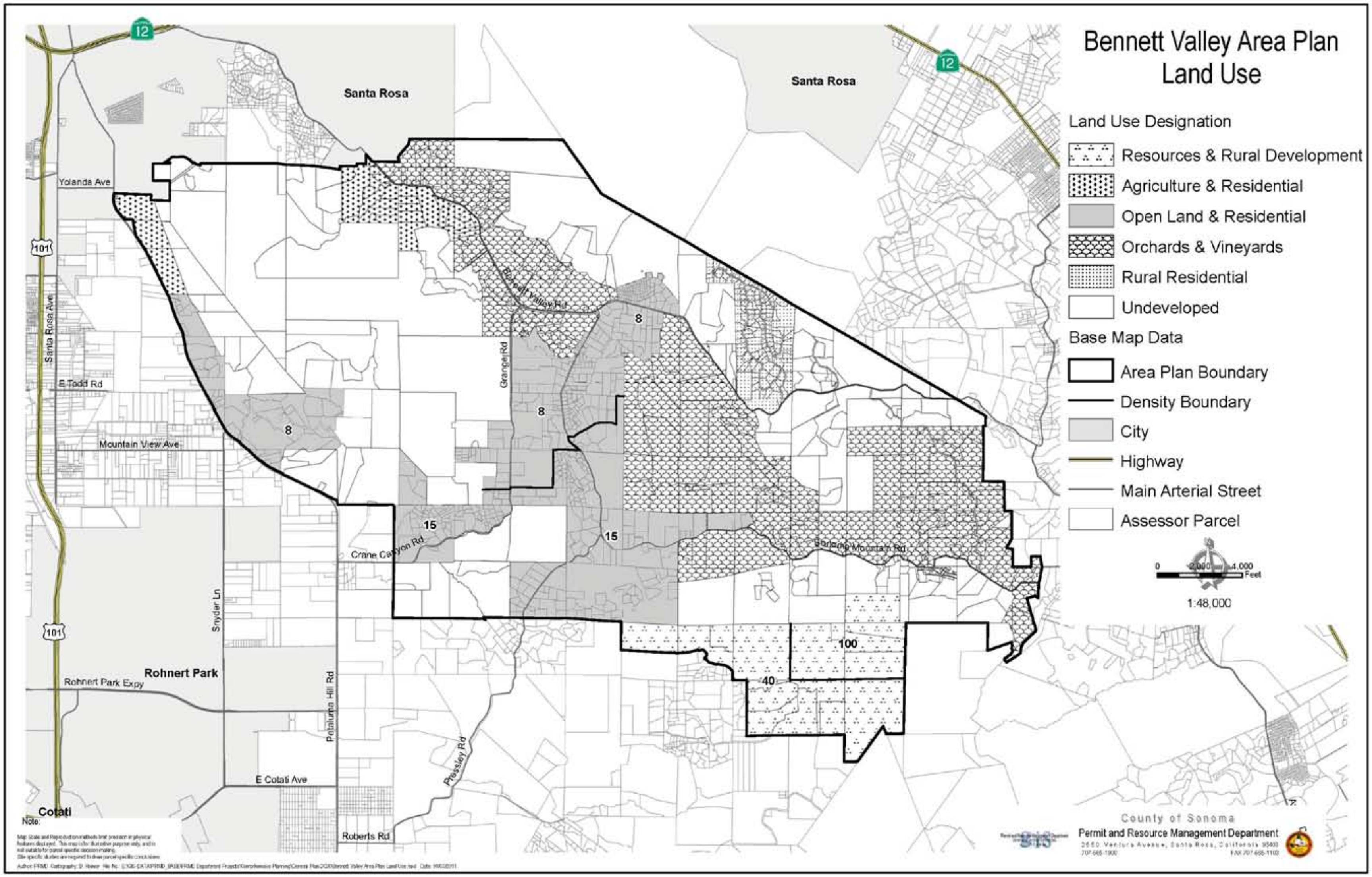
L. Sonoma Mountain Road East-West Alignment: A-1, 2; C-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

Open Land Between Bennett Valley Road and Sonoma Mountain Road (West of Enterprise): A-2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1, 2; H-1, 2; I-1

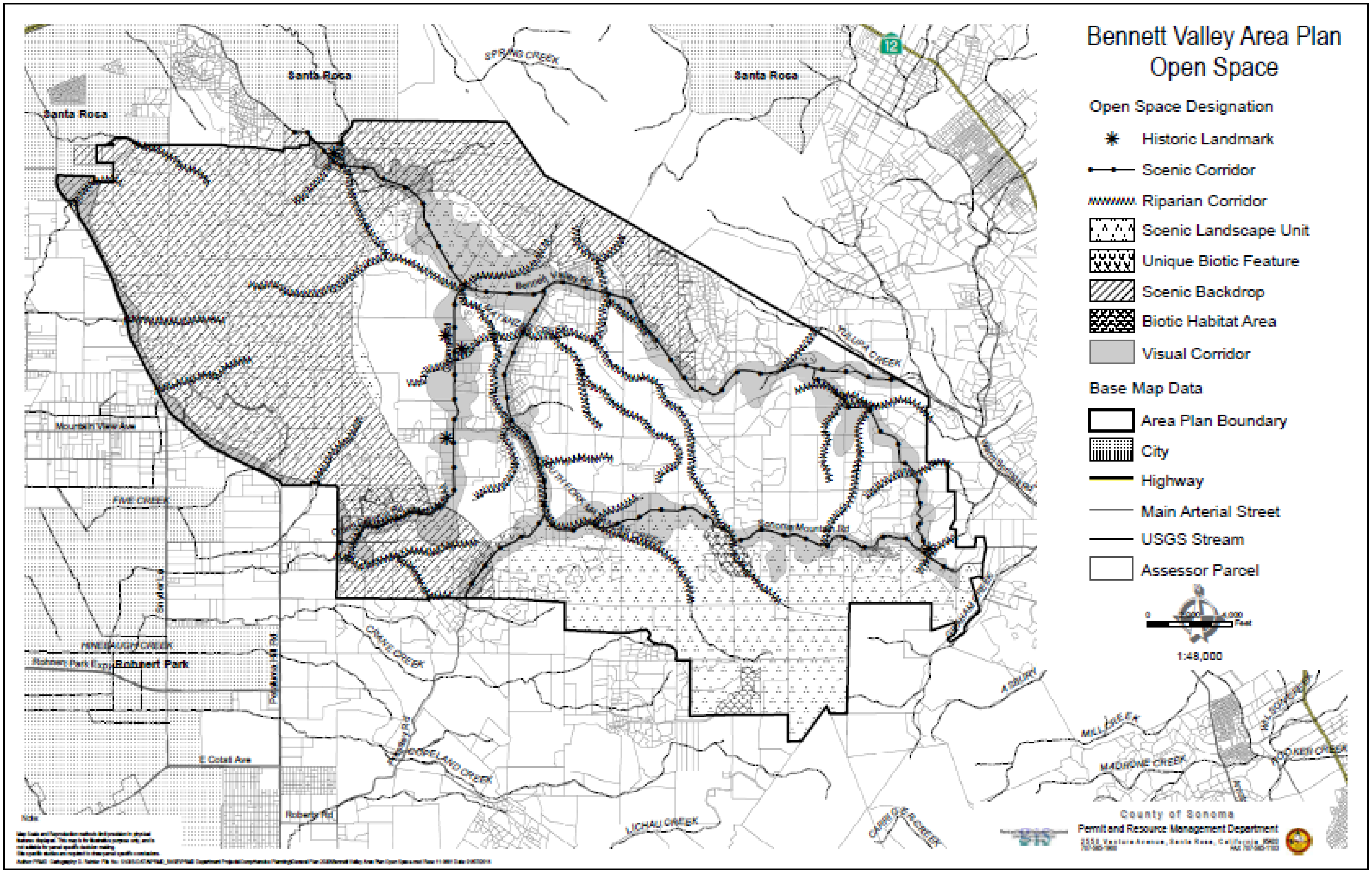
M. Enterprise Road Area: D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

N. Bennett Ridge: A-2; C-2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; H-1; I-1

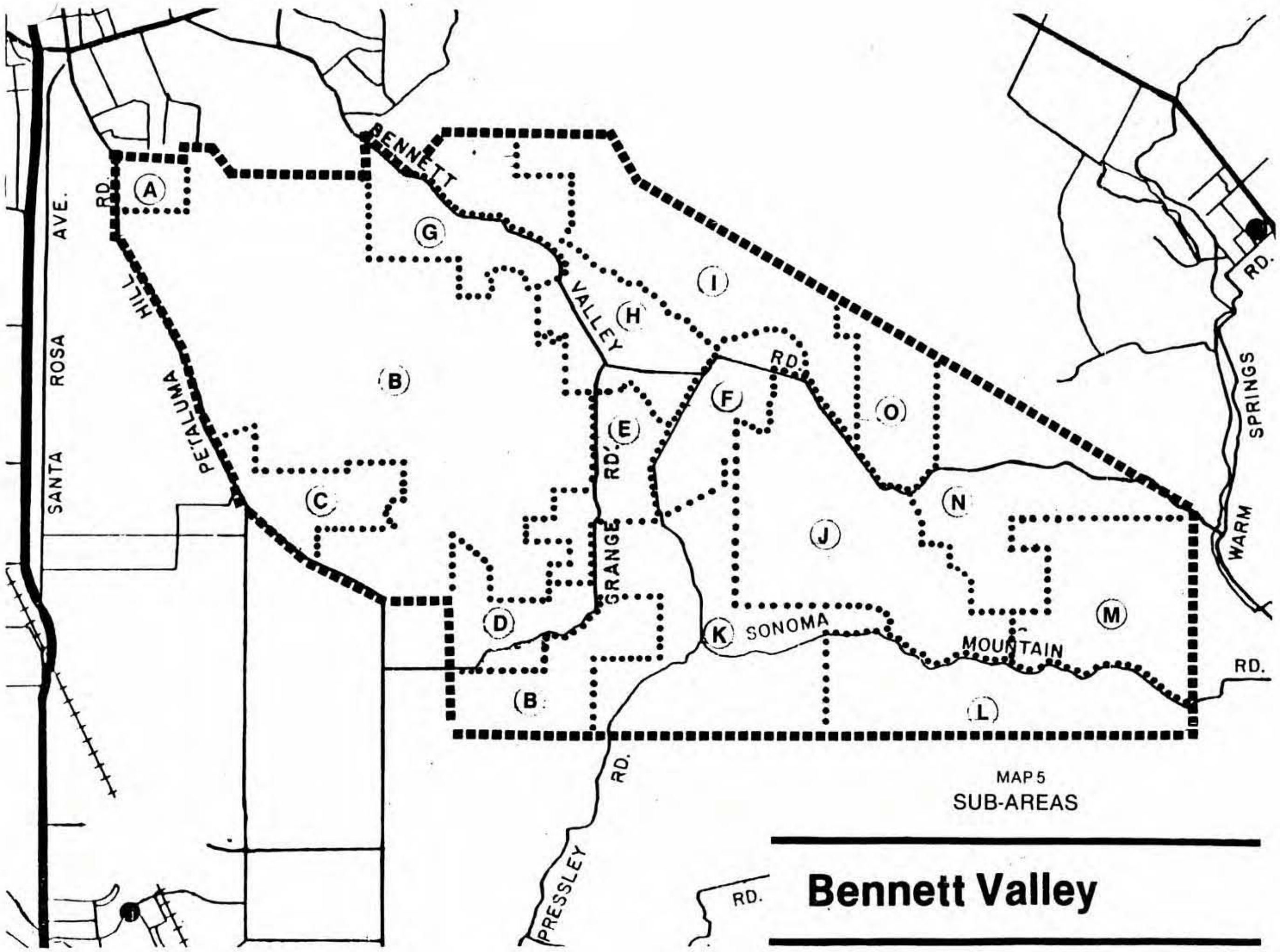
Map Bennett Valley Area Plan Land Use



Map - Bennett Valley Area Plan Open Space Map



Map - Bennett Valley Area Plan Sub Areas



PLAN IMPLEMENTATION TOOLS

Mechanisms in addition to zoning are needed to achieve the desired goals of a Land Use Plan. The mitigations specifically related to the subarea analysis are some of the implementation measures. Specific standards for development will also implement the goals and policies of this Plan. The following section addresses Development Guidelines, Public Service Standards, other techniques and Development Staging.

BENNETT VALLEY DEVELOPMENT GUIDELINES

DESIGN REVIEW COMMITTEE

To insure the adherence to the goals and policies set forth in this study, the Board of Supervisors should establish a Design Review Committee to advise the County regarding development within the Bennett Valley study area. All properties depicted on the Area Subject to Design Review Map shall be subject to these guidelines. However, properties outside of the Bennett Valley Area Plan boundary shall not be subject to other goals, policies and implementation measures set forth in this Area Plan.

(1) The Bennett Valley/North Sonoma Mountain Design Review Committee shall consist of seven (7) members who shall be residents of the Area Subject to Design Review as depicted on Figure B. Members shall be appointed by the Board of Supervisors which shall take into consideration expertise in architecture, landscape architecture, site planning, engineering or other similar fields.

(2) All meetings of the Bennett Valley/North Sonoma Mountain Design Review Committee shall be open to the public, and interested Bennett Valley/North Sonoma Mountain area residents shall be encouraged to attend sessions.

(3) The Bennett Valley/North Sonoma Mountain Design Review Committee shall review the siting and design of subdivisions and single-family dwellings within the area depicted on Figure A except that after the Committee has reviewed a subdivision, individual single-family dwellings within that subdivision need not be reviewed a second time.

(4) Advisory decisions by the Bennett Valley/North Sonoma Mountain Design Review Committee shall be made in writing to the Planning Director.

(5) The following findings shall be made for any project recommended for approval by the Committee or ultimately approved by the Planning Director.

   a. That the site is adequate in size and shape to accommodate the proposed use.

   b. That private streets and driveways, both existing and proposed, are properly designed and located to carry the type and quantity of traffic generated by the proposed use and to minimize visual impact.

   c. That approval of the proposed use at the proposed site will have no significant adverse effect on adjacent property.

   d. That the proposed use is consistent with the County General Plan, and where applicable, the Bennett Valley Area Plan.

e. That the minimum requirements are met with respect to:

i. Visual/scenic corridor, riparian corridor, scenic landscape unit and critical habitat and unique biotic feature setbacks.

ii. Height and location of fences and walls.

iii. Controlling erosion and screening structures with landscaping.

iv. Other conditions to insure conformity with the intent and purpose of this plan, where applicable.

If the Design Review Committee recommendation results in staff refusal to sign off the building permit, an applicant may appeal in the same manner provided for in Chapter 26 of the Sonoma County Code.

STANDARDS - APPLICATION

Review of any proposed development should consider each of the standards described below. Each standard should be applied to the maximum extent feasible, recognizing that in some cases these standards when applied to a particular project may be contradictory. General Plan policies shall apply where the development guidelines conflict with the General Plan. The Design Review Committee should consider the total impact of the project in determining the extent to which each standard should be applied.

(1) It is the policy of this study to preserve the natural state of the land and vegetation.

(2) Structures shall blend with the existing landscape and vegetation to the maximum feasible extent. Therefore, minimum setbacks shall be consistent with the Sonoma County Subdivision Ordinance, the General Plan, or where applicable, with the adopted Bennett Valley Area Plan, whichever is more restrictive. No new structure shall be sited within visual/scenic corridors, riparian corridors or unique biotic resource areas as designated on the Critical Open Space Plan Map of the Bennett Valley Area Plan, where applicable, except in the visual/scenic corridor where the entire parcel is included within such designation or except in the visual/scenic corridor where said structure is a fence or agricultural appurtenance. Where the entire parcel is included in a visual/scenic corridor area, or where said structure is an agricultural appurtenance greater than 200 sq. ft., the Bennett Valley/North Sonoma Mountain Design Review Committee shall condition the approval of such structure(s) to mitigate adverse effects to the open space resource. In considering mitigation measures on agricultural appurtenances, the Design Review Committee will give priority to the needs of productive agriculture. A fence or agricultural appurtenance less than 200 square feet is permitted without design review.

(3) Site plans shall be presented to the Bennett Valley/North Sonoma Mountain Design Review Committee including:

a. An existing topographic map
b. An existing vegetation plan
c. Photographs of the site from four (4) directions
d. A proposed grading plan (if any)
e. A proposed landscape plan
f. A plan showing siting, bulk, design, color and materials of structures.

(4) Approval of plans for new structures shall consider the relationships of the site.

(5) All new structures shall be sited so that they harmonize with the natural surroundings, including but not limited to topography and vegetation; specifically

a. Roof lines shall follow established lines of land and/or tree forms;

b. Existing vegetation and landforms shall be utilized to screen structures from public view.

(6) New structures should be sited to take advantage of solar energy where that siting does not conflict with the public view.

(7) Structures shall utilize color, texture and materials that blend harmoniously with surrounding landscape. The following are recommended for harmonious development:

a. Materials: natural wood siding or shingles and natural stone for exteriors;

b. Colors: earth tone;

c. Roofing: fire resistant but dark toned if visible;

d. Roofline: considered in relationship to the total composition of structure with landscape.

(8) Utilities shall be placed underground from source point, unless masked by existing vegetation.

(9) Project outdoor lighting shall comply with the outdoor lighting policies of the General Plan Open Space and Resource Conservation Element.

(10) Existing structures shall be encouraged to comply with the standards for new structures as they undergo remodeling and maintenance.

(11) Existing neighborhoods shall be encouraged to undertake tree planting and landscaping programs to screen existing development from public view and to increase the privacy, comfort and habitability of the neighborhood (Chart 1).

Chart 1 SOIL PLANTING MATRIX

PLANTING CHOICES	MAJOR SOIL GROUPINGS IN BENNETT VALLEY					
		A	C	D	E	G
A. Choice of plants NOT LIMITED BY SOILS. Soils are deep through very deep, moderately coarse through medium textured, moderately well through well drained, moderately rapidly through moderately slowly permeable. (Soils in this group can have slight salinity or alkalinity).	Akc	x				
	Bof	x				
	Cca		x			
	Ccb		x			
	DbE		x			
	GgE	x				
	GgG	x				
C. Choice of plants LIMITED BY FINE TEXTURES. Soils are deep through very deep, moderately fine through fine textured, moderately well drained, moderately slowly through slowly permeable.	GlD					x
	GlE					x
	GlF					x
	GoF					x
	HcC			x		
D. Choice of plants LIMITED BY VERY SLOWLY PERMEABLE (CLAYPAN) SUBSOILS. Soils are moderately well drained, with slow or very slow subsoil permeability.	HcD			x		
	LaC	x				
	LaD	x				
	LuA	x				
E. Choice of plants LIMITED BY WETNESS. Soils are somewhat poorly through very poorly drained. (Drained soil phases will be placed in appropriate group according to their current drainage status. Slight salinity and/or alkalinity may be present).	LvB	x				
	MbC	x				
	PeC	x				
	Phb	x				
	PlC	x		x		
	PsC			x		
G. Choice of plants LIMITED BY DEPTH. Soils are shallow through moderately deep, well drained, over hardpan, bedrock, or other unfractured reuse material.	RaC		x			
	RaD		x			
	RaE		x			
	RnA				x	
	SkC			x		
	SkE			x		
	SkF			x		
	ToE					x
	TuE					x
	YsA	x				
	ZaA	x				
	ZaB	x				

PUBLIC SERVICE STANDARDS

To maintain present standards for the schools, redistricting the elementary school boundary to take advantage of Bellevue Union's declining enrollment, relieve Bennett Valley Union's overcrowding and converting bus service to a self-supporting entity by requiring a fare should be considered.

The cumulative impact of additional development on the school system should be completely analyzed in the consideration of major and minor subdivisions and rezonings.

The Sheriff's Department foresees no need to expand facilities as a result of increased development. The Fire Department, however, will require at least an additional pumper and another firefighter. The present revenue base is not sufficient to provide the additional equipment and staff will not be funded. Other revenue sources will need to be sought.

At the densities proposed, the capacity of the roads should not be exceeded. Improvements to roads other than safety and maintenance will occur if, and only if supported by the local residents, and if designated in the General Plan Circulation and Transit Element. If road improvements are desired, funding will be generated by development fees, trust funds, state and federal government funding, or combination of these. In the case of conflict of policies of standards between the Bennett Valley Area Plan and the General Plan, the more restrictive policies or standards shall apply.

If tax revenues are insufficient to support present public service standards for future development, and if the public wishes to maintain these standards, alternative sources of funding must be generated. Both Trust Funds and Assessment Districts can be used to provide fund for schools, fire departments, roads and landscaping.

Trust Funds are a one-time assessment that can be established by the Board of Supervisors without a vote of the people. They are not expensive to administer and they place the fiscal burden on new development. Trust Funds are most appropriate for providing for one time capital expenditures.

The following procedure should be utilized to implement road trust funds:

(1) Determine condition of roads.

(2) Determine minimum facility that would be required by development allowed in Land Use Plan and compute cost of facility.

(3) Develop a factor for a County share of road costs based on factors such as through traffic and typical maintenance costs before development.

(4) Assess a per lot fee based on total construction costs minus county share of such costs, divided by the number of potential building sites.

(5) Lot fee would be due and payable at the time of lot sale (lots in excess of 100 acres would be exempt).

Assessment Districts also generate revenues. They are taxing jurisdictions established for a particular purpose by a two-thirds vote of the residents involved. They are both expensive and difficult to establish particularly with the new taxation requirements of Jarvis-Gann, and place the burden of the assessment on the entire district, rather than the new development. Assessment Districts are continual sources of funds which can provide for ongoing operational expenditures.

Provision of permanent Open Space is a major objective of this plan. The Land Conservation Act of 1967 as amended provides a property incentive for Open Space Easements, if the County makes the findings that the preservation of the land as open space is consistent with the General Plan and is in the best interests of the County.

Permanently dedicated Open Space can also be preserved and qualify for income and estate tax benefits if the landowner deeds development rights or property to the Sonoma Land Trust.

Where land is not voluntarily restricted from development, preservation of other unique resources in complex. Sensitive archaeologic sites and biotic communities could be irreversibly damaged if adequate precautions are not exercised. Specific designation of such sensitive areas might result in their destruction; thus, in concert with County policy, sensitive archaeologic and biotic sites are mapped in a generalized way. Any development proposals that fall in one of the mapped locations will be referred to the appropriate experts for further investigation and mitigation as part of the project level CEQA review.

From: Neighborhood Coalition
To: Christina Rivera
Cc: Susan Gorin; David Rabbitt; Chris Coursey; James Gore; Lynda Hopkins; Crystal Acker; Cannabis
Subject: Impact of Cannabis on Health and Safety of Sonoma County Residents
Date: Monday, March 13, 2023 11:00:51 AM
Attachments: image.png
Health and Safety Letter.pdf

EXTERNAL

Please see the attached letter concerning the impact of cannabis on health and safety of Sonoma County residents.

Thank you.

Nancy and Brantly Richardson, Communications Directors
SonomaNeighborhoodCoalition@gmail.com

March 13, 2023

Honorable Christina Rivera
Sonoma County Administrator
600 Administration Drive
Santa Rosa, California 95403

Re: Impact of Cannabis on Health and Safety of Sonoma County Residents

Dear Ms. Rivera:

Congratulations on your appointment as Sonoma County's Administrator. In your new role, the Neighborhood Coalition of Sonoma County respectfully requests you address the urgent issues surrounding the impact of cannabis on the health and welfare of Sonoma County residents. The County's robust support for the cannabis industry is undeniable. The County's focus, however, appears to be on the economics of the substance and providing financial support to growers and sellers, while ignoring the dark underbelly of cannabis and the risks posed to the public by its production and use.

As you undoubtedly are aware, Proposition 64 created The California Marijuana Tax Fund with designated funding, including annual funding as follows: (1) $2 Million to the UC San Diego Center for Medical Cannabis Research; (2) $10 Million to California universities for research as to the impact and implementation of Proposition 64; (3) $3 Million to the CHP to develop protocols for assessment of driving under the influence of cannabis; and (4) $50 Million for grants to local health departments and community-based nonprofits supporting, among other issues, mental health treatment and substance use disorder treatment.

In addition to the earmarked funds, Proposition 64 directs the remaining funds be dedicated as follows: (1) 60% to youth programs, including drug education, prevention, and treatment; (2) 20% to prevent and alleviate environmental damage from illegal marijuana producers; and (3) 20% to programs designed to reduce driving under the influence of marijuana and for a grant program designed to reduce negative impacts on health or safety resulting from the proposition.

The plentiful funding available through Proposition 64 Public Health and Safety Grant Program requires no local or matching funds. Nevertheless, we are not aware of the County's accessing these funds in any significant way to address rapidly emerging and serious public health risks inextricably entwined with the cannabis industry, an industry the County leaders so wholeheartedly support. These risks clearly were foreseen by the topics identified in Proposition 64's specification of funding coverage. And yet, what is the County doing to educate youth and the public about drug prevention and treatment? Similarly, what is the County doing to prevent and alleviate environmental damage from cannabis production? Finally, what is the County doing to ensure the safety of its citizens from the crime resulting from the presence of the cannabis production?

So, you may ask, why are we alarmed? A few select examples underscore the accuracy of the damage and risks that concerned the Proposition 64 drafters.

Health -

The Press Democrat reported a study by the Southern Illinois School of Medicine[1] detailing reports to the nation's poison control centers of more than 7000 cases of children eating marijuana edibles between 2017 and 2021, climbing from about 200 to more than 3000 per year. More than half of those cases involved toddlers, ages 2 and 3, and more than 90% got the edibles at home. Nearly 600 children were admitted to critical care units with depressed breathing or even coma. Almost twice as many were admitted to non-critical care units and more than a third were seen in emergency rooms.

The health risks of marijuana to children are not limited to directly ingesting it. Not surprisingly, secondhand marijuana smoke contains many of the same cancer-causing toxins as secondhand tobacco smoke according to Brooke Hoots, a Centers for Disease Control and Prevention epidemiologist. According to the CDC, the substance within marijuana that causes a "high" — tetrahydrocannabinol, or THC — can be passed to young children from secondhand smoke. Researchers in New York City found about one-third of parents surveyed reported marijuana smells in their home while children were there, according to an article published in January 2021. It took years for the world to understand the damage to children from secondhand tobacco smoke. Clearly secondhand marijuana smoke presents similar, if not more harmful, risks to children.

These reports are exemplary of the types of risks about which it falls on the County to pro-actively educate and warn the public in order to protect its youngest citizens from the fallout of the County's embrace of cannabis.

The negative consequences of cannabis use among our youth has been documented and presents immediate concerns for our County's teen and young adult population with ramifications impacting the entire County. According to a recent article in the Wall Street Journal[2], "Young people are especially vulnerable to cannabis's effects because their brains are still developing," a conclusion confirmed by a study reviewing scans of teenagers' brains before and after they

[1] See The Press Democrat, January 8, 2023
[2] Cannabis and the Violent Crime Surge, Allysia Finley, June 6, 2022, Wall Street Journal

started using pot. “They found that parts of the brain involved in decision making and morality judgments were altered in pot users compared to nonusers.” The article goes on to detail further concerns which mandate action by our public health officials.

On the other end of the age spectrum, a new University of California San Diego School of Medicine study has identified a sharp increase in cannabis-related emergency department visits among the elderly.

“The study, published Jan. 9, 2023 in the *Journal of the American Geriatrics Society* , identified a 1,808% relative increase in the rate of cannabis-related trips to the emergency department among California adults ages 65 and older from 2005 to 2019. Researchers used a trend analysis of data from the Department of Healthcare Access and Information and found that cannabis-related emergency department visits went from a total of 366 in 2005 to 12,167 in 2019.
The significant increase is particularly troublesome to geriatricians, given that older adults are at a higher risk for adverse health effects associated with psychoactive substances, including cannabis. The study highlights that cannabis use among older adults can lead to unintended consequences that require emergency care for a variety of reasons. Cannabis can slow reaction time and impair attention, which may lead to injuries and falls; increase the risk for psychosis, delirium and paranoia; exacerbate cardiovascular and pulmonary diseases and interact with other prescription medications.”[3]

In that study, the author noted, “We know from work in alcohol that older adults are more likely to make a change in substance use if they see that it is linked to an undesirable medical symptom or outcome — so linking cannabis use similarly could help with behavioral change,” said Alison Moore, MD, MPH, co-author of the study and chief of the Division of Geriatrics, Gerontology, and Palliative Care in the Department of Medicine at UC San Diego School of Medicine. As with young children, this study underscores the need for the County’s public health agencies to pro-actively educate the public, and particularly older adults, about the risks of cannabis in order to avert these medical crises.

In regard to adults of all ages, the deleterious effects of cannabis on the cardiovascular health of adults were recently reported by researchers who concluded, "Thus, there is growing evidence from both laboratory and population studies that cannabis consumption may be harmful for cardiovascular health." [4]

The impact of cannabis on mental health is similarly alarming. “Overall, use of higher potency cannabis, relative to lower potency cannabis, was associated with an increased risk of psychosis and CUD. Evidence varied for depression and anxiety. The association of cannabis potency with CUD and psychosis highlights its relevance in health-care settings, and for public health

[3] Tiffany Kary 1/23/23 Bloomberg Newsletter

[4] Frequent Cannabis Use Tied to Coronary Artery Disease Marlene Busko February 28, 2023
https://www.medscape.com/viewarticle/988902?

guidelines and policies on cannabis sales."[5] These concerns as to increased potency of cannabis permeate the impact of the drug in every aspect of public health as processors and manufacturers develop products and methods for increased potency, seemingly without any oversight or concern as to the impact on public health. To fulfill its duty to protect the public health of its residents, the County must impose limits as to potency of cannabis and marijuana products and disclose to residents the full impact of these products on their physical and mental health.

In all these settings, the County is uniquely capable of providing outreach to the public to warn and prevent these deleterious outcomes from cannabis and can do so at no cost to the County with the Proposition 64 funding. These deep-seated and long-term public health issues require immediate investigation. The County cannot wait for these outcomes to fully manifest themselves before acting. At that point the proverbial horse will be out of the barn.

Environment -

Proposition 64 also provides funding to prevent and alleviate environmental damage from illegal marijuana producers. In this regard, it should be noted the environmental risks of cannabis production do not neatly fit into legal or illegal markets. These risks are profound and diffuse, crossing over environmental abuses ranging from water and land use pollution to greenhouse-gas emissions with a litany of other environmental harm along the way. These are all issues about which the County should be alarmed, and which require investigation and assessment as soon as possible.

Evan Mills, writing in "The Journal of Impact and ESG (Environment Social Governance) Investing"[6], identifies specific examples of the scope of these environmental issues including but not limited to pollution from pesticide use, water use, land-use change, waste production, volatile organic compound (VOC) releases to the air, and solvents used to produce extracts. As to the carbon footprint of cannabis, he reported indoor cannabis cultivation requires significantly more energy input than most products and is on a par with that of even the most energy-intensive industrial materials (cement, zinc, copper, and aluminum). For the legal and illicit cannabis markets combined, a decade ago Mr. Mills estimated the corresponding annual energy and greenhouse-gas emissions equal to that of three million cars nationally, a whopping $6 billion *annual* energy bill. He concluded that given rising demand, the numbers are likely higher today, and that original analysis did not include the full array of emissions. He further estimated demand for energy by cannabis facilities is growing at such a rate that all of California's existing wind energy, for example, could easily end up being, in effect, diverted solely to power cannabis cultivation. These concerns impact the entire state, and more specifically, Sonoma County, where we particularly value our environment and health.

[5] (The Lancet – Psychiatry – Association of Cannabis Potency with Mental Illness and Addiction. – Volume 9, Issue 9, September 2022)

[6] https://evan-mills.medium.com/cannabis-esg-risk-is-a-buzzkill-for-investors-1c9749def519

Again, we believe the County should be immediately taking advantage of the availability of Proposition 64 monies, at no cost to the County, to identify and remediate environmental harm from cannabis operations of all types.

Safety –

The drafters of Proposition 64 also correctly identified safety as among the negative impacts which would flow from its passage and earmarked funds for counties to access to reduce negative impacts on safety resulting from the proposition. The recent headlines underscore the criminality which has flowed from the presence of the cannabis industry in Sonoma County as the robberies of dispensaries have become almost commonplace. While dispensaries in Santa Rosa are charged with providing their own security[7], the criminal element they attract impacts the entire community.[8]

These concerns about safety were recently detailed in a study by the Los Angeles Times entitled "Legal Weed – Broken Promises"[9]. In its extensive investigation, the Times reported on the risks and safety abuses throughout the State relating to cannabis production including the safety and health risks to those being hired to work in that industry. That report included extensive investigation in Northern California. The Times' findings provide ample evidence for the need for the County to avail itself of the Proposition 64 funding in order to mitigate the negative impact of cannabis on our County and to keep its citizens safe.

Conclusion -

These concerns and examples are the proverbial tips of the icebergs which the County must navigate if it is to fulfill its duty to protect the health and safety of its citizens as well as to protect our environment from harm as a result of the passage of Proposition 64. The immediate access to these funds and the implementation of the information and programs flowing from those actions dovetail with the County's undertaking revision of its health ordinance on April 4, 2023. Fortunately, the funding for the County to accomplish those objectives is provided without cost by The California Marijuana Tax Fund. Those monies should allow the County to delve deeply into these issues to identify them, educate people about them, and to prevent, or at least limit, the harm foreseen by Proposition 64 and the legalization of cannabis.

We ask that you, as the new navigator for the County's ship of state, navigate those icebergs by aggressively seeking solutions to these problems using that funding to insure the health and safety of our County and its citizens.

Neighborhood Coalition
Nancy and Brantly Richardson, Communications Directors
SonomaNeighborhoodCoalition@gmail.com

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[7] Santa Rosa City Ordinance 2017-025-G. Security
[8] See Santa Rosa Press Democrat 1/19/23 and 2/4/23 front page articles; also see
[9] L.A. Times 10/31/22

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Cc:	Susan Gorin; David Rabbitt; Lynda Hopkins; Chris Coursey; James Gore
Subject:	NOP for EIR Cannabis: Scoping Comments for Neighborhood Compatibility
Date:	Tuesday, March 14, 2023 9:14:44 AM

EXTERNAL

Date: March 14, 2023

To: **cannabis@sonoma-county.org**, **crystal.acker@sonoma-county.org**

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, James Gore<James.Gore@sonoma-county.org>, Crystal Acker <crystal.acker@sonoma-county.org>

Subject: NOP for EIR Cannabis: Scoping Comments for **Neighborhood Compatibility**

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

In support of the Count's efforts, Neighbors of West County (NOW) is providing the following recommendations for study in the EIR and incorporation into the final Cannabis Ordinance. The following comments are provided specifically to the Neighborhood Compatibility (NC) requirement called out in the Project Description of the NOP scope document issued Feb 6, 2023. For over five years, the community has submitted substantive evidence into the record as to the need for an ordinance that addresses Neighborhood Compatibility and it is great the Framework/NOP now recognizes this as a top priority. As we know the topic of Neighborhood Compatibility (NC) has been a difficult topic for all parties - Growers, residents, and County staff. The inability to successfully address this issue is one of the main reasons for this EIR. Neighborhood Compatibility has been one of the largest stumbling blocks of the current Ordinance and the new Ordinance will only be successful if this is properly addressed.

The analysis of Neighborhood Compatibility must address the most critical issue to our health, safety and the peaceful enjoyment of our properties. Commercial operations that have a high value product are incompatible with residential neighborhoods. The recent increase in cannabis burglaries, weapons and high speed pursuits brings home this point. The County Ordinance must include neighborhood separation criteria that ensures sufficient separation of a commercial operation from a residential type neighborhood that, at a minimum, considers odor, groundwater, visual, safety (including crime, road access and wildfire), and noise impacts. Setbacks of 1000 ft. and 20 acre minimum parcel size should be studied and required.

The EIR portion of this process focuses on the 19 environmental elements required by CEQA. Although Neighborhood Compatibly is not called out specifically, its requirement is covered in many of these elements so needs to be addressed and resolved. These CEQA Environmental elements include: Aesthetics/Visual, Air Quality, Hazardous Materials and waste, Hydrology and Water quality, Land use/planning inclusive of compatibility with existing communities, Noise, Public Services including crime and neighborhood safety, wildfires and cumulative impacts.

The Health and Safety Section of a General Plan would also encompass NC. These factors have significant irreversible repercussions for rural communities if not properly addressed. Much of Sonoma County is widely recognized for its rural character, country living and small-town charm. Permanently altering these characteristics in the name of commercial cannabis cultivation, will negatively impact the many to benefit the few. This commercial industrial type land use is not consistent with rural residential neighborhoods made up predominately of family homes with a few hobby farmers. Nothing in the scale, value, or activity of a commercial cannabis operation resembles our rural life. It can permanently change the character of neighborhoods. It will negatively impact property values.

<u>Aesthetics</u>: Cannabis hoop houses appear out of touch with surrounding community features and are unsightly if located in rural environments. These indisputably have significant visual impacts and degrade the existing visual character of rural communities. The EIR should analyze the types of barriers and distances to avoid these impacts and the disposal of the materials when they are disassembled or abandoned. The use of permanent foundations and electrical components must be disallowed.

<u>Air Quality</u>: Cannabis odor can be detected at least 1000 ft. from the source. Since it can be grown nearly year around, a neighborhood's air quality can be negatively impacted much of the year. The EIR should analyze and model odor impacts at various distances and under various wind conditions from the cannabis odor emission source. Odors at levels of 50,000 odor units or more have been produced at cannabis facilities and should be studied at that level with final ordinance criteria set at that level. Analyze what measures are necessary to stop odor from leaving the property. Santa Barbara County requires Odor Abatement Plans which should be studied for inclusion here.

<u>Water</u>: Cannabis is one of the thirstiest crops (3 to 6 times more than grapes depending on the study). Most rural residences are on wells with minimal water use compared to cannabis. We can’t afford large users with the resources to drill deeper wells adjacent to residential wells. Sonoma County has not updated their water studies for decades, does not understand the impacts of the new norm of global warms/droughts, the effects of increased population growth and uses, and does not know the cumulative impacts, so it makes no sense to allow a high water usage crop in the vicinity of residential wells.

Health and Safety: It is recognized by all parties, County staff, growers and neighbors that cannabis's value is incomparable to any crop we've seen. At $500K - $2m acre compared to the next highest value crop, -grapes at $30K acre, it is a game changer for safety. The current County Ordinance acknowledges such by imposing security requirements. It should be noted the intent is to increase security on cultivation sites, but this does nothing to protect the safety of the surrounding community. This is not a hypothetical scare, many neighbors have been impacted. Criminals have gone to the wrong address. The County Sheriff acknowledges such risks and that they can't likely respond quickly to a rural incident, and suggests neighbors arm themselves. It seems impossible to think a highly valued cash crop could be compatible in a rural residential neighborhood. Below is the Health and Safety clause from Yolo County cannabis ordinance which tries to address some of these concerns. Although the criteria are qualitative not quantitative, we feel all parties would know when a site is appropriate.

Yolo County Health and Safety Clause: The proposed use, together with the applicable conditions, will not impair the integrity or character of the neighborhood nor be detrimental to the public health, safety, or general welfare.
a. The population in the area has been taken into consideration.
b. The crime rate in the area has been taken into consideration.
c. The record of nuisance abatements in area has been taken into consideration.
d. <u>Community character has been taken into consideration.</u>
e. Community support has been taken into consideration.

<u>Land Use & Planning</u>:

One tool to help solve the compatibility issue is distance provided by setbacks and buffers. A 1000 ft. setback seems to be common distance in various county ordinances.

1. Yolo has 1000 ft. setbacks for new permits. Measured from the closest point of the residential boundary to the closest point of any structure or outdoor area containing cannabis. These buffers increase to 1500 ft. from residential zone properties.
2. Santa Barbara Odor agreement between the growers and citizens defines "No odor areas: (Publicly Accessible Locations **-** PAL), which includes parks, businesses, day care centers, youth centers, schools, churches, and homes. Residential parcels that are within 1,000 feet measured from the property line". Their 2018 County summary requires 1500 ft. setbacks in AG-1 areas.
3. Sonoma County Ordinance has 1000-foot setbacks from schools, parks, etc. Further it states "… children are sensitive populations". Given the fact that children spend a larger percentage of their time at home than they do at school, it makes sense to have the same 1000-foot setbacks at home (currently 100 ft.) implemented (from the property line).

<u>Zoning</u>: Ag land and residential zoned lands: In response to the turmoil around the original 2017 ordinance, the County and BOS removed non Ag parcels (zoned AA and AR) and increased the parcel size to 10 acres. The AA & AR areas are primarily residential now and as such seem very incompatible. The 10 acre minimum was a start at providing the necessary separation between the growers and families. There is no good reason to reduce this as that would only set us all back. Note Santa Barbara County prohibits Commercial cannabis activities on

AG-I zoned lots that are equal to, or less than, 20 acres in size. Sonoma County should study the same- 20 acre minimum.

The current zonings of Agricultural, Resource and Rural Residential in these areas no longer reflect the actual use on the ground and are no longer adequate in defining where cannabis is allowed. These areas have been carved up into smaller parcels (10 acres or less); many are now residential in nature and cannot provide adequate separation between homes and commercial cannabis. Yet there are 1,595 Ag zone parcels over 10 acres; the County should study these parcels, exclude those too close to neighborhoods and report on the quantity and locations of such. Then determine if these can accommodate the expected level of cannabis in Sonoma County.

Another set of criteria to include or exclude a grow site would be to see what's currently on the land. For example one goal would be "Residential character is to be preserved (no grow)":

a. current land use is residential
b. neighborhood is clearly defined
c. currently little or no commercial ag operations
d. adjacent to residential area

We provide another example from Yolo County, which specifically states "Ensure neighborhood compatibility" as one of its primary goals: Yolo County Ordinance: Summary: Sec. 8-2.1402 Purpose
The adoption of this article is necessary and desirable to accomplish and balance the following:
A. Protect the public health, safety, and welfare.
B. Protect environmental resources and minimize environmental impact.
C. Ensure neighborhood compatibility.
D. Ensure safe access to medical cannabis for patients.
E. Support agricultural economic development including recognition of valuable new crops, preservation of agricultural land, and creation of opportunities for new farmers.
F. Recognize cannabis as an agricultural crop with unique challenges including Federal classification, legal history, crop value, transaction security, distinct odor, and energy and water requirements.
G. Recognize competing and evolving community values and interests related to the cannabis industry.
H. Avoid establishing undesirable precedents for other agricultural sectors.
I. Avoid unintended consequences including unforeseen community impacts and over-regulation that drives cannabis activities underground.
J. Allow for adaptation to changing market, cultural, and regulatory considerations over time
K. Acknowledge the will of the voters in passing Proposition 64, The Control, Regulate and Tax Audit Use of Marijuana, in 2016

<u>Cana-Tourism and visitations</u> – There is much push by the cannabis industry to allow visitation to their cultivation sites, including adjunct parcels that aren't designed as

cannabis but allow them to get around the spirit of the law. This is similar to the problems with the recent uptick in Airbnb's and the push for winery events into our rural residential neighborhoods, where there has been significant push back. Now the County is struggling to regulate these activities. These type of visits are inconsistent with resident's quiet enjoyment of their property and should not be allowed. To accommodate the wants of the industry, it would make more sense to study how to allow these in industrial and commercial settings.

<u>Define Cannabis as Ag Product</u>: One of the stated goals in the Project Description is "Consideration of a GP Amendment… addressing the relationship between cannabis and traditional agricultural …. uses". To the NOW group that sounds like an attempt to redefine cannabis as traditional agriculture. We have two concerns:

1. The possibility of cannabis being considered an agricultural crop and thereby given all the special dispensations of the right-to-farm act must be analyzed to prevent unintended consequences. Right now cannabis is not considered ag at the state level. The fact that it is a high value drug sets it apart from every other traditional ag crop. The EIR needs to address all the significant impacts of this possible change of status of cannabis, including setbacks to riparian corridors, wetlands and parcels with BH zoning. As we've seen with vineyard development, Best Management Practices are just suggestions and violators of those BMPs are rarely disciplined for violating them.
2. Redefining cannabis as Ag (or something similar to get around the spirit of the law), would potentially reduce the public's rights, protections, and ability to have their voice heard on impacts caused by a neighboring activity. This is 100% contrary to the concept of Neighborhood Compatibility and must not be allowed. Study what rights and protections would be lost.

Finally, the CAG (Cannabis Advisory Group), which was comprised mainly of growers, pointed out in their March 2018 report to the BOS: "Many rural landowners are upset with the influx of cannabis operations and permit applications in their neighborhoods. They are upset for a variety of reasons: environmental concerns, access concerns, concerns about odor, crime, aesthetics, and the onset of commercial activity in a serene rural residential setting…..**The residential character of the area would be significantly compromised by the installation of a commercial cannabis cultivation operation**…." . Considering the industry's acknowledgement on the Adjacency issue, we loudly encourage the County to study during the CEQA process and ultimately incorporate NC standards into the final ordinance that protect the average citizens way of life. This will ensure nearby property owners rights to health, safety and peaceful enjoyment of their properties.

Thank you
Neighbors of West County (NOW)
Bill Krawetz
Anna Ransome

From: Mary Plimpton
To: Cannabis; Crystal Acker
Subject: CANNABIS EIR SCOPING: WILDLIFE PROTECTION
Date: Tuesday, March 14, 2023 4:18:45 PM

EXTERNAL

Scoping Document: **Wildlife Protection**

Amidst all the important issues being discussed pertinent to Sonoma County's policies governing CANNABIS CULTIVATION, PROCESSING and related BUSINESSES, as well as the potential fiscal impacts
on the County, we ask for your consideration that wildlife not become collateral damage.

In support of Sonoma County's draft cannabis ordinance framework, we **request that study elements be included in the environmental impact report that explicitly serve to monitor and protect Sonoma County's richly diverse wildlife populations.**

"You cannot begin to preserve any species of animal unless you preserve the habitat in which it dwells. Disturb or destroy that habitat and you will exterminate the species as surely as if you had shot it. So conservation means that you have to preserve forest and grassland, river and lake, even the sea itself. This is not only vital for the preservation of animal life generally, but for the future existence of man himself -- a point that seems to escape many people."
- Gerald Durrell, naturalist and author (7 Jan 1925-1995)

Habitat Loss and Importance of Connectivity
Over the last decade, natural areas in the West—including forests, wetlands, deserts, and grasslands—have been lost to development at the rate of one football field every two and a half minutes (Disappearing West, Center for American Progress, 2016).

At the same time, more than 300 California animal species are at or near the brink of extinction, and many western wildlife species are in severe decline.

Over the past decades, habitat loss in Sonoma County accrued 22% faster than in other counties in the state and 81% faster than elsewhere in the US.

Without habitat protections, the continued collapse of wildlife populations will have profound human and economic consequences in Sonoma and elsewhere.

Sonoma County is fortunate to be home to 860 protected areas (California Protected Area Database 2019, GreenInfo Network) that provide wildlife habitat, recreational opportunity, and ecosystem services. However, Sonoma County is also the most highly parcellated county in California. (Greenbelt Alliance, 2006).

As County population density has increased, the availability of adequate habitat has decreased in tandem with the proliferation of roads, fencing and other development that degrades habitat and impedes movement of wildlife.

In addition to maintaining and expanding protected areas, Sonoma County needs to protect Wildlife Corridors, the continuous areas of natural and working lands connecting protected areas. Corridors allow for daily, seasonal, and generational movement of plants and animals. Keeping landscapes connected via habitat linkages or Corridors is the most frequently recommended strategy for maintaining ecosystem resilience in the face of climate change. (Heller and Zavaleta, 2009).

In addition to supporting healthy movements of plants, animals, and other resources, Corridors contribute to clean and abundant water. Through an inclusive stakeholder process, areas of Sonoma County have already been identified as priority Terrestrial and Riparian Corridors (Gray et al, 2020a). These priority areas provide critical linkages for wildlife between coastal areas to the Berryessa Blue Ridge National Monument, as well as providing access to cooler areas (Gray et al, 2020b).

Protection of native fish and wildlife is consistent with Sonoma County's highest values of livability. Sonoma County's Fish and Wildlife Commission is charged with:

o Public education relating to the scientific principles of fish and wildlife conservation
o Improvement of fish and wildlife habitat
o Scientific fish and wildlife research conducted by institutions of higher learning, qualified researchers, or governmental agencies

The expansion of cannabis, similar to other types of development, is likely to come with ecological costs. These costs may include lower freshwater availability and quality due to withdrawal, road construction, pesticide, degraded wildlife habitat (e.g., vegetation clearing and fencing), and direct mortality (e.g., toxicants and poaching), and disturbance (e.g. lights, equipment noise, human presence) (Parker-Shames, 2021).

Recommendations
In developing Sonoma County cannabis Environmental Impact Report, we request:

1. Sonoma County does not issue "crop protection" licenses to trap, poison or shoot wildlife to cultivators of cannabis, and that illegal killings of wildlife be prosecuted to the fullest extent of the law.

2. Sonoma County's Cannabis programmatic EIR include a county-wide inventory of our various wildlife populations, including identification and

specification of their habitat and movement requirements to sustain healthy populations. Data should include information about resident and migratory species.

3. Sonoma County supports existing or initiates new projects that track wildlife population trends and biodiversity metrics. This data should be made available to the public and should include strategies to address detriment to wildlife from cannabis cultivation.

4. Address the impacts of additional water use on groundwater and aquifers that ultimately and profoundly impact wildlife survival.

References

Parker-Shames, P., Choi, C., Butsic, V., Green, D., Barry, B., Moriarty, K., Levi, T., & Brashares, J. S. 2021. The spatial overlap of small-scale cannabis farms with aquatic and terrestrial biodiversity. Conservation Science and Practice, e602. https://doi.org/10.1111/csp2.602
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Gray, M., Micheli, L., Comendant, T., and Merenlender, A. 2020a. Climate-Wise Habitat Connectivity Takes Sustained Stakeholder Engagement. Land. 9. 413. 10.3390/land9110413.
Gray, M., Micheli, L., Comendant, T., and Merenlender, A. 2020b. Quantifying Climate-Wise Connectivity across a Topographically Diverse Landscape. Land. 9. 355. 10.3390/land9100355

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	CANNABIS UPDATE EIR - SCOPING - GENERAL PLAN AMENDMENTS
Date:	Tuesday, March 14, 2023 7:37:31 PM

EXTERNAL

Cannabis Update EIR – Public Comment on the Notice of Preparation

Agricultural and Forest Element – General Plan Amendments

In the analysis and discussion of the potential impacts associated with a General Plan Amendment to include cannabis within the meaning of "agriculture" and "agricultural Use" as used in the Sonoma County General Plan use the following criteria:

1. Analyze all unintended consequences and their prevention If cannabis is considered an agricultural crop and receives all the special dispensations of the right-to-farm act
2. Analyze how a high value drug which is illegal at the federal level sets cannabis apart from every other traditional ag crop.
3. Address all the significant impacts of this possible change of status of cannabis, including setbacks to riparian corridors, wetlands, and parcels with BH zoning.
4. Analyze suggested and currently used Best Management Practices and how and violations of those BMPs are rarely disciplined for violating them. Provide alternatives for enforcement.
5. Acknowledge that redefining cannabis as Ag (or something similar to get around the spirit of the law), would potentially reduce the public's rights, protections, and ability to have their voice heard on impacts caused by a neighboring activity. Acknowledge this is 100% contrary to the concept of Neighborhood Compatibility. Study what rights and protections would be lost.

From the Notice of Preparation:

Agricultural & Forest Resources. *The EIR will describe the County's current agricultural resources and land uses, including lands subject to Williamson Act Land Conservation contracts, consistent with the Sonoma County General Plan. The General Plan identifies preservation of agricultural land for agricultural uses as the primary goal for the three agricultural land use categories: Land Intensive Agriculture, Land Extensive Agriculture, and Diverse Agriculture. To support that goal, the General Plan includes many policies to protect and enhance agricultural lands and to encourage land uses related to agricultural production, agricultural support, and visitor-serving uses that promote agriculture. The analysis will address compatibility of cannabis operations with traditional agricultural land uses and potential conversion of agricultural lands to non-agricultural uses. The analysis will also include a discussion of potential impacts associated with a General Plan Amendment to include cannabis within the meaning of "agriculture" and "agricultural use" as used in the Sonoma County General Plan. The EIR will describe the County's current forested/timber resources and land uses consistent with the Sonoma County General Plan. The analysis will address compatibility of cannabis operations with timber resources and potential conversion of timberlands.*

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	Cannabis Update EIR - Scoping - Zoning Changes
Date:	Tuesday, March 14, 2023 7:48:20 PM

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR

<u>ZONING CHANGES</u>: (From the NOP) "The Cannabis Program Update would result in a series of zoning changes that may retain, replace, expand on, or eliminate existing provisions of the current cannabis ordinance".

Scientifically analyze the impacts of any zoning changes that replace, expand on or eliminate existing provisions of the current cannabis ordinance on parcels where cultivation (or mfg., sale, etc.) is currently prohibited. Identify these impacts and possible mitigations. The analysis must be data driven, including by not limited to the following concerns.

1. Analyze if the lands currently zoned for cannabis can accommodate the expect level of cultivation, such that expansion into non-zoned areas is not necessary. Note: Total acreage designated as agricultural land use is 326,562 acres or 34.1% of the total acreage in Sonoma County. Of that over 1,595 parcels are over 10 acres.

2. Analyze these parcels to determine which are good candidates for cultivation.

3. Determine if these can accommodate the expected level of cannabis in Sonoma County.

From:	nrchrdsn@sonic.net
To:	Cannabis
Cc:	Crystal Acker
Subject:	Cannabis Update EIR - Scoping- Economic Analysis
Date:	Tuesday, March 14, 2023 12:08:17 PM

EXTERNAL

New additions to previously submitted email of same title highlighted in yellow. Please note.

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR - Economic Analysis

The Framework for the revised cannabis ordinance (March 2022) includes an economic analysis "to help inform relevant policy decisions."

Study, confirm or refute the HdL economic report released March 2023**.** https://sonoma-county.legistar.com/View.ashx?M=F&ID=11658055&GUID=9AF6DE4F-C9BA-4C84-B3E6-313B573F0575

Include the following criteria in the economic analysis:

Include a robust and credible baseline financial and economic analysis of all aspects of the cannabis industry operations including: Cultivation (Outdoor, Mixed light, Indoor). Processing. Manufacturing, Testing, Retail (Dispensaries, Delivery)

Analyze cultivation operations of various sizes and types (outdoor; indoor; mixed light). Evaluate Sonoma County's commercial cannabis cultivation operations viability in relation to the statewide cannabis industry, both legal and illegal. Evaluate state viability for future federal legalization. Evaluate expected revenues derived from taxes, fines for violations, permit and inspection fees, etc. Include all expenses and costs incurred by all County departments (including Sherriff and Courts) involved in implementing and administrating the program.

Ascertain if there would be sufficient income from all cannabis operations to meet the County's legal and promised obligations to establish and maintain the required education, health, and safety programs as required by Proposition 64. Analyze potential future health expenses. Prop 64 provides for grants to local health departments and community-based nonprofits supporting, among other issues, mental health treatment and substance use disorder treatment. Analyze the funding received and whether these goals are achieved.

Analyze whether the finance objectives of Sonoma County Cannabis Business Tax Measure A have been achieved. Specifically, as stated in Measure A: *"to fund essential county services such as addressing industry impacts, public safety, fire, health, housing, roads, and environmental protection,..." . And as stated in the Arguments for Measure A: " contributing their fair share to the funding of vital public services such as public safety, fire, health, housing, roads, and environmental protection. Measure A would provide funds to implement strict standards and location requirements for medical cannabis businesses adopted by the Board of Supervisors. Too many unregulated cannabis operations have damaged our forests, diverted our streams, and increased violent crime. Our new regulations and revenue from this tax will protect our environment and finally help put an end to these illegal operators. The children of Sonoma County are our most important asset. Implementing these regulations and funding enforcement will reduce the risk of accidental ingestion of cannabis products, increase health education and outreach, and decrease violent crime in our neighborhoods."* If not as expected, the reasons for that, and what updates to the Ordinance tax structure is necessary to achieve such.

Analyze the economic impact of county and state payments to growers due to disaster losses (flood/drought/fire). Approximately 30% of Sonoma County growers have applied for relief under the DCC Drought Relief program in return these operator agreed to not engage in commercial cannabis activity for 12 months. This would indicate unsustainable uses and areas. Analyze and report on a) the total number of growers (including by cultivation method) under the drought relief program, b) the level of drought relief payments applied for and/or paid, and c) County and State fee's not paid while under this program.

Analyze the new tax structure adopted by the BOS on Feb 28, 2023, for the following:

- Overall is the tax levels and structure sustainable long term. The Controller office estimated the tax rate does not pay the current costs and must use fund balance to fund the difference. Analyze their assumptions of future revenue and costs for achievability in light of the market trend of further price reductions, competitive pressures, and County cost increases. See HDL report for reference.
- Analyze the County tax revenue and cost structure to support each cultivation method (indoor, mixed light, and outdoor). Determine if each of these segments is economically self-sustaining, or if one segment is subsidizing the other. If not self-sustaining, analyze what tax rates are necessary to make so. For example, a 10K sq. ft. indoor grower pays $125,000 and a similar size outdoor grower only pays $7,500. Does $7,500 cover the County costs? Compared to an indoor operation, an outdoor grow has potential many more issues: odor, water, security, Aesthetics, waste, wildfire, noise, building code requirement, neighborhood compatibility, etc.
- The tax structure was based at looking at the revenue generate by each cultivation method to set a consistent tax rate per dollar of revenue. Analyze where a better method would be based on cost of County to support each cultivation method. Analyze what minimum tax level would be required for each segment to pay for itself.
- Equity legal concern. Analyze whether 2 growers having similar size operations , paying significantly different total tax dollars, is either legal, "fair", and/or violation of social justice equity standards. The County Auditor Controller summary report of Feb 28, 2023 (page 6) shows 15 indoor growers paying more total tax than the 99 outdoor growers.

Analyze the level of cannabis operators who are not compliant with tax obligations, the revenues lost, the budget shortfall this has caused and the social programs not funded.

Analyze whether economic benefits of outdoor cultivation outweigh the negative impacts on neighborhoods and the environment.

Analyze whether outdoor cultivation is economically viable in light competition from larger growers around the state. The HdL report shows the cultivation market is completely saturated, significantly oversupplied, and massive already established big growers control the market. The report stated the top 20 growers can already supply the market needs many times over, and these growers business model is to drive the cost of outdoor cultivation even farther down to $100 pd.

Analyze if revenue will support services needed including but not limited to staffing costs to implement the program, including permitting, compliance inspection, and code enforcement; permit and inspection fees and other applicant-incurred costs to obtain permits and run permitted operations; and civil penalties. Determine if the product pays for itself with reduced revenues.

Analyze impacts to public services such as landfill costs resulting from disposal of waste from the various cannabis operations.

Analyze the impact of canna-tourism on the current revenue from the Transit Occupancy Tax. Napa County concluded that canna-tourism would undermine existing tourism and harm its tax base. Study and compare Napa report. https://www.winebusiness.com/content/file/9111_Report_082019.pdf with Sonoma County.

Analyze how canna-tourism and wine tourism might overlap and dangers to public safety due to known augmented intoxication from combining cannabis with alcohol.

Study two additional policy options:

1) significantly reducing the size, type, and scope of cannabis cultivation

2) the elimination of ALL cultivation in the County.

Present the full range of policy options.

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Cc:	David Rabbitt; Lynda Hopkins; Chris Coursey; Susan Gorin; James Gore
Subject:	NOP of EIR Cannabis / Scoping Comments for Traditional Farming Compatibility
Date:	Wednesday, March 15, 2023 11:28:30 AM
Attachments:	CLUO-BOS-3-8-2111102021.pdf CLUO-BOS-6-28-21 Letter-6-28-2111102021.pdf

EXTERNAL

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

In support of the County's efforts, Neighbors of West County (NOW) provide the following recommendations for scoping study in the EIR and incorporation into the final Cannabis Ordinance. The following comments are provided specifically to the compatibility of cannabis cultivation with *traditional farming practices.*

In review of documents submitted in neighboring counties, both during their cannabis ordinance process, as well their real life experiences on the ground, serious concerns have been raised as to the co-existence of a cannabis operation with a nearby traditional farm. In summary, two main concerns were raised and a third issued noted:

1. Normal farming practices (chemicals, dust, burning) are problematic for cannabis cultivation because such interferes with the cannabis plants' growth and can contaminate it, making it unsalable.

2. Value disparity between traditional crops and cannabis is so large it creates a legal liability that is unsustainable for the traditional farmer.

3. Many of the traditional agriculture operations in Sonoma County rely on farm tours, farm stays and farm stands. The required security measures for cannabis in addition to the odor would be in conflict with those activities.

In the case of Yolo County, the Yolo County Farm Bureau (YCFB) outlined their members' concerns both upfront in the CEQA Ordinance development stage and subsequently in their suit challenging such ordinance.

They feel cannabis is incompatible with traditional family farming: Almonds at $6K an acre verse $1m an acre for cannabis, being such a high difference in value, leads to an economic situation that would likely drive the traditional farmer out of business.

> · "The value disparity between traditional crops and cannabis is so large it creates the reality of serious economic risk to the continuation of traditional ag near cannabis: the traditional farmer or rancher cannot afford to pay for crop damage that may be caused by normal farming practices"
>
> · Traditional farming uses chemicals, creates dust and may require burning, all of which can cause drift onto a neighboring cannabis farm. This can reduce cannabis yield, which cannabis operators have already threatened to bring suit over. An almond farmer making $6K a ton could never compensate a

cannabis grower making a $1m an acre. And any insurance would be unaffordable.

· Cannabis is a “no pesticide residue” product, so is incompatible with ordinary farming practices that uses such.

· Williamson act violation - Act requires land devoted to Ag or compatible use. Since cannabis interferes with ordinary farming practices it is incompatible (Govt. code section 51238.1)

Attached are two YCFB letters to the BOS dated March 8, 2021 (see “Point 3”) and June 28, 2021 (see paragraphs 3 and 4) that spell out these concerns.

Similarly in Napa County, their report prepared for the Cannabis Regulation Initiative (the Elections Code Section 9111 report, section, VI. Environmental Impacts, subsection C. Introduction of Pests and Diseases) found similar concerns but between cannabis and grapes:

> “Pests and diseases are a significant concern for grape growers, as State regulations for cannabis generally disallow application of a broad range of common herbicides and insecticides. This can create the fear that cannabis crops may harbor pests. Conversely, cannabis growers may blame other farmers when their cannabis has illegal pesticides, as their product must meet strict testing requirements before it can be sold. The Initiative does not require any buffers or setbacks between cannabis and other crops, which are necessary to avoid conflicts and potential impacts.”

Santa Barbara reports similar problems (reported by NPR on August 14, 2019):

> In June, Joseph learned that the fungicide she has been spraying on her grapes for decades could be drifting onto the cannabis. Unlike food crops, cannabis can't be sold if there's any trace of fungicide or pesticide in it, according to state law. So while the county investigates, she's using a more expensive and far less effective spray on the grapevines that are nearest to the cannabis farm. "We may lose crop because we can't protect it," Joseph says.”
>
> Other traditional California agriculture is also facing challenges living side by side with the new crop. In Carpenteria, avocado farmers are facing a similar dilemma as north county winemakers. Scott Van Der Kar has an avocado, lemon and cherimoya farm and can't spray the pesticides he has been using for decades.

The Sonoma County EIR study must examine these conflicts, find solutions and develop a program that protects our diverse traditional farms.

Thank you for consideration of these comments.

Neighbors of West County (NOW)

Bill Krawetz & Anna Ransome

YOLO COUNTY
FARM BUREAU

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SECRETARY & TREASURER
Denise Sagara

March 8, 2021

Yolo County Board of Supervisors
ATTN: Jim Provenza, Chair
625 Court Street
Woodland, CA 95695

RE: Draft Cannabis Land Use Ordinance
Review March 9, 2021

Dear Supervisor Provenza;

Yolo County Farm Bureau (YCFB) is here to once again comment that we do not believe that this Cannabis Land Use Ordinance (CLUO) is "ready for prime time".

YCFB has raised many issues since this process started over 4 years ago. I am making only five points today – all of which you have heard before. YCFB requests that the appropriate county legislative bodies, the Board of Supervisors and the Planning Commission rethink the direction in which the County is going.

POINT 1: The EIR should have had a base line of NO CANNABIS (other than the six plant personal use authorized under CA Law). Preparing a comprehensive document by injecting a "given" of dozens of permitted grows distorted the entire process. The perception to the rest of us is that the County's development process for the CLUO was cannabis grower/processor driven.

POINT 2: We – Yolo County Farmers and Ranchers of traditional crops do not consider cannabis agriculture although we recognize it is so described in State law. There are many incompatibilities between cannabis and neighboring or nearby traditional Yolo County crops as I outline.

POINT 3: The disparity in value between cannabis and traditional crops creates seeds of incompatibility that can lead to the inability of the neighboring traditional farmer being able to continue farming. Example: value of an acre of cannabis - $1M. Value of an acre of almonds - $6,000. You need to remember that cannabis is a "No pesticide residue" crop. For instance: pesticides can be put on a neighboring crop according to law – but – testing could show residue on the cannabis grow. And, farmers create dust. However, when dust gets on a neighbor's outdoor cannabis crop the traditional farmer is told the crop has lost value, and he/she is threatened or sued. Insurance is expensive and may not be available at a cost the farmer can afford. In some areas of the State we are seeing cannabis growers use tort law to sue their neighbors. There are instances where pesticide applicators will not apply pesticides for fear a neighboring cannabis grow might be impacted – thus, the traditional farmer may not be able to protect his crop and may lose it. We add that Cannabis can be grown in pots – completely enclosed in space that does not let outside air in or inside air out. The ideal location for all cannabis operations is indoors, in restricted inside air conditions, and in industrial zones located in or near cities. We believe that the DEIR did not cover this value disparity/ incompatibility and inside option adequately.

POINT 4: The FEIR offers a 1,000 foot buffer from a cannabis grow (we note that there are excellent arguments that the buffer should run from any part of the cannabis operation because of the issues they create) to a residence on 20 acres or less, and a 200 foot buffer to a residence located on an ag zoned parcel of over 20 acres. The FEIR justifies this distinction by noting that the house on the "ag zoned" parcel is "incidental" to the ag use and therefore should not expect to be insulated from incidents of "agriculture". Again, in Yolo County cannabis is not a traditional crop. No farmer should have to accept cannabis as a very close neighbor because the State has decided to so categorize it. We also note that the 1,000 feet buffer is a minimum and it must run to the property line --- not include the neighbor's land adjacent to his/her residence. Otherwise, the cannabis grower is "taking" the neighbor's land without paying for it.

POINT 5: we believe that cannabis growers should have the burden of themselves paying for the added risk to neighbors. You all know from the crime statistics that cannabis brings in people with questionable backgrounds. Our members have told us that they have cannabis connected trespass/thievery issues that cause problems. Cannabis growers have security: guard dogs, armed guards, intensive and intrusive lighting to protect their operations. However, the main focus of cannabis security plans should be the neighbors. Thus, cannabis operations should have to provide the county sheriff with a security plan that is focused on protecting those neighbors. They should pay for policies of insurance with reasonable and inflation adjusted limits to protect those neighbors from harm and loss. They should not be able to start any operations until the sheriff has accepted and signed off on an individual plan. The added policing required by these operations should not be the responsibility of the property tax payers of Yolo County.

Sincerely,

Joe Martinez

Joe F. Martinez
President

Cc: County Supervisors
Patrick Blacklock, CEO
Taro Echiburu, Yolo County Community Services
Leslie Lindbo, Yolo County Chief Assistant Department Director
California Farm Bureau Federation

YOLO COUNTY
FARM BUREAU

Yolo County Farm Bureau

69 W Kentucky Avenue, Woodland CA 95695
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PRESIDENT
Joe F. Martinez
1st VICE PRESIDENT
Garrett Driver
2nd VICE PRESIDENT
Mike Hall
SECRETARY & TREASURER
Denise Sagara

June 28, 2021

Yolo County Board of Supervisors
625 Court Street
Woodland, CA 95695

RE: 6/28/2021 Agenda Item #49: Time Set 9:00 am

First – Yolo County Farm Bureau is writing in regard to redirecting your attention to the comments we verbally made at the BOS meeting on June 8. They bear repeating. Outdoor cannabis is incompatible with traditional county agriculture and if you allow it, you will be endangering the ability of those who farm your major Yolo County food crops, who unfortunately find themselves near outdoor cannabis grows, to continue to compete in our world price structure.

YCFB is concerned that some County staff and elected officials seem to believe that outdoor cannabis cultivation is compatible with traditional Yolo County agriculture. Yet, although we have sent written documentation explaining the detrimental impacts of cannabis on food crops since 2017, today's staff report disregards the evidence and documentation explaining how cannabis negatively impacts food crops and therefore is detrimental to Yolo county as a whole.. We note the language in the FEIR at page 3-9: the authors of the FEIR appear to believe that State Pesticide regulations and their enforcement by the County Ag Commissioner, and enforcement of "nuisance dust" by the YSAQD "solve" both issues because "regulations and enforcement" are in place. Thus –ipso facto – no incompatibility.

The existence of and good intentions behind a regulatory scheme do not make it the solution to obvious environmental impacts. The personal experience of one of our board members illustrates this reality: No one doubts the training and the expertise of county employees, or their commitment to do their jobs carefully and well: That is especially true of those who handle herbicides. Some years ago the growers noticed that about 10 walnut trees at the east end of a roadside row had sustained spray drift damage. After looking at the possibilities they realized that the County of Yolo had put on a roadside weed herbicide – and the walnut trees were unintended recipients. The regulations were there --- the good intent was there – but the damage was done. This illustrates that a law on the books is just verbiage: it is not the same as physical barriers and impediments to prevent spray damage. Then, we have the conundrum: The owner of a $1M/acre dollar crop sustaining accidental damage through no intent or bad motive as an adjunct from farming the neighboring $6T/acre almond orchard. This risk- loss of conventional farming - has to be counted in your assessment because it IS an environmental cost of outdoor cannabis cultivation.

Second: Along with more evidence of incompatibility I revisit an issue that I thought would have been handled last meeting: I was assured that the letter filed by Mr. Kyle Lang would be read into the record. However, it was not read. The relevant information that needed to be read was that The Lang family has raised walnuts in Yolo County, both organic and conventional, since 1937. I summarize it now: Kent Lang lived on their River Ranch in West Sacramento just under a mile from an outdoor cannabis grow. Kyle Lang advises that regular and normal farming practices are absolutely not compatible based on the following examples: "each time we disced our field we immediately got texts demanding and begging us to stop because we were ruining the buds. We piled dead trees to burn and were told not to –we were damaging the cannabis. – And should wait until November. When we sprayed nutrition or for pests, we received the same texts telling us – again -to stop and wait until November. Obviously – waiting until November was not an option if one expects to continue farming. Kyle sums up this part of his narrative by stating "The County really needs to look at the negative impacts to regular agriculture activities because every activity regular farming does will negatively impact the marijuana plant. The marijuana plants need to have a sterile medical filtration system to keep dust, fertilizer sprays and any chemical sprays from devaluing their highly sensitive plants."

Secondly, Kyle gave first hand information about the skunk stench that is part of the cannabis operation for at least 3 months of the year. Kyle outlined that the stench of cannabis would spread for 2-3 miles around and with wind it would become concentrated –and travel farther. He states that there were several tenants living on the River Ranch, and they, along with Kent, experienced the terrible stench of "standing next to a dead rotting skunk" in 109 degrees. It was so strong it would keep him up at night, and caused both him and their tenants to have bad headaches. Kyle also pointed out that crime came with the marijuana: he knows of two times trespassers tried to use their land to access the back of the marijuana grow. He concludes by stating, "If our county cannot see the issues growing pot brings to our agricultural practices and way of life, then our county cannot claim to be 'pro agriculture'".

We note that the Staff Report seems to be discussing outdoor cultivation and – maybe -600 ft buffers. What happened to the 1000 feet? What happened to 10,000 feet? ? Why not consideration of at least the suggested 2,500 foot buffer? We stress that there has been NO discussion of indoor cultivation: it is a ridiculous argument for Staff to use the excuse that a "filtration system might fail". Seriously? Any system "might fail" but it is ridiculous for Staff to try to use this long-shot of a reason to disregard the very valid indoor cultivation alternative.

Staff clearly seems to be fixated on outdoor cultivation coupled with minimal buffers, which remain a major unresolved issue because the proposed 600 foot buffer is seriously inadequate. Cannabis is not only incompatible but has serious negative impacts that must not be imposed on a rural farm constituency and their accompanying farming and ranching. The reality of nearby outside cannabis cultivation incompatibilities include nauseating odors that will destroy their quality of life, damage their health, and bring crime onto their ranches and farms.

Very truly yours,

Joe F. Martinez
President

From: Marshall Behling
To: Crystal Acker
Subject: NOP of Cannabis Program Update of EIR
Date: Wednesday, March 15, 2023 11:17:39 AM
Attachments: Cannabis EIR NOA response re firearms.pdf

Please submit the attached for inclusion in the Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR.

Thank you,
Marshall Behling.

March 15, 2023

Crystal Acker, Supervising Planner
crystal.acker@sonoma-county.org
cannabis@sonoma-county.org

Via email

Re: Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR

To whom it concerns:

I am in receipt of the Notice of Preparation (NOP) for the Sonoma County Comprehensive Cannabis Program Update.

Projects resulting in fencing, 24-hour security, security lighting, weapons and firearms being discharged are by definition changing their surrounding environment and thus triggering project-specific CEQA requirements.

Cannabis cultivation involves a valuable crop that criminals may try to steal. It is an easily fencible product with a sizable and ready-made market for both the illegal and legal markets. The all-cash transactions are large. All this makes for a perfect storm for criminal activity including house robberies, hostage taking, violence, shoot-outs and murder – all within Sonoma County. It is because of this that Sonoma County's current cannabis ordinance states; "Weapons and firearms at the cultivation site are prohibited."

This results in cannabis growers arming themselves for self-protection which in term causes fear by neighbors both by the criminals mistaking the neighbors for the grower and by the grower being careless with the weapons. This fear is an environmental effect as it causes stress in surrounding neighborhoods and wildlife in excess of a mile away that result in calls of concern to the sheriff and posts on NextDoor. This environmental effect is aggravated when casual shooting occurs on a grow site such as target shooting because neighbors don't know if such shooting is related to a theft. Accordingly, the EIR should develop adequate mitigation to reduce guns and shooting on cannabis grow sites. These should include ban on weapons on grow sites as the existing Sonoma County Cannabis regulation does but also extending such no-weapon area to the whole parcel containing the permitted grow site.

Analyze and Mitigate the Following:

Study how the weapons and firearms prohibition is being administered and enforced. Currently, Sonoma County Agricultural Commissioner is defining "site" as only the permitted grow square feet. As example, a 10+ acre site may have up to one acre of permitted cannabis grow. Sonoma County's Agriculture Commissioner states weapons and firearms are only prohibited from that one acre grow leaving the remaining 9+ acres of the site available for weapons, firearms and/or a rifle range.

Analyze security issues for areas near cultivation sites, including the factors that Yolo County used in its cannabis ordinance. Analyze potential impacts due to similarity with hemp.

Impacts on Lead Contamination:

Analyze the impact to the soil, ground water and surface water of uncollected led bullets that are decaying in or on the soil. The analysis should include California Department of Fish and Wildlife studies.

Wildfire and Hazardous Land Use risk:

Study the impacts of weapons and firearms at the cannabis cultivation site and their potential for becoming hazardous. According to California code, "A land use that presents a significantly elevated potential for the ignition, prolonged duration, or increased intensity of a Wildfire due to the presence of flammable materials, liquids, or gasses, or other features that initiate or sustain combustion. Such uses are determined by the Local Jurisdiction and may include, but are not limited to, power-generation and distribution facilities; wood processing or storage sites; flammable gas or liquids processing or storage sites; or **shooting ranges**."

Analyze increased wildfire risk from cannabis operations where weapons, firearms and/or rifle ranges are stored, used and or discharged.

Health and Safety:

Commercial cannabis activity shall not create a public nuisance or adversely affect the health or safety of the nearby residents.

Make project determinations based on the Mandatory Findings of Significance, which protects adjacent property owner's rights to health, safety and the peaceful enjoyment of their properties.

Analyze the noise from weapons, firearms and rifle ranges and the impact on neighborhoods and the surrounding wildlife.

Analyze prohibiting all weapons, firearms and or rifle ranges on all parcels where cannabis cultivation is permitted.

From:	Brian Connell
To:	Crystal Acker; Cannabis
Subject:	Comments regarding the EIR that is being prepared to support revisions to the Sonoma County Cannabis Ordinance
Date:	Thursday, March 16, 2023 10:51:16 AM
Attachments:	BVGG cannabis letter.pdf

BENNETT VALLEY
Grape Growers

By email: crystal.acker@sonoma-county.org;
cannabis@sonoma-county.org

March 16, 2023

Crystal Acker, Supervising Planner
PRMD

Re: Designation of Bennett Valley as an cannabis exclusion zone

Dear Ms. Acker:

The Bennett Valley Grape Growers (BVGG) promotes Bennett Valley as a premiere source of premium wine grapes and wines. The BVGG also helps its members improve grape and wine quality while promoting good stewardship of the land through the use of sustainable farming practices. The BVGG was founded soon after Bennett Valley was designated Sonoma County's thirteenth appellation in 2003. The appellation boundaries roughly correspond to the Matanzas Creek watershed. Our 36 primarily family-owned vineyards average less than 20 acres each. Most growers live on site. At harvest time, our grower-owners, their families, and friends work alongside the harvest crews.

PRMD has requested "scoping" comments regarding the environmental impact report that is being prepared to support revisions to the Sonoma County Cannabis Ordinance. The BVGG requests that PRMD direct its consultants to study and evaluate establishing an exclusion zone for all of the land situated within the Bennett Valley Area Plan. This includes all of the land in the Bennett Valley appellation. We understand that designating an exclusion zone would prohibit commercial cannabis from being grown, processed, or sold in Bennett Valley.

The BVGG believes that such an exclusion zone would be in the best interest of our members and enhance marketing opportunities for Bennett Valley grapes and wine. It will assist our mission to promote Bennett Valley as a premiere source of premium wine grapes and wines as well as good stewardship of the land. We understand that the Bennett Valley Community Association and Bennett Valley Grange are also requesting an exclusion zone.

Sincerely,

Brian Connell
President
briconnell@gmail.com

From:	Ms. Harriet Buckwalter
To:	Cannabis; Crystal Acker
Cc:	Raymond Krauss
Subject:	FMWW Comments for EIR Public Scoping
Date:	Thursday, March 16, 2023 4:59:14 PM
Attachments:	2023-03-12 FMWW Letter re Cannabis Ordinance EIR Public Scoping Session.pdf

Ms. Acker,

Please include attached comments as part of the public record for the Cannabis EIR scoping.

Many thanks,
Harriet

Harriet Buckwalter, Co-Chair - she/her
Friends of the Mark West Watershed
Upper Mark West Fire Safe Council
hbuck@sonic.net
(707) 538-5307
6985 Saint Helena Road
Santa Rosa, CA 95404
markwestwatershed.org

A watershed community
dedicated to preserving, protecting,
and restoring the Mark West Creek and its
watershed as a natural and community
resource.

Friends of the Mark West Watershed
6985 Saint Helena Road
Santa Rosa, CA 95404
info@markwestwatershed.org
Tel: 707-538-5307
www.markwestwatershed.org

Date: March 12, 2023

To: Crystal Acker, Planning Division, County of Sonoma

RE: Cannabis Ordinance Updates & EIR Public Scoping Meeting

Dear Ms. Acker,

We are writing to you on behalf of the Friends of the Mark West Watershed (FMWW), a community of neighbors, landowners, and supporters dedicated to preserving, protecting, and restoring the Mark West Creek and its watershed as a natural and community resource. We work to engage the community in stewardship projects, offer educational opportunities, and also collaborate with several other non-profit and governmental agencies invested in the ecological health and sustainability of the Mark West Watershed. We became involved in the many public hearings about various parts of the cannabis ordinance because of concerns that ordinance language was not strong enough to protect our watershed from negative impacts.

The science continues to support a very careful consideration of any new impacts to our critically impaired watershed. The recent flow availability analysis of the Mark West Watershed (study included starting on page 3 of this document) demonstrates that **all groundwater use depletes streamflow over time, regardless of the time of use, or the distance from the stream.** All new water uses in our watershed must be carefully considered. We are aware that the protections we advocate for in this ordinance may not be enough alone to solve our water balance problems, yet any new increases in water use will absolutely tip the balance in the wrong direction. Please ensure that this flow availability analysis which demonstrates the negative impact of groundwater use on streamflow is included in the scope of the EIR.

Please also enter into the EIR scoping record the documents submitted on our behalf by Shute, Mihaly, & Weinberger in 2018 (included at the end of this document). The scientific data in these documents is crucial to the understanding of how any new water use in our watershed can have significant impacts on streamflow. We believe that the EIR needs to consider this evidence when analyzing potential impacts, and that the science will demonstrate why this watershed (and any other critically impaired watershed) needs to be an area excluded from cannabis cultivation zoning.

Thank you for your consideration,

Harriet Buckwalter
FMWW Co-Chair
hbuck@sonic.net

Integrated Surface and Groundwater Modeling and Flow Availability Analysis for Restoration Prioritization Planning, Upper Mark West Creek Watershed, Sonoma County, CA

Wildlife Conservation Board Grant Agreement No. WC-1996AP
Project ID: 2020018

December 2020

Prepared for:

Sonoma Resource Conservation District
1221 Farmers Lane, Suite F, Santa Rosa, CA 95405

and

State of California, Wildlife Conservation Board
1700 9th Street, 4th Floor, Sacramento, CA 95811

Prepared by:

O'Connor Environmental, Inc.
PO Box 794, Healdsburg, CA 95448

Under the direction of:

Coast Range Watershed Institute
451 Hudson Street, Healdsburg, CA 95448
www.coastrangewater.org

PROFESSIONAL GEOLOGIST
JEREMY KOBOR
No. 9501
STATE OF CALIFORNIA

Jeremy Kobor, MS, PG #9501
Senior Hydrologist

Matthew O'Connor, PhD, CEG #2449
President

William Creed, BS
Hydrologist

Dedication

In recognition of those many residents of the Mark West Creek watershed that have suffered losses in the past few years to the Tubbs Fire and the Glass Fire, we dedicate this report in their honor. Many of the citizen contributors to this effort have been working for many years to advance the consciousness of the community with respect to wildfire hazards, fuel management and fire safe communities, and it is an unfortunate truth that there remains much to be done. We dedicate this report in the spirit of community service and the example that has been set by these citizens, families, friends, and communities.

Acknowledgements

Many individuals and organizations contributed to the successful completion of this project including the various members of the project team from the Sonoma Resource Conservation District, Coast Range Watershed Institute, O'Connor Environmental Inc., Friends of Mark West Watershed, the Pepperwood Foundation, and Sonoma County Regional Parks. Many individual landowners graciously provided access for field reconnaissance and streamflow and groundwater monitoring work. Other agencies and organizations including California Sea Grant, California Department of Fish and Wildlife, National Marine Fisheries Service, Sonoma Water, Trout Unlimited, Permit Sonoma, and Sonoma Water also contributed significantly to the project by sharing data and providing input through three Technical Working Group meetings.

Limitations

The descriptions of watershed and streamflow conditions described in this report are based on numerical model simulations which were developed using best available data and hydrologic practices. Available model input data varied widely in its resolution and accuracy, and while the model was calibrated successfully to available streamflow and groundwater monitoring data, the extent of available calibration data is relatively limited. All model scenarios represent hypothetical actions on the landscape and do not imply any interest or commitment on the part of landowners to implement them. Both the existing condition and scenario results represent approximations of real-world conditions that contain uncertainty and should be interpreted as a guide for understanding watershed hydrology and the effects of potential management actions rather than as precise quantitative predictions of actual or future conditions.

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Executive Summary

Introduction

The Mark West Creek watershed provides critical habitat for threatened and endangered anadromous fish and was recently identified in the California Water Action Plan as one of five streams statewide for targeted flow enhancement efforts. Effective implementation of a flow enhancement program requires a detailed understanding of the natural and man-made controls on spring and summer streamflows. The primary goal of this project is to provide a comprehensive hydrologic analysis of streamflow conditions and the relative effectiveness of various potential flow enhancement actions in upper Mark West Creek watershed relative to salmonid habitat requirements. The project provides a framework for prioritizing restoration efforts and developing effective strategies and projects to protect and enhance streamflows.

This study evaluates the upper 40 mi^2 of Mark West Creek watershed upstream of the Santa Rosa Plain (Figure E1) identified as critical salmonid summer rearing habitat in the State Water Resources Control Board Emergency Order WR 2015-0026-DWR (SWRCB, 2015). The study was conducted over a three year period and was completed by the Coast Range Watershed Institute (CRWI) in cooperation with the Sonoma Resource Conservation District (SRCD), Friends of Mark West Watershed, Sonoma County Regional Parks, and the Pepperwood Foundation. Assistance was also provided by local staff of California Department of Fish & Wildlife (CDFW). Funding for the project was provided by a Streamflow Enhancement Program grant from the California Wildlife Conservation Board (WCB).

O’Connor Environmental, Inc., completed the modeling analysis under contract with CRWI. The completed model is intended to serve as a tool to help evaluate the hydrologic consequences of future project proposals. The principal mission of CRWI as a tax-exempt scientific not-for-profit organization in this regard is to provide a virtual “home” for the model and to make it available for future use and updates as new management questions arise and new data become available. In this way, CRWI seeks to extend the benefits to the public of this grant-funded project beyond the immediate utility of its findings.

Approach and Methods

The principal element of the project was development and calibration of a distributed hydrologic model using the computer model code MIKE SHE. Inputs included a wide variety of climate, topographic, land cover, soils, water use, and hydrogeologic data. Outputs included estimates of the annual and seasonal water balance, streamflow hydrographs, and groundwater levels throughout the watershed. The model was constructed using 0.5-acre square grid cells to represent the landscape and stream channel cross sections spaced at 100-ft intervals to represent major stream channels. The model simulates continuous daily hydrologic conditions over a 10-yr period from water year 2009 to 2019. The model was calibrated to streamflow data at three locations and groundwater elevation data at nine locations supplemented by observations of flow conditions (wet vs. dry) on the main stem of Mark West Creek and mapped locations of seeps and springs.

A wide variety of existing and new data sources were used to construct the model. Topographic inputs were derived primarily from the Sonoma County LiDAR Digital Elevation Model (DEM). Climate inputs were derived from monitoring data collected by various entities as well as distributed climate estimates from the U.S. Geological Survey. Land cover data and vegetation properties were based on detailed mapping of vegetation communities provided by Sonoma County Agricultural Preservation and Open Space District in combination with LiDAR-derived Leaf Area Index data and literature-based rooting depth estimates. Soil properties were based on the U.S. Department of Agriculture's Soil Survey Geographic Database (SSURGO) and adjusted during model calibration.

Hydrogeologic inputs were based primarily on new analyses performed for this study which included interpretation of the distribution and thickness of geologic materials from more than

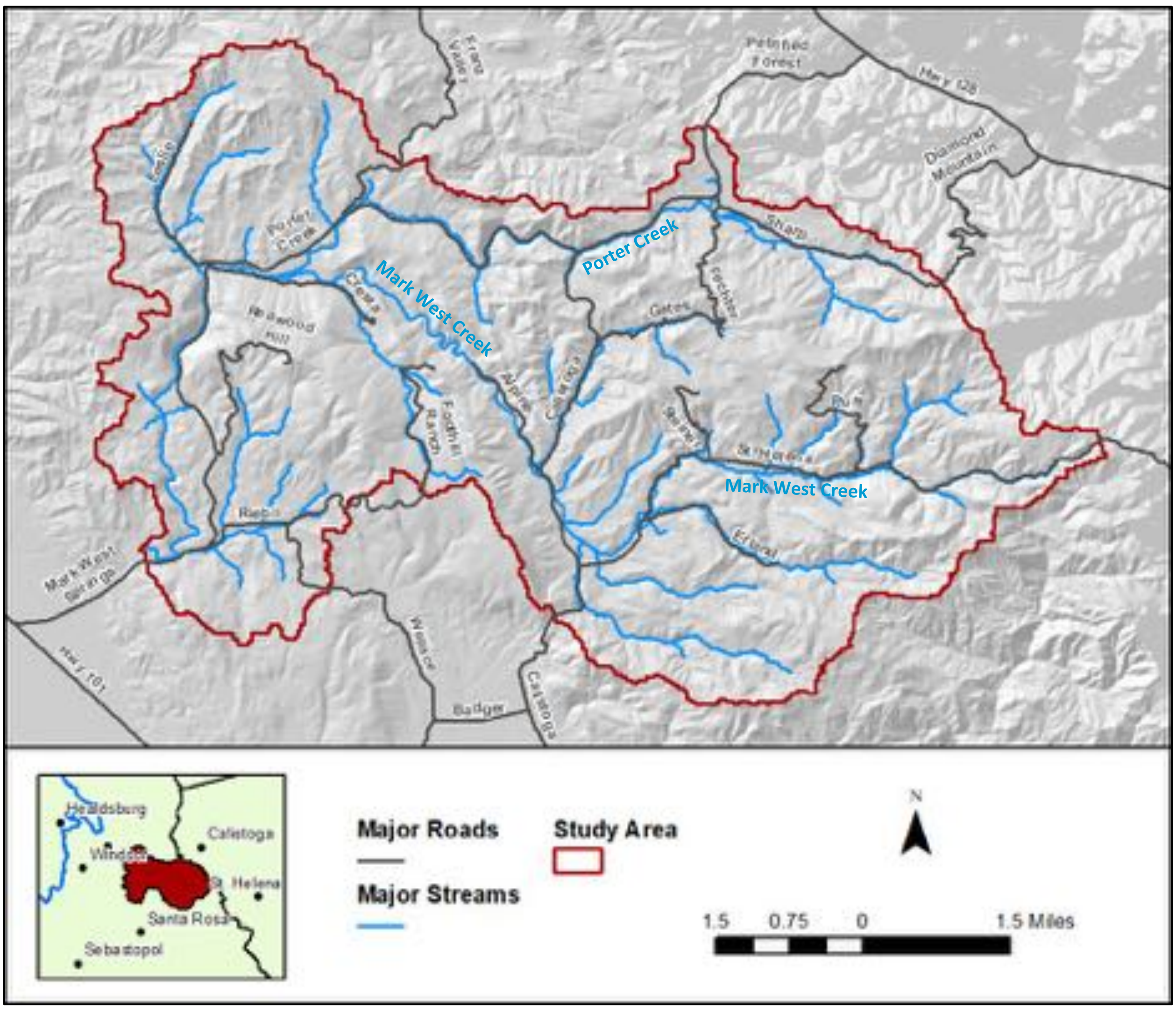


Figure E1: Map of the study area showing major roads and streams.

150 subsurface geologic logs obtained from Well Completion Reports and estimation of aquifer properties from analysis of pump tests completed for Sonoma County Well Yield Certifications at 23 wells. Estimates of the volumes, rates, and sources of water use were based on data from a variety of sources including the State Water Resources Control Board Emergency Order (Order WR 2015-0026-DWR) and Water Rights Database, available Well Completion Reports, spatial mapping of water uses (including vineyards, cannabis farms, wineries, and residences), literature values and other official estimates of water use for various purposes including data from the Town of Windsor and the City of Healdsburg.

Existing Hydrology and Streamflow

Annual precipitation varied widely over the 10-yr study period from 19.5 inches in 2014 to 61.2 inches in 2017, a pattern typical of streams in the California Coast Range (Table E1). Annual streamflow also varied widely from 8.3 to 32.8 inches, largely in response to precipitation patterns. Simulated Actual Evapotranspiration (AET), representing water use by vegetation plus evaporation, accounted for the largest outflow from the watershed over the long-term, ranging from 14.1 to 24.1 inches per year largely in proportion to annual precipitation (Table E1). Simulated annual infiltration recharge to groundwater varied substantially as a function of precipitation from 0.8 inches in the drought year 2014 to 10.1 inches in 2017, an unusually wet year (Table E1).

The simulated groundwater recharge rates indicate large spatial variability, with much of the watershed generating less than 2 in/yr and some portions of the upper watershed generating more than 20 in/yr (Figure E2). Numerous factors affect recharge rates; however, the spatial variations in recharge appear to be primarily controlled by soil properties, topographic position, and the west to east precipitation gradient. Recharge is concentrated in the upper Mark West Creek watershed upstream of and including the Van Buren Creek watershed, as well as in the upper Humbug Creek watershed (Figure E2).

The Climatic Water Deficit (CWD) provides a measure of the seasonal moisture stress and may be indicative of vegetation health and associated fire risk. This metric varied widely across the watershed from 15 to 40 in/yr except locally where lower rates occur due to availability of shallow groundwater (Figure E2). Topographic aspect appears to be a primary control on the spatial variability of CWD with north-facing slopes characterized by lower PET having significantly lower CWD values relative to south-facing slopes.

Groundwater discharge by seeps and springs represents the primary process responsible for generating summer streamflow in the watershed. This discharge is highly concentrated in the upper watershed with the watershed area upstream of Van Buren Creek generating 55% of the total springflow in the watershed despite representing only 17% of the total watershed area. Much of this discharge occurs along steep incised stream banks comprised of bedrock of the Sonoma Volcanics exposed in the upper watershed. Surface water-groundwater interaction through the streambed is relatively limited in most reaches owing to the limited depth and distribution of alluvium overlying bedrock in narrow valley bottoms. The exception to this occurs

Table E1: Annual watershed (top) and groundwater (bottom) water budgets simulated with the hydrologic model, units are inches of water per year.

	Inflows		Outflows			
Water Year	**Precipitation**	**Irrigation**	**AET**	**Streamflow**	**Groundwater Pumping**	**Change in Storage**
2010	42.51	0.07	24.06	17.14	0.15	1.23
2011	43.97	0.07	23.13	17.92	0.15	2.84
2012	28.07	0.07	20.07	10.67	0.15	-2.76
2013	28.87	0.07	17.58	12.83	0.15	-1.62
2014	19.46	0.07	14.06	8.30	0.15	-2.97
2015	26.57	0.07	14.94	12.74	0.15	-1.19
2016	33.30	0.07	17.30	13.83	0.15	2.09
2017	61.18	0.07	21.47	32.75	0.15	6.88
2018	26.59	0.07	18.93	9.07	0.15	-1.49
2019	49.77	0.07	21.63	23.44	0.15	4.62
Average	**36.03**	**0.07**	**19.32**	**15.87**	**0.15**	**0.76**

	Inflows		Outflows					
Water Year	**Infiltration Recharge**	**Streambed Recharge**	**Interflow**	**Baseflow**	**Springflow**	**ET from Groundwater**	**Groundwater Pumping**	**Change in Storage**
2010	6.05	0.71	4.29	0.76	0.58	0.82	0.15	0.16
2011	7.49	0.70	4.00	0.80	0.62	0.89	0.15	1.73
2012	2.22	0.57	1.72	0.63	0.84	1.08	0.15	-1.63
2013	2.39	0.58	2.19	0.60	0.68	0.98	0.15	-1.62
2014	0.84	0.52	1.09	0.50	0.76	1.06	0.15	-2.19
2015	2.10	0.66	1.53	0.59	0.67	1.02	0.15	-1.20
2016	4.44	0.60	2.55	0.67	0.48	0.75	0.15	0.44
2017	10.12	1.03	3.39	0.86	0.97	1.07	0.15	4.72
2018	2.87	0.53	1.91	0.62	0.72	1.06	0.15	-1.05
2019	8.17	1.03	3.48	0.83	0.99	0.99	0.15	2.76
Average	**4.67**	**0.69**	**2.61**	**0.69**	**0.73**	**0.97**	**0.15**	**0.21**

in a short reach of Mark West Creek immediately upstream of the Porter Creek confluence where relatively thick and broad alluvial deposits create losing conditions and local disconnection of surface flow in drier water years. Across the entire study area, the volume of water that recharges from streams to groundwater is approximately balanced by the volume that discharges to streams through the streambed (Table E1).

In wet years the average summer streamflow in Mark West Creek was about 0.7 cubic feet per second (cfs) below Van Buren Creek and 1.5 cfs below Porter Creek, whereas in dry years these flows declined to about 0.3 and 0.7 cfs, respectively (Figure E3 shows 10-yr average conditions). Except for the reach upstream of Porter Creek that experiences local surface flow disconnection during drier years, most reaches retain small but consistent streamflows even under drought conditions. Year to year variations in springtime streamflows were substantially larger than the variations in summer flows with average springtime flows below Van Buren Creek ranging from 2 to 8 cfs and below Porter Creek from 6 to 30 cfs.

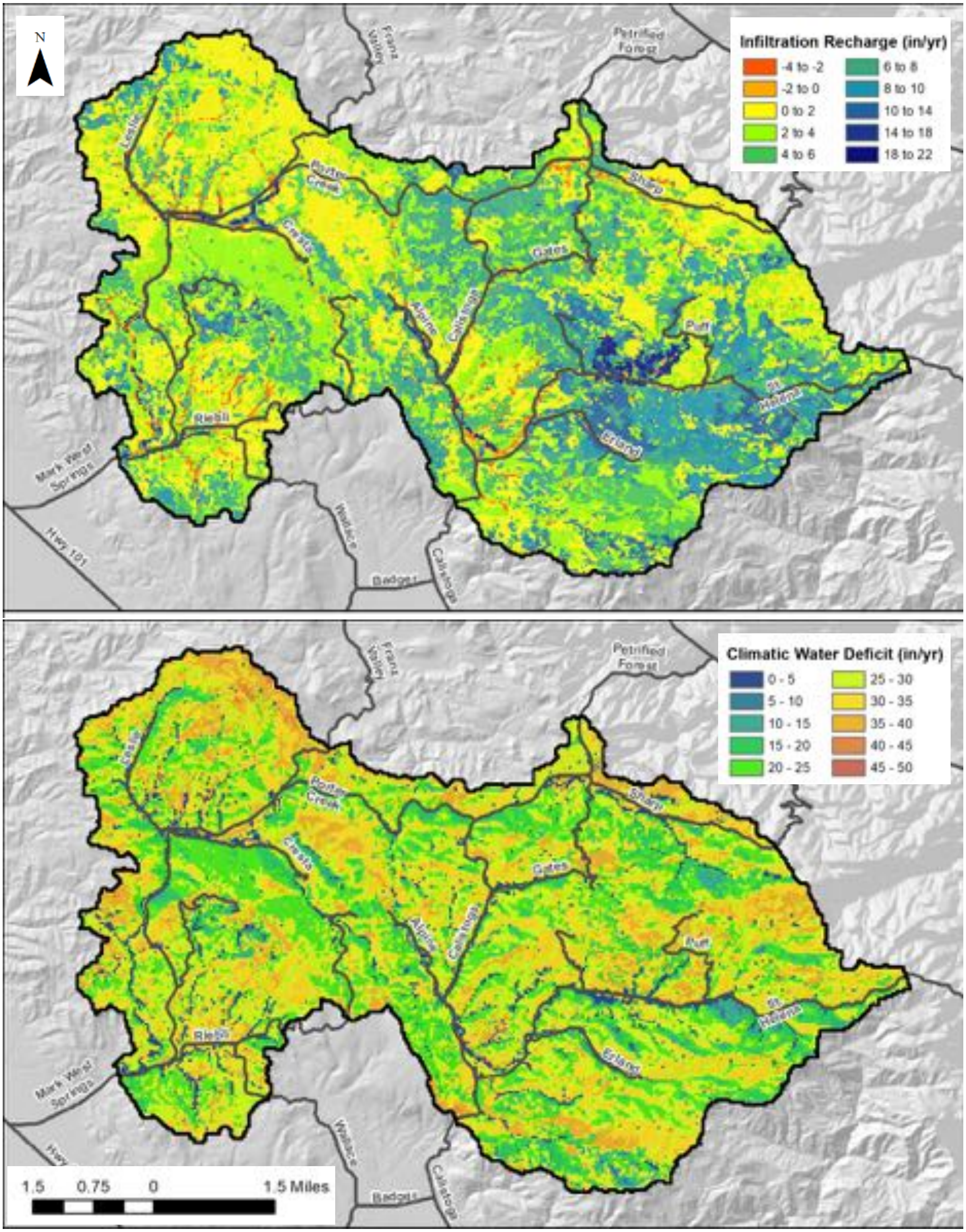


Figure E2: Mean annual infiltration recharge (top) and climatic water deficit (bottom) simulated with the hydrologic model of the upper Mark West Creek watershed.

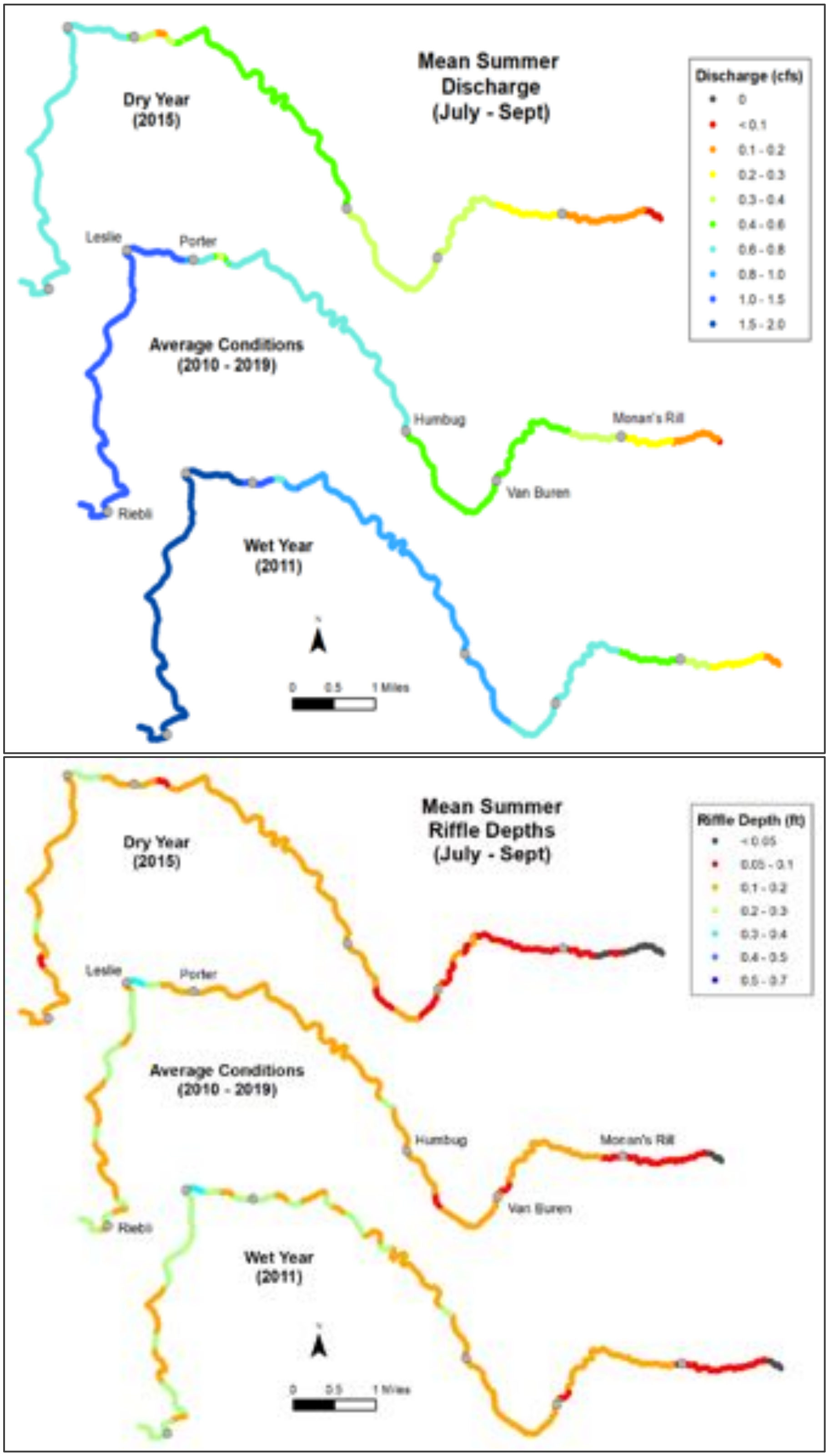


Figure E3: Mean summer streamflows (top) and riffle depths (bottom) in mainstem Mark West Creek simulated by the hydrologic model.

In most water years, average summer riffle depths remain above 0.1-ft in most locations downstream of Monan's Rill, and below Porter Creek depths reach 0.2 - 0.3 ft in many locations (Figure E3). Minimum flow depth in riffles are of interest as an indicator of fish habitat conditions. Average springtime riffle depths vary substantially between years. During the drought conditions of 2014, depths were less than 0.2-ft upstream of Van Buren Creek and between 0.2-0.4 ft below Porter Creek. In the wet water year 2017, riffle depths remained above 0.2-ft as far upstream as one river mile above Monan's Rill and were above 0.5-ft in portions of the lower watershed. The simulated spatial distributions of riffle depths reflect both reaches where riffle depths are limited by reduced streamflows (most notably the reach upstream of Porter Creek which loses flow to the alluvium) as well as where depths are limited by geomorphic controls such as the reaches about 1-mile upstream of Riebli Creek (Figure E3).

Existing Water Use

Total water use in the watershed was estimated to be approximately 430 ac-ft/yr, equivalent to about 0.5% of the mean annual precipitation. The largest uses are residential and vineyard irrigation which account for about 48% and 33% of the total water use respectively (Figure E4). Industrial uses account for the next largest fraction at about 9%. The remaining 10% consists of irrigation for pasture and other crops (6%), irrigation of cannabis (3%), winery use (<1%), and vineyard frost protection (<1%) (Figure E4). About 85% (367.1 ac-ft/yr) of the total use in the watershed is from groundwater with the remaining 15% (63.6 ac-ft/yr) coming from surface water sources. About 81% (51.5 ac-ft/yr) of the total surface water use is direct diversion to pond storage, 10% (6.7 ac-ft/yr) is direct stream diversions, and 9% (5.4 ac-ft/yr) is diversion at springs.

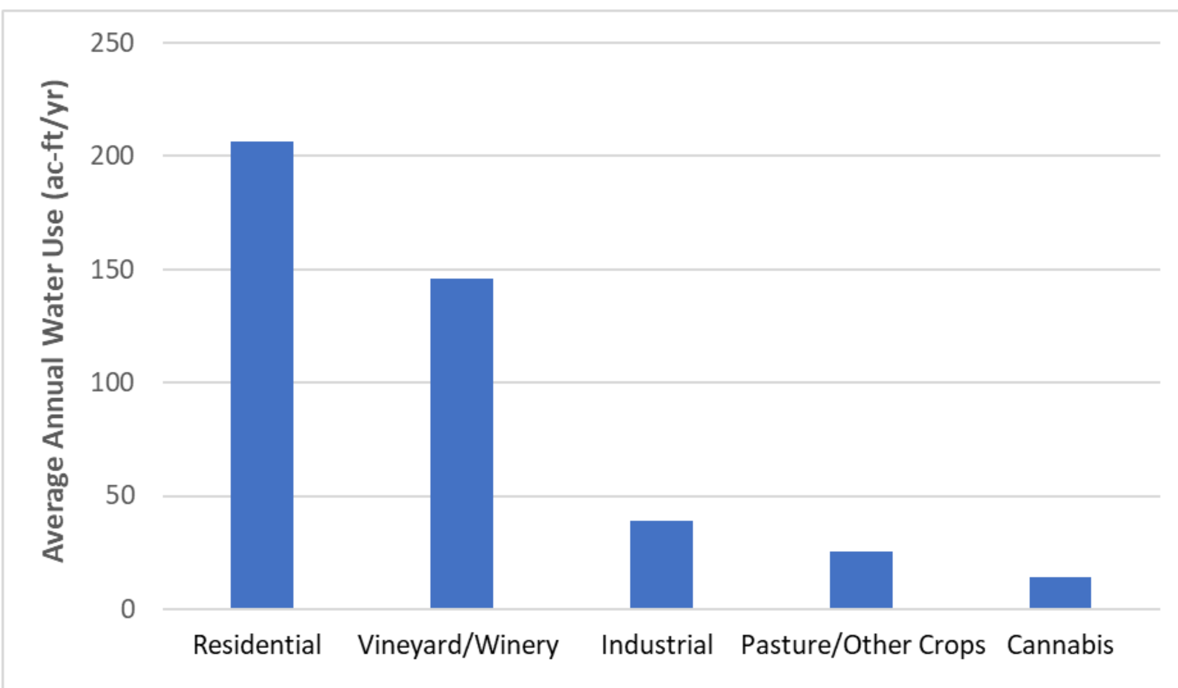


Figure E4: Water use in the Mark West Creek watershed study area by major water use category.

Fish Habitat Characterization

We developed two streamflow classifications based on the simulation results to represent habitat conditions, one for smolt outmigration and one for juvenile summer rearing. Both classifications focus on a 0.2-ft Riffle Crest Thalweg Depth (RCTD) threshold which is intended to represent the minimum flow conditions required to provide suitable habitat for salmonids (optimal habitat conditions require higher RCTDs than these minimum thresholds). We also compiled available continuous temperature data collected by CDFW, Trout Unlimited, CA Sea Grant, and Sonoma Water from 15 locations to develop a simple water temperature classification based on Maximum Weekly Maximum Temperature (MWMT) relative to thresholds of impairment for salmonids. Finally, we compiled available physical habitat data from CDFW habitat surveys and our own field observations to describe other important factors for salmonid habitat including pool characteristics along with spawning and winter refugia conditions.

A simple scoring system was used for each flow classification. Scores range from zero for reaches where RCTDs never reach the target of 0.2-ft during the summer rearing and spring outmigration timeframes in the 10-yr average condition to four for reaches that continuously maintain 0.2-ft RCTDs even during drought conditions. We developed a final habitat suitability classification based primarily on the flow and temperature classifications but also informed by the other available physical habitat data and recent fisheries monitoring information.

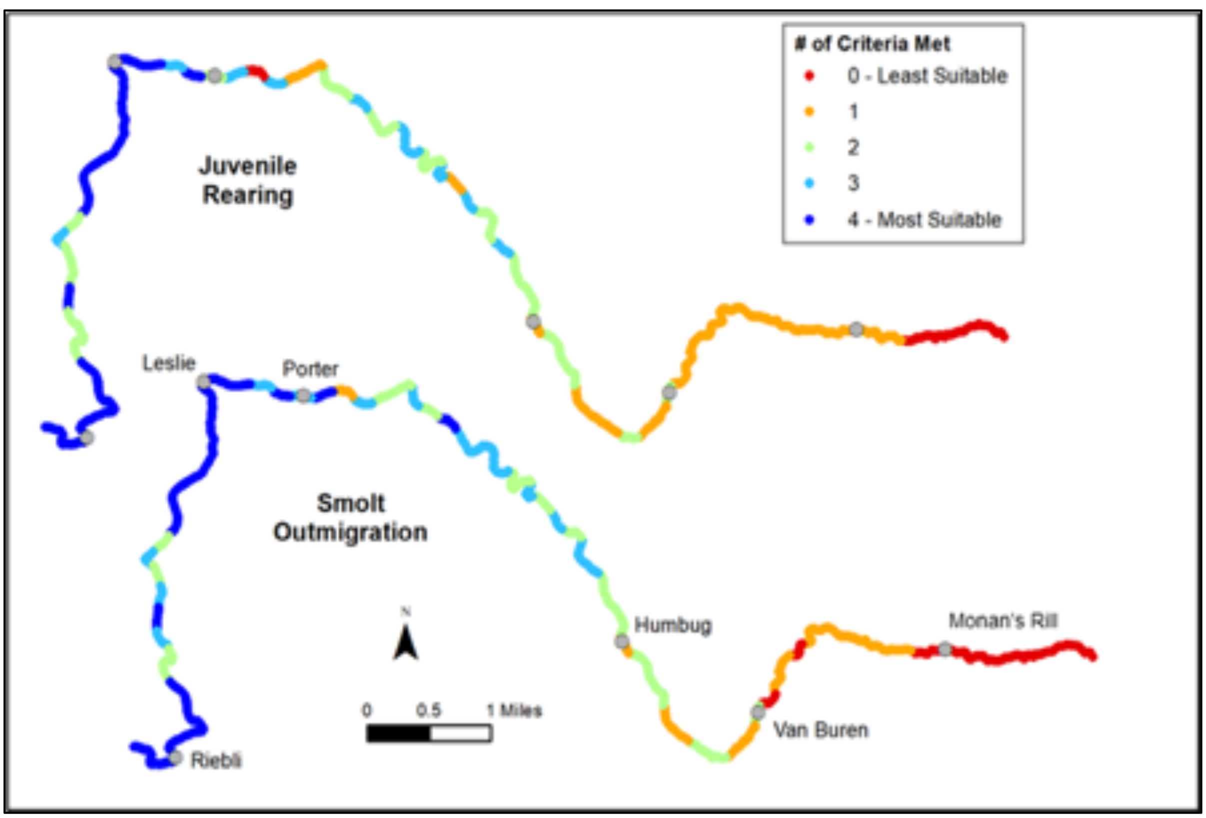


Figure E5: Flow-based habitat suitability classifications for juvenile rearing and smolt outmigration in mainstem Mark West Creek.

The flow-based habitat classification results indicate that most reaches are impaired for smolt outmigration and juvenile rearing (Figure E5). Upstream of Van Buren Creek either zero or one of four flow classification criteria are met, most reaches between Humbug Creek and Porter Creek meet two or three of the criteria, and most reaches below Porter Creek meet three or four criteria (Figure E5). Notable exceptions to this include short reaches upstream of Porter Creek and between Leslie and Riebli Creeks which are more flow-limited than adjacent upstream and downstream reaches. Most reaches are also impaired with respect to stream temperature, with two of three temperature criteria met upstream of Van Buren Creek and only one criterion met between Van Buren Creek and a point about 2-miles upstream of Porter Creek (Figure E5). Documented temperature impairment is most severe in the 2-mile reach upstream of Porter Creek with none of the criteria met (MWMT > 23.1 °C) at available monitoring stations; no data was available farther downstream (Figure E6).

We examined temporal variations in temperatures relative to streamflows observed at the stream gauges in the watershed and found no obvious correlations between streamflow and temperature at the most temperature-impaired locations. This suggests that streamflow is not the primary control on temperature and that even significant streamflow enhancement is unlikely to mitigate elevated temperatures. We also examined the relationship between pool depth and temperature in six pools monitored in 2017 by CDFW upstream and downstream of Humbug Creek. Pools with depths greater than 3.5-ft maintained temperatures below severely impaired levels whereas shallower pools less than 2.5-ft deep did not. Although based on a limited sample size and a single water year, these observations suggest that deep pools likely

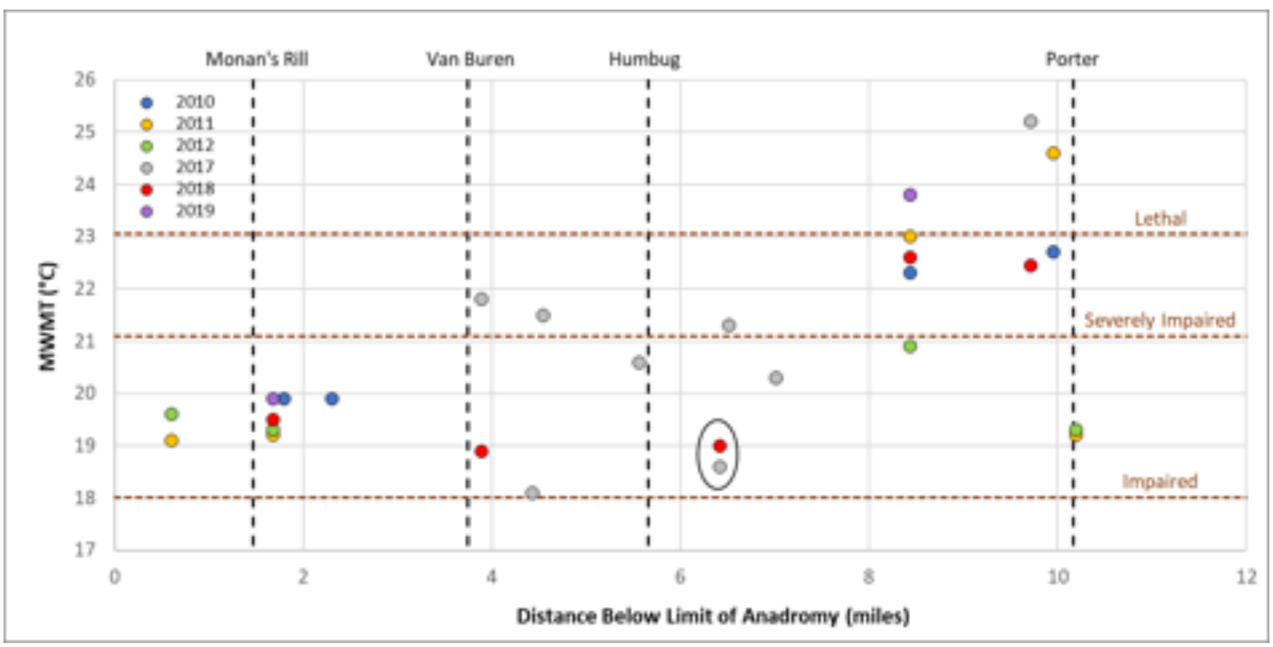


Figure E6: Longitudinal and temporal variations in Mean Weekly Maximum Water Temperature (MWMT) derived from continuous temperature data at 15 stations between 2010 and 2019, black oval indicates location of deep pool cold water refugia; temperature data from CDFW, Sonoma RCD, CA Sea Grant, and Trout Unlimited.

provide critical refugia for salmonids in Mark West Creek when extreme high temperatures occur in shallower pool habitats.

The overall salmonid habitat classification identifies an ~4 mile reach of Mark West Creek between about 0.5 river miles downstream of Van Buren Creek and about 2 river miles upstream of Porter Creek as providing the best overall habitat for salmonids in the watershed (Figure E7). This reach is considered most suitable because it represents the best combination of flow and water temperature conditions and is also consistent with available data and observations about other indicators of habitat quality such as pool and spawning conditions.

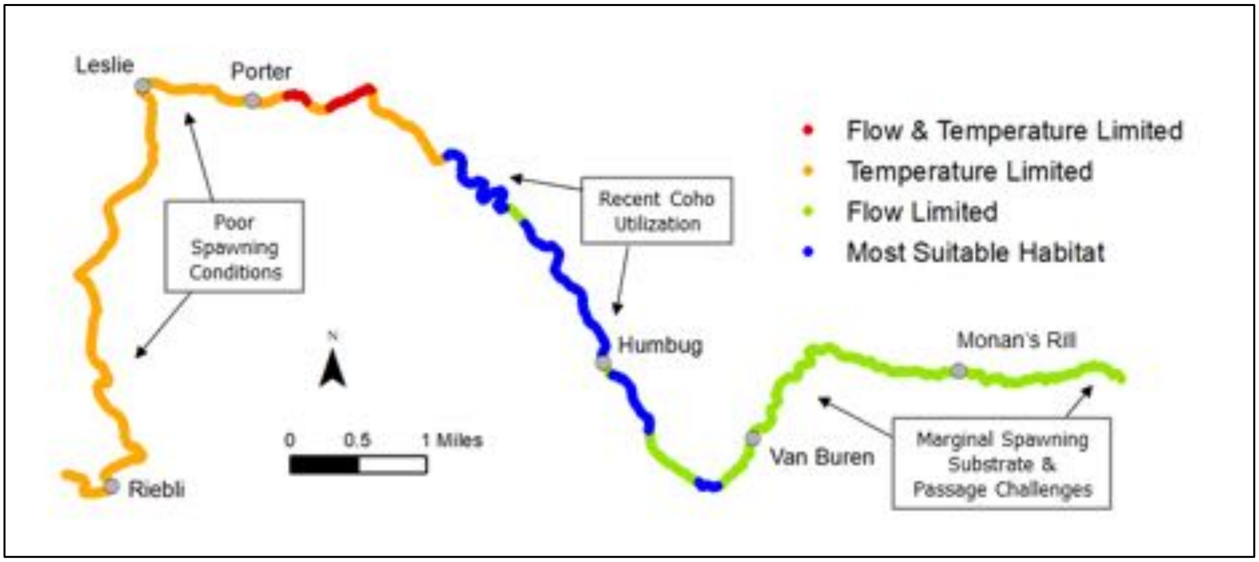


Figure E7: Final overall habitat suitability classification for Mark West Creek identifying the high priority reaches with the most suitable overall habitat conditions in blue.

Scenario Analysis

The model was used to evaluate alternative streamflow enhancement strategies along with predictions of climate change effects on streamflow. Individual enhancement strategies, combinations of these strategies, and alternative future climate conditions were evaluated in different model runs (scenarios) to identify advantages and disadvantages of different strategies under a variety of conditions. The scenario analysis is intended to provide guidance regarding streamflow management to stakeholders in the watershed, natural resource managers, and government regulatory authorities. Scenarios analyzed are summarized in Table E2.

<u>Water Use</u>

Analysis of changes in streamflow revealed that the sustained cumulative effects of surface water diversions and groundwater pumping are modest and that cessation of all water use would result in increases in mean summer streamflow of about 6% (0.04 cfs) in the ~4-mile high priority reach and ~8% (0.09 cfs) at the watershed outlet (Figure E13). The analysis suggests that the groundwater response timescales are long and the reported flow increases represent conditions in the 10-yr period following 40-yrs without water use. Cumulatively, surface water diversion and groundwater pumping each have an approximately equal sustained effect on streamflows, however cumulative groundwater use is more than five times that of surface water use in the watershed. Surface water diversions were also found to result in more substantial short-term (daily) streamflow depletion up to about 14% with the largest impacts occurring in the reach downstream of Humbug Creek (Figure E8).

Streamflow depletion from groundwater pumping was found to occur over long (decadal) timescales. While we did find some sensitivity in the rate of depletion as a function of distance of wells from streams and springs and depths of screened intervals, all wells generated depletion given enough time. The rate of depletion from near-stream wells (within 500-ft) screened in the upper 200-ft was about 1.7 times the rate for wells at greater horizontal distance from streams screened at depths greater than 200-ft. No direct relationship between the seasonality of pumping and the timing of streamflow depletion was apparent, with maximum depletion occurring during winter despite maximum pumping occurring during the summer months. This results from pumping effects on groundwater recharge and discharge processes being most pronounced during the active recharge season and from buffering of summer streamflow depletion by reductions in transpiration of riparian vegetation.

Pond Releases

The summer pond release scenario generated the largest increases in average summer streamflow of the stand-alone scenarios, with increases of about 13-14% (0.08 cfs in the high priority reach and 0.16 cfs at the watershed outlet) (Figure E13). The predominance of gaining streamflow conditions (groundwater discharge to streams) in most reaches of the creek causes only limited flow losses to groundwater (losing streamflow condition) downstream of the releases, which makes this strategy particularly well-suited for this watershed which is characterized by a lack of thick alluvial deposits adjacent to streams. The springtime pond release scenario was designed to increase flows over a short (3-week) period coinciding with the timing of the end of typical peak smolt outmigration in May. Examination of discharge and riffle depth hydrographs during drought conditions of 2014 shows that the spring releases substantially increase flows in the identified high priority reach during this critical period, extending the duration of passable conditions by approximately two weeks.

Forest, Grassland, & Runoff Management

Large-scale implementation of forest, grassland, and runoff management projects resulted in modest but significant changes in the water balance. All three strategies increase groundwater recharge but through different mechanisms. Forest management decreased actual evapotranspiration by about 5% on treated lands resulting in more water available for recharge, grassland management increased the water holding capacity of soils increasing soil water availability for recharge, and runoff management increased infiltration resulting in increased recharge as well as AET (Figure E9). Watershed-wide increases in infiltration recharge ranged from about 2-4% (230-420 ac-ft/yr).

Table E2: Overview of the scenarios evaluated with the hydrologic model.

Scenario Category	Scenario #	Scenario Name	Brief Description
Water Use	1	No Diversions	All surface water diversions turned off
	2	No Groundwater Pumping	All groundwater pumping turned off
	2B	No Pumping Near Streams	Wells within 500-ft of streams and screened in upper 200-ft turned off
	2C	No Pumping Near Springs	Wells within 500-ft of springs turned off
	2D	No Pumping From Tuff	Wells screened in surficial tuffaceous materials turned off
	2E	No Distal Pumping	Wells distal to streams/springs/tuff and not screened in upper 200-ft turned off
	3	No Water Use	All surface diversions and groundwater pumping turned off
Land/Water Management	4	Forest Management	Forest treatment on 7,054 acres of oak and Douglas Fir forests
	5	Grassland Management	Application of organic matter on 2,874 acres of grasslands
	6	Runoff Management	Manage runoff from 310 acres of developed lands to maximize infiltration
	7	Summer Pond Releases	Release water from three ponds with a total release of 0.19 cfs from June 15^{th} to Sept 15^{th}
	7B	Spring Pond Releases	Release water from three ponds with a total release of 0.82 cfs from May 7^{th} to May 28^{th}
	8	Combined Management	Combination of Scenarios 4 through 7
Climate Change	9	CNRM Climate Change	2070-2099 timeframe future climate as predicted by the CNRM model under the rcp8.5 emmisions pathway
	10	CCSM4 Climate Change	2070-2099 timeframe future climate as predicted by the CCSM4 model under the rcp8.5 emmisions pathway
	11	GFDL Climate Change	2070-2099 timeframe future climate as predicted by the GFDL model under the SRES B1 emmisions pathway
	12	MIROC esm Climate Change	2070-2099 timeframe future climate as predicted by the MIROC esm model under the rcp8.5 emmisions pathway
Mitigated	13	GFDL & Pond Releases	Combination of Scenarios 11 & 7 or 7B
	14	GFDL & Combined Management	Combination of Scenarios 11 & 7 or 7B

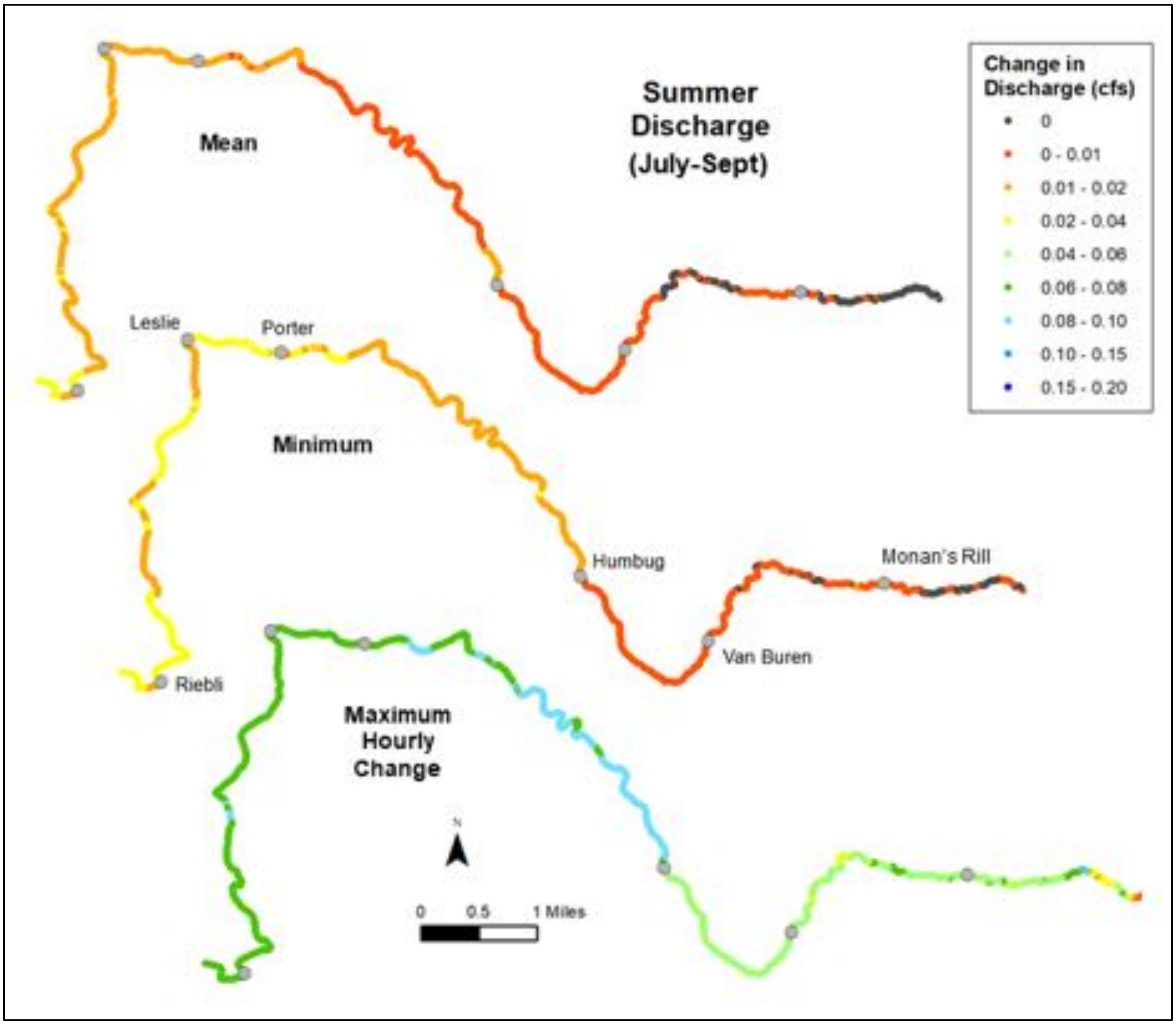


Figure E8: Changes to mean and minimum summer streamflow, and maximum hourly changes from cessation of all surface water diversions (Scenario 1).

Of the three management scenarios, forest management generated the largest increases in average summer streamflow (6%) in the high-priority reach followed by runoff management (3%), and grassland management (2%) (Figure E13). Runoff management generated a larger response at the watershed outlet (10%) reflecting the concentration of developed areas in the lower watershed. Increases in springtime discharges for the runoff and grassland management scenarios were minimal, however the forest management scenario generated increases of 0.5-0.7 in the high priority reach. These changes represent 4-6% of the total flow and primarily reflect small increases in runoff during spring storms.

<u>Combined Management</u>

Combining all the land/water management scenarios (pond releases with forest, grassland and runoff management), mean summer discharges in the high priority reach increased by about 21% (0.13 cfs) and by about 28% (0.31 cfs) at the watershed outlet (Figures E10 & E13). These changes represent about 86% of the sum of the changes of the four individual scenarios indicating a small negative feedback in effectiveness when the effects on the water balance dynamics from the various actions are combined.

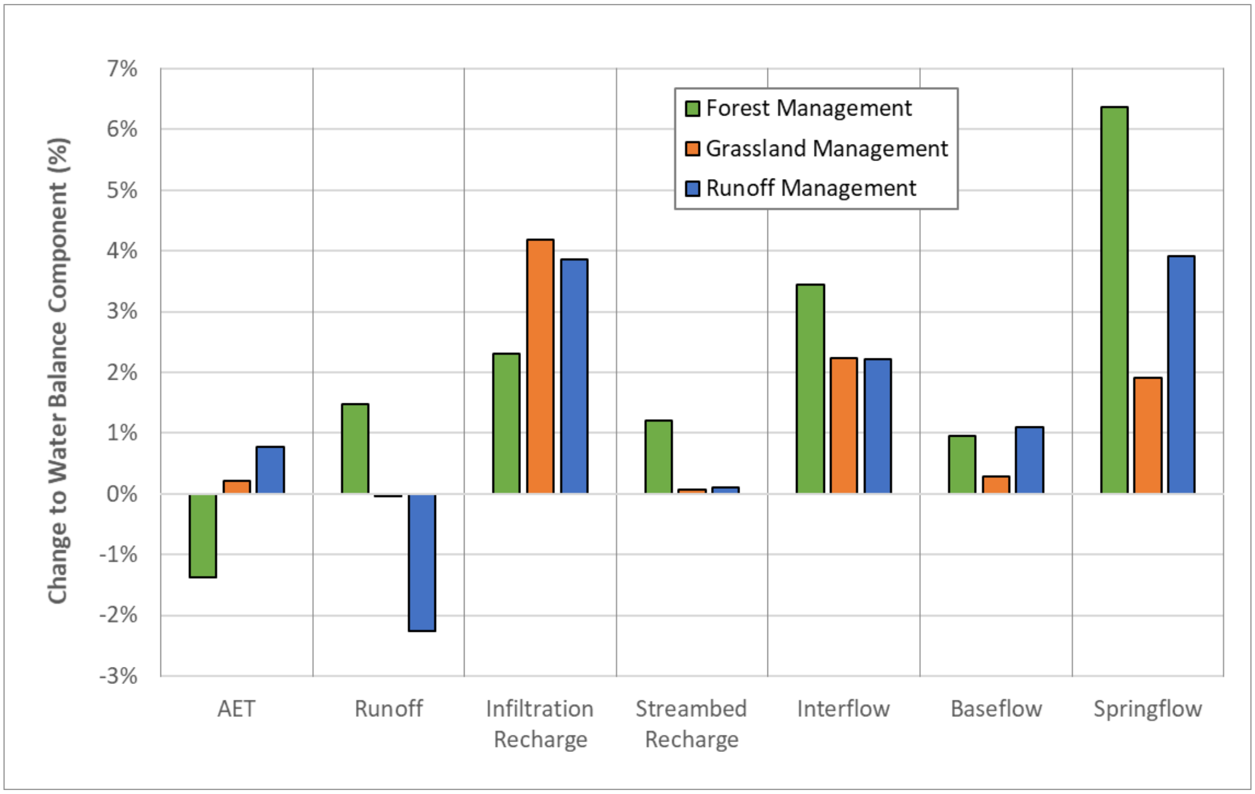


Figure E9: Watershed-wide percent change in select water balance components for the forest, grassland, and runoff management scenarios (Scenarios 4-6).

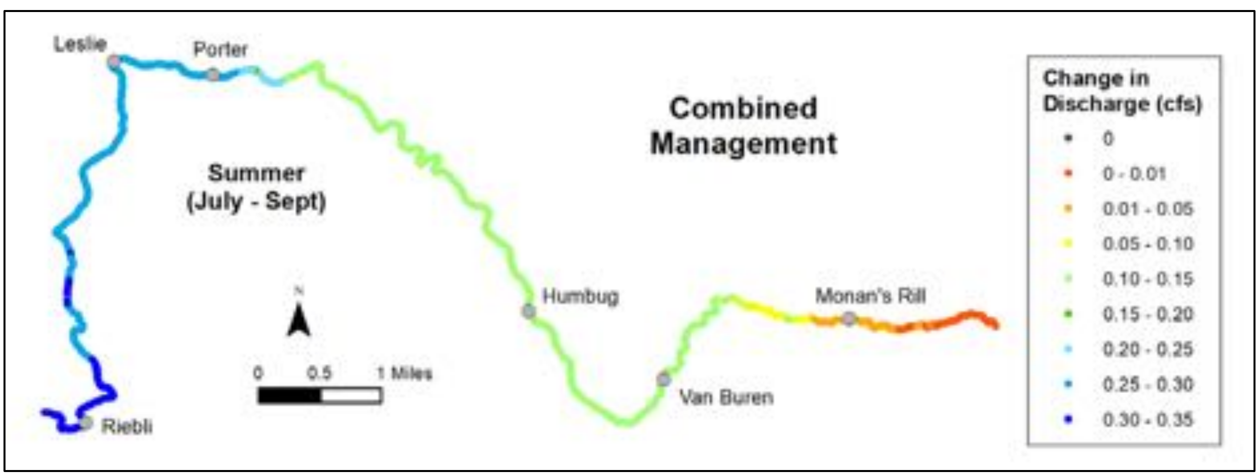


Figure E10: Simulated changes to the 10-yr average mean summer streamflow for the combined management scenario (Scenario 8, note the scale in the legend is different from previous figures for other scenarios).

Climate Change

Four climate change scenarios were selected to represent the range of plausible changes to precipitation and temperatures as predicted by available climate model data, and to include a scenario representative of the mean projections. These scenarios predict a range of maximum temperature increases of between 3.7 and 11.0°F and changes in mean annual precipitation ranging from a decrease of 21% to an increase of 37%.

The 10-yr mean annual water balance results indicate substantial variability in predictions of future hydrologic changes. The CNRM scenario predicts large increases in both infiltration recharge (44%) and streambed recharge (33%), the CCSM4 model predicts minimal changes in recharge, and the GFDL and MIROC esm scenarios predict significant decreases in infiltration recharge (29-40%) and streambed recharge (17-25%) (Figure E11). Increased recharge in the CNRM scenario results in increases in groundwater discharge expressed as interflow (32%), baseflow (11%), and springflow (36%). Similarly, groundwater discharge decreases for the scenarios that predict decreases in recharge. The largest decreases are predicted by the MIROC esm scenario where interflow, baseflow, and springflow are predicted to decrease by 30%, 21%, and 46% respectively (Figure E11). Comparison of the water balance for the driest of the 10 years in each simulation reveals that the trajectories of the changes in the water balance between the four scenarios are more similar during drought conditions than for long term average conditions, with all four scenarios predicting decreases in runoff, infiltration recharge, and streambed recharge under drought conditions (Figure E11).

All four scenarios indicate increases in Climatic Water Deficit (CWD). The mean CWD for the watershed over the 10-yr simulation period is predicted to increase from 26.0 in/yr under existing conditions to between 30.3 and 33.9 in/yr under future climate conditions. Increases in CWD of this magnitude (17-30%) may be expected to lead to significant changes in vegetation communities and increases in fire risk. It is important to note that these simulations represent the hydrologic effects of changes in climate but do not include secondary effects that may be expected under a significantly altered future climate regime such as changes in vegetation cover and irrigation water demands.

The climate change scenarios generated a wide range of predictions of future streamflows with three of the four scenarios indicating decreases in average summer streamflow of between 6% and 47% and one scenario indicating increases of about 15-19% (Figure E13). In contrast to the variable predictions in mean summer discharges, all four models predict large decreases in mean spring discharges that would be expected to hinder outmigration of juvenile salmonids. The CNRM scenario produces the smallest decreases with mean spring discharge in the high-priority reach of Mark West Creek decreasing from 7.8 cfs to 5.1 cfs (Figure E13). The MIROC esm scenario predicts the largest decreases with flows in the high priority reach decreasing from 7.8 cfs to 3.0 cfs.

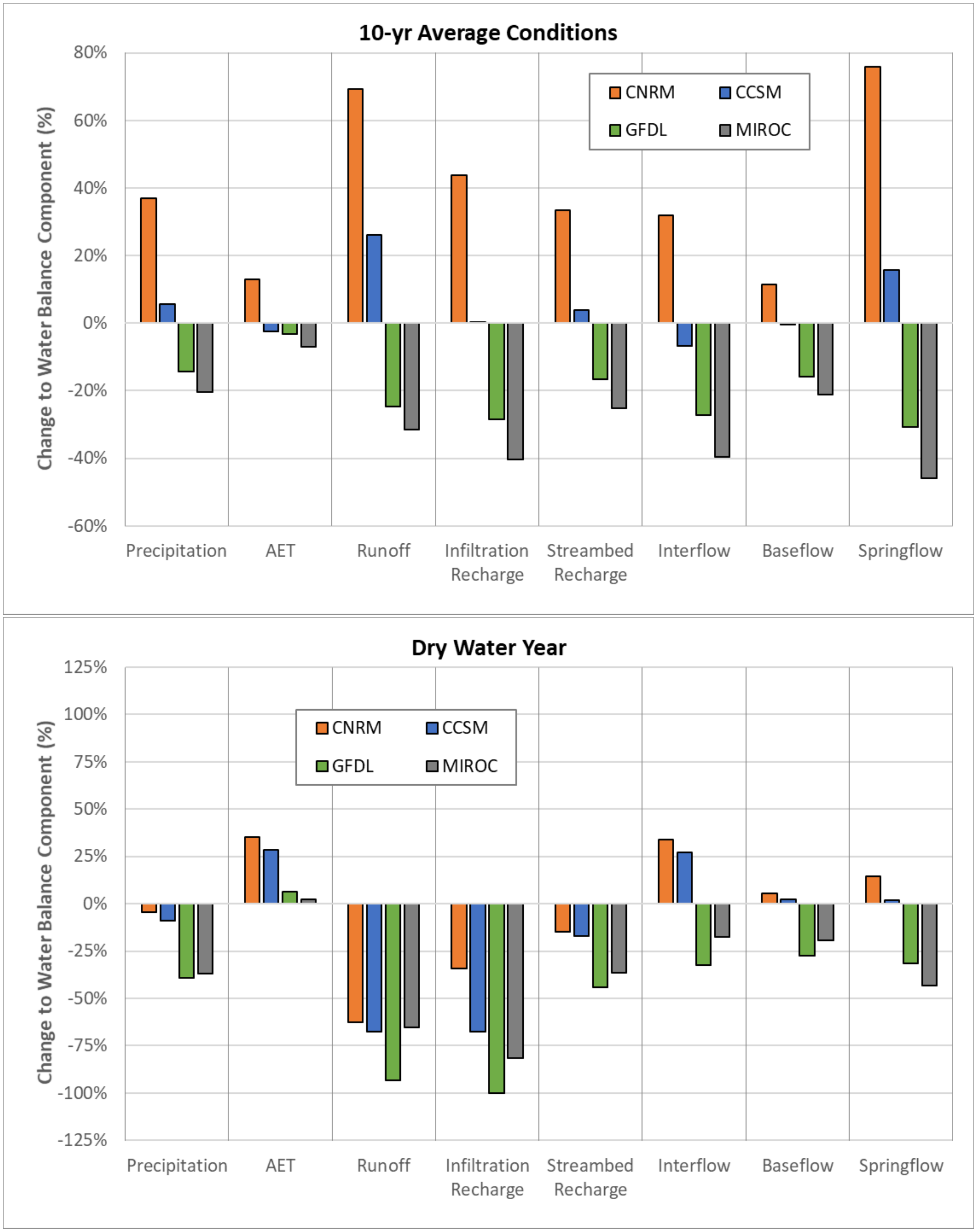


Figure E11: Percent change in various components of the water balance for the four climate change scenarios relative to existing conditions; 10-yr average conditions (top) and the driest water year in each 10-yr simulation period (bottom).

Mitigated Scenarios

The mitigated scenarios combine the pond release and combined management scenarios with the GFDL future climate scenario. These scenarios indicate that pond releases can likely offset a significant portion of the projected decreases in summer streamflow predicted by some of the climate models and if combined with forest, grassland, and runoff management, are likely large enough to completely offset these projected decreases (Figures E12 & E13). If future climate more closely resembles the predictions of the CNRM or CCSM4 models, pond releases and combined management would be expected to result in summer flow enhancement above existing conditions. None of the potential actions generate changes large enough to significantly offset the substantial decreases in springtime discharges predicted by the four climate scenarios. Shorter-duration flow releases over periods of days to weeks strategically timed during the critical smolt outmigration period in spring could increase flow depths above fish passage thresholds and likely provide a key climate change mitigation strategy to address predicted reductions in streamflow during the spring season (Figure E12).

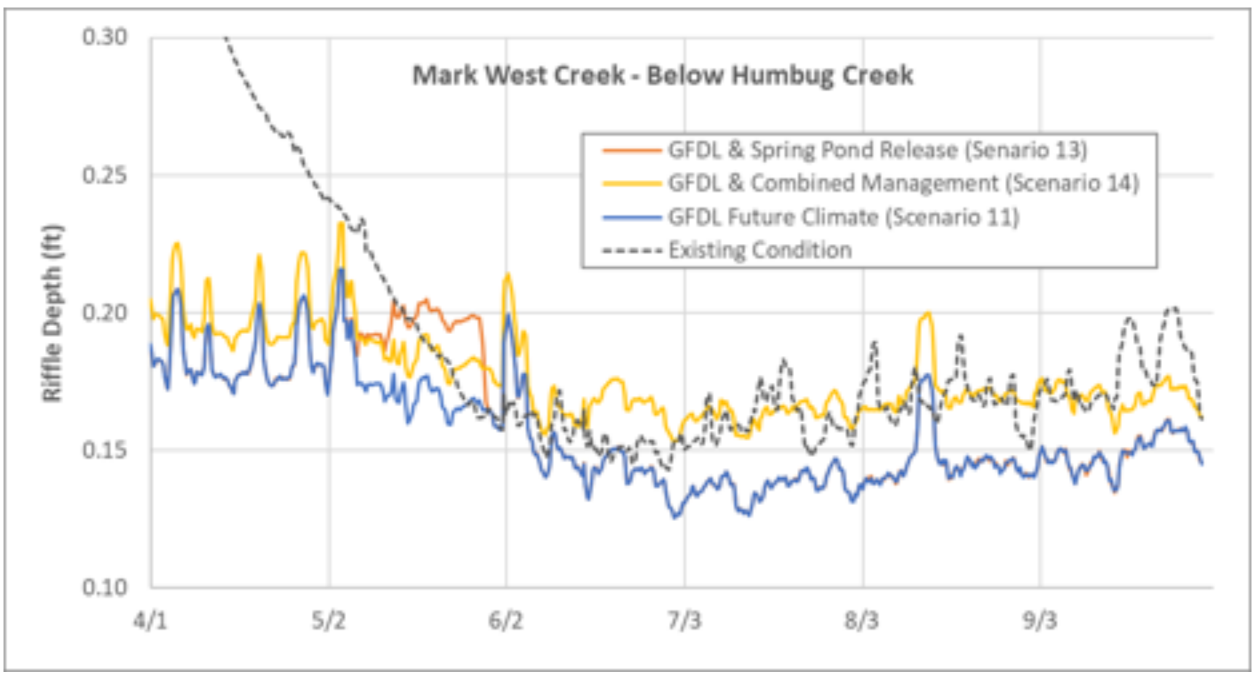
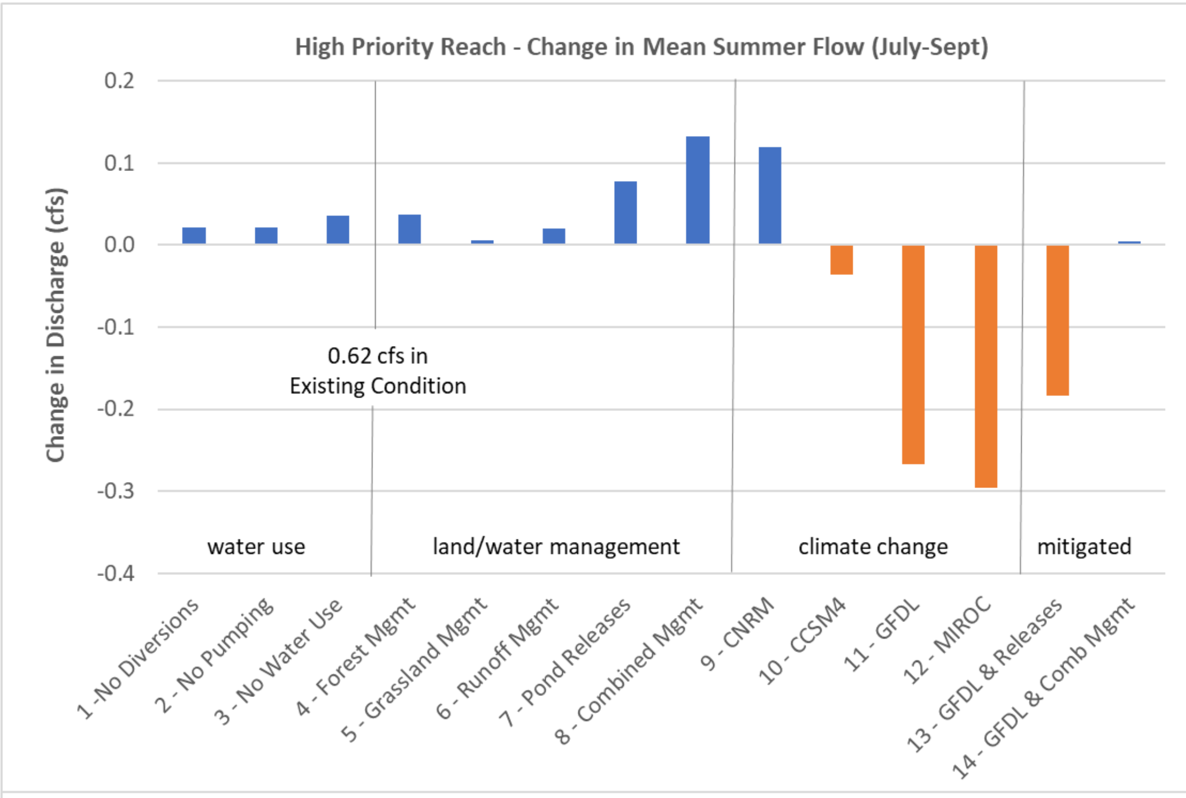


Figure E12: Spring and summer riffle depths for the driest year in the 10-yr simulation in Mark West Creek below Humbug Creek for existing conditions, the GFDL future climate scenario (Scenario 11), the GFDL & spring pond release scenario (Scenario 13), and the GFDL & combined management scenario (Scenario 14).



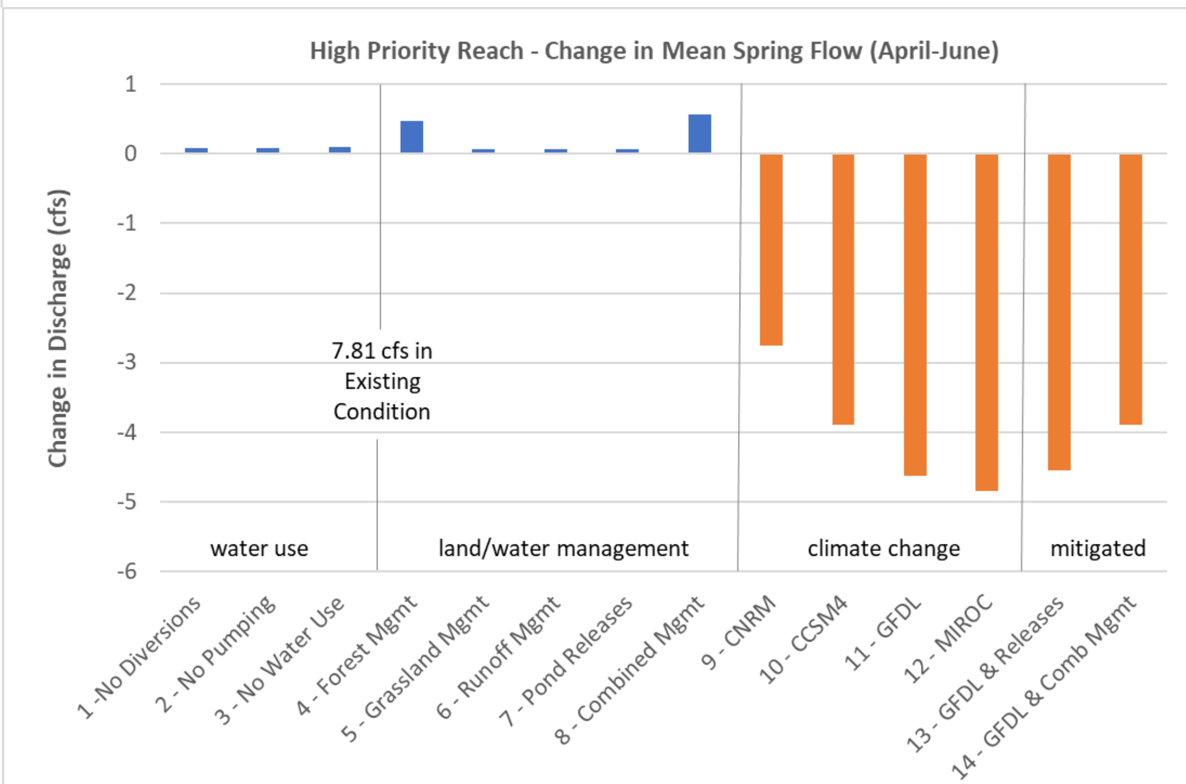


Figure E13: Summary of the simulated changes in mean summer (top) and mean spring (bottom) streamflow for Scenarios 1-14 averaged over the high-priority habitat reach.

Restoration & Management Recommendations

Habitat Enhancement

Based on simulated riffle depth and observed water temperature data informed by CDFW habitat inventory and CA Sea Grant fisheries monitoring data, the four mile reach extending from 0.2 miles upstream of Alpine Creek to 2.0 miles upstream of the Porter Creek confluence has the best overall conditions for supporting salmonids (Figure E14). We recommend that habitat enhancement projects be focused in this high priority reach where there exists the greatest likelihood of supporting overall reach conditions suitable for salmonids.

Based on a limited number of sample sites, water temperatures in the high priority reach appear to remain below severely impaired levels in pools with depths above about 3.5-ft whereas severely impaired temperatures occur in shallower pools (see Figure E6). More temperature monitoring and pool inventory analysis is recommended to identify pools providing critical temperature refugia. A temperature study is also warranted to better understand the controls on water temperatures and identify possible mitigation actions. Our preliminary findings suggest that streamflow is not the primary control on temperature and that encouraging formation of stable deep pools and maximizing shade on the stream surface are likely the most important immediate mitigation actions.

In-stream large wood (logs and trees) loads are low in Mark West Creek and projects to install large wood to encourage formation and enhancement of existing deep pools is recommended. Where needed, riparian planting projects to maximize shading of the summer water surface are recommended. Opportunities for development of off-channel habitat projects to enhance winter rearing habitat are also available in the identified reach, and these types of projects are also recommended to support improved conditions in the reach for other limiting life cycle stages.

Flow Protection/Enhancement

Summer baseflow throughout Mark West Creek is controlled primarily by spring discharge concentrated in the upper watershed. We recommend that the various flow protection and enhancement actions described below be focused in the watershed area contributing to the identified high priority reach where they are more likely to provide the most meaningful flow benefits. The portion of the watershed upstream of Van Buren Creek is of even greater importance for streamflow protection and enhancement given the disproportionate role this area plays in generating summer streamflow supplied to downstream reaches (Figure E14).

To assist in understanding the relative effectiveness of the various flow enhancement strategies we normalized simulated increases in streamflow based on a ‘typical’ parcel/project for six project types in consultation with Sonoma RCD. We also developed a rough cost estimate for each typical project and normalized the results again based on a $25,000 project cost. The six projects and estimated costs include:

- Groundwater Pumping Offset – installation of a 10,000 gallon rainwater catchment tank and associated reduction in groundwater pumping - $38,000

- Surface Diversion Replacement – replacement of a direct stream or spring diversion with a new groundwater well - $33,000
- Runoff Management – construction of an infiltration basin sized to capture the 10-yr 48-hr storm volume from a 3,000 ft^2 rooftop or other impervious area - $22,500
- Grassland Management – compost application on 4.6 acres of grassland (average per parcel acreage in the model scenario) - $7,000
- Forest Management – thinning and/or controlled burning on 5.6 acres of forested lands requiring treatment (average per parcel acreage in the model scenario) - $15,000
- Pond Release – summer flow release of 11.3 ac-ft from an existing on-stream pond (average release volume of the three ponds in the model scenario) - $20,000

Releasing water from existing ponds was found to be by far the most effective individual strategy for enhancing streamflows. On a cost basis, the streamflow benefits of one flow release project were found to be more than 50 times greater than an average surface water diversion replacement project and more than 500 times greater than an average grassland management project (the second and third most effective strategies, Figure E15). Examination of existing ponds revealed that there are only three ponds upstream of the high-priority reach with sufficient storage to provide meaningful releases, and we recommend that flow release projects be developed for these ponds if possible.

There are many existing ponds that could likely be enhanced, and new ponds could be created specifically for flow releases. Given the disproportionate effectiveness of pond releases for streamflow enhancement this approach should be seriously considered. Water temperature and other water quality and invasive species considerations should be an important aspect of planning flow release projects since water temperatures are already impaired and it is critical that flow releases do not further increase temperatures or introduce invasive species. There are various strategies that may be employed to mitigate elevated pond temperatures during planning and design (e.g. bottom releases, surface covering, cooling towers).

Replacing direct stream or spring diversions from surface water with groundwater pumping was the second most effective of the six project types, whereas offsetting groundwater pumping with storage was the least effective (Figure E15). While the modeling did suggest some relationship between the degree of streamflow depletion and the screen depth and distance of wells from streams/springs, these differences were modest and we did not find any direct relationship between the timing of pumping and the timing of streamflow depletion. These findings suggest that replacing direct stream and spring diversions with storage and/or groundwater pumping is a viable approach for enhancing streamflow conditions but that offsetting groundwater pumping with storage or shifting the timing of pumping from summer to winter is unlikely to lead to appreciable improvements in flow conditions. This is not to suggest that specific wells in specific locations are incapable of streamflow depletion; however, our review of well data and modeling results indicate that this would be uncommon in the study area.

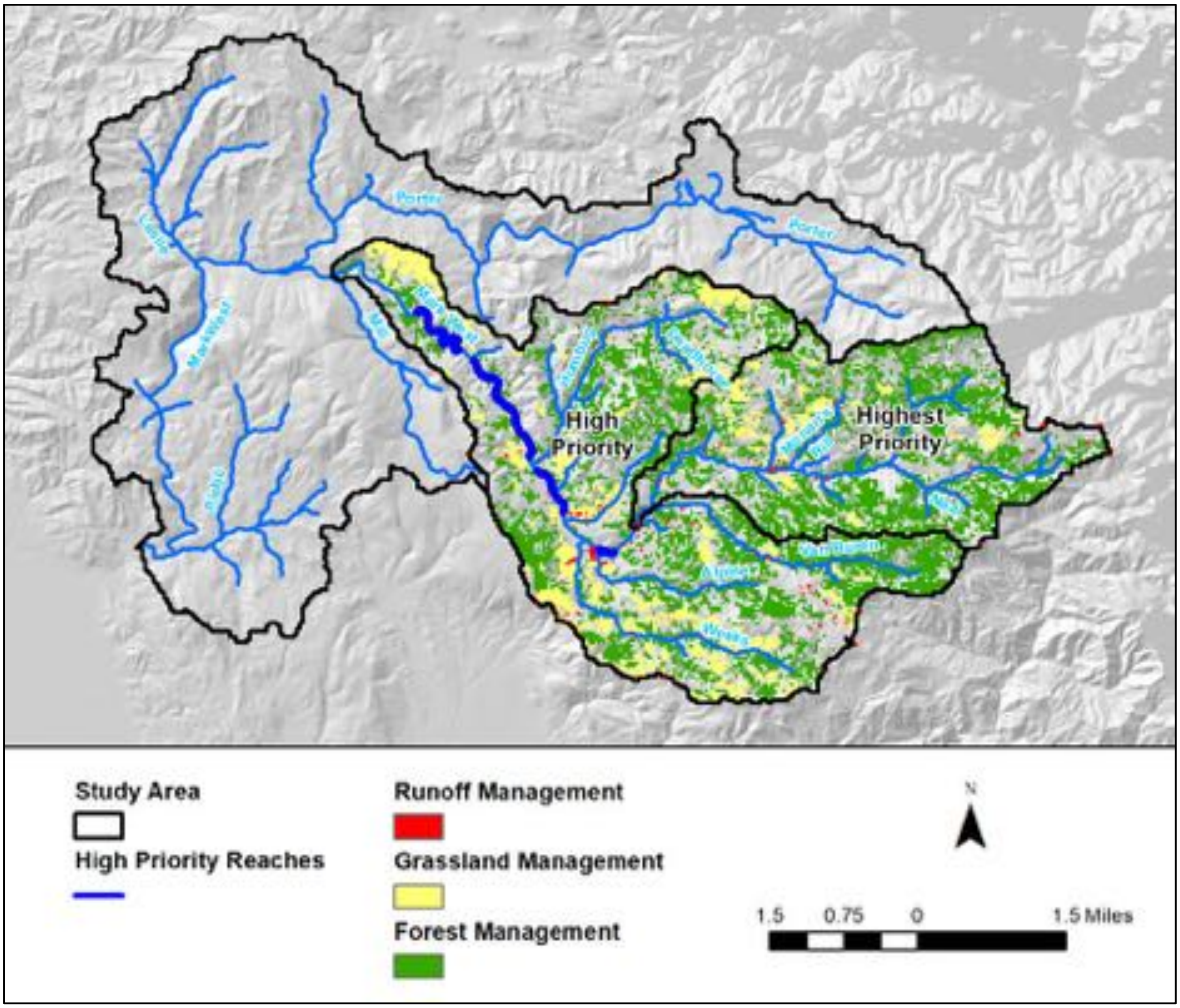


Figure E14: Locations of the identified high priority reaches for habitat enhancement projects and high priority watershed areas for flow enhancement projects.

Requiring new wells to be drilled at a specified minimum distance from a stream or spring or screened at a minimum depth may extend the length of time before streamflow depletion occurs; however, it will not prevent streamflow depletion from occurring. The long response timescale (decades) of streamflow to groundwater pumping revealed by our modeling suggests that a volumetric approach to managing groundwater is more likely to mitigate streamflow depletion compared to approaches focused on well location or time of use. It is important to note that the total pumping stress in the watershed is relatively small (~3% of mean annual infiltration recharge) and that the limited degree of streamflow depletion under existing conditions is not meant to suggest that groundwater pumping could not lead to significant streamflow depletion were the total volume of pumping to increase substantially in the future. That said, our analysis indicates that streamflow is not very sensitive to groundwater pumping at current rates.

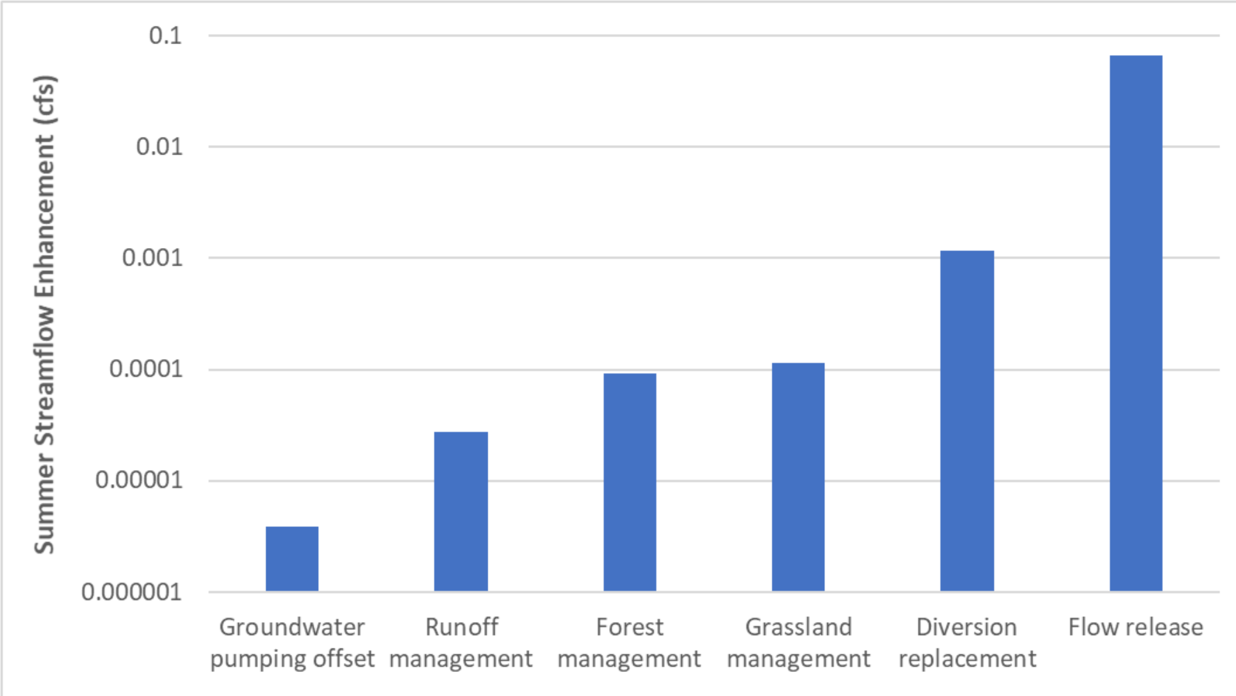


Figure E15: Summary of the simulated increase in mean summer streamflow for the six primary individual flow enhancement actions represented by the model scenarios and normalized to a $25,000 average project cost.

Grassland, forest, and runoff management were also found to result in summer streamflow improvement; however, the benefits per unit cost are one to two orders of magnitude lower than those of pond releases or diversion replacement (Figure E15). Grassland and forest management resulted in about equal benefits on a unit cost basis with about three to four times the effectiveness of runoff management. These three strategies also have important secondary hydrologic benefits in addition to enhancing streamflows in that they reduce seasonal vegetation moisture stress which may be expected to reduce fire risk. These benefits are in addition to the primary non-hydrologic benefits of these types of projects for reducing fuel loads (forest management) and sequestering carbon (grassland management). There are also potential negative consequences of extensive forest management in terms of potential habitat loss for avian and terrestrial species which must be carefully considered. In summary, while runoff, forest, and grassland management may not directly result in substantial streamflow improvement, these efforts have multiple benefits and are likely important strategies for managing fire risk and mitigating climate change impacts as discussed in more detail below.

<u>Climate Change Adaptation</u>

Climate change is expected to result in a dramatic decrease in springtime streamflow, particularly during drought conditions. These declines are expected to have significant effects on salmonid outmigration with some scenarios predicting impassable conditions developing as early as late winter and persisting through spring and summer. The only feasible strategy to mitigate these changes is to implement spring pond releases. While it may not be possible to significantly improve conditions throughout the smolt outmigration period, relatively high release rates could be achieved for a period of several days to weeks to provide a window of passable flow conditions timed to coincide with expected peak smolt outmigration. Although the summer streamflow predictions vary widely, some scenarios show significant declines in summer streamflow. We recommend that flow release projects be developed and adaptively managed to provide a combination of larger pulses of streamflow during outmigration and lower-magnitude releases to sustain streamflow during summer baseflow depending on conditions in a given year.

The runoff, forest, and grassland management strategies influence the quantity of flow from springs which in general is relatively cold, therefore these approaches may be expected to assist in mitigating elevated water temperatures whereas the more effective strategies (pond releases and diversion replacement) would not be expected to provide significant temperature benefits. These strategies also help reduce vegetation moisture stress by increasing the quantity of water available to plants in the case of runoff and grassland management and decreasing water demand from the landscape for the case of forest management. Reduced moisture stress may be considered an important benefit in terms of reducing current wildfire risk and the increase in wildfire risk expected resulting from climate change. In summary, implementation of runoff, forest, and grassland management projects are expected to help build resiliency to climate change by providing multiple benefits beyond potential streamflow improvement and spring and summer pond releases provide a means of adaptively managing flow conditions for salmonids in the face of a changing climate.

Conceptual Designs

The final phase of the project involved development of conceptual designs for two site specific streamflow enhancement projects. The projects focus on the approach of runoff management and were selected to take advantage of local site conditions and project opportunities on properties managed by our project partners the Pepperwood Foundation and Sonoma County Regional Parks. The projects illustrate two possible approaches to managing runoff for enhanced groundwater recharge and we anticipate similar approaches as well as other alternative methods could be applied on parcels throughout the watershed.

<u>Goodman Meadow</u>
Site 1 is located within the Pepperwood Preserve at the Goodman Meadow near the headwaters of Leslie Creek in the northwest corner of the Mark West Creek watershed. The Goodman Meadow site consists of a relatively flat, approximately 12-acre natural basin perched on a topographic bench. The design converts portions of the meadow into an infiltration basin by constructing a berm and outlet structure along the downstream edge of the meadow (see Appendix A). The design creates approximately 5.3 ac-ft of storage within 1.4-acres comprising the lower portion of the meadow. Based on hydrologic modeling of the conceptual design, the basin would be capable of generating about 1.9 ac-ft/yr of additional infiltration recharge. This enhanced recharge would increase the mean springtime flow in upper Leslie Creek by about 0.01 cfs and extend the duration of connected surface flow by about 12 to 21 days.

Mark West Regional Park

Site 2 is located on a terrace on the east bank of Porter Creek about 1,800-ft upstream of its confluence with Mark West Creek. The site is slated to be developed as the main entrance and parking area for Mark West Regional Park managed by Sonoma County Regional Parks. Park facilities have not yet been designed in detail but are expected to be contained within approximately 3.1 acres currently occupied by a barn structure and an adjacent parking area and gravel road (see Appendix B). The stormwater management design described here is intended to become a part of the overall design for the park facilities and consists of collecting runoff from the developed portions of the park entrance in a network of diversion ditches and directing these flows into a series of two linear, gravel filled infiltration basins designed to maximize groundwater recharge. The total storage capacity of the basins is 0.65 ac-ft.

The scale of the site design features is too fine to be accurately represented in the regional hydrologic model; however, based on regional runoff management scenario results, we estimate that the project will generate between 0.3 and 1.2 ac-ft/yr of additional infiltration recharge. It is unlikely that the project by itself will generate significant increases in streamflow in Porter Creek, however the regional modeling suggests that large-scale adoption of stormwater best management practices has the potential to increase the mean springtime streamflow in lower Porter Creek by about 0.05 cfs and extend the duration of surface flow connection by up to 13 days.

Chapter 1 – Introduction

The project described in this report was completed by O'Connor Environmental, Inc. (OEI) under the direction of the Coast Range Watershed Institute (CRWI) in cooperation with the Sonoma Resource Conservation District (SRCD), Friends of Mark West Creek, Sonoma County Regional Parks, and the Pepperwood Foundation. The project was funded by a Proposition 1 Streamflow Enhancement Program grant (Grant Agreement No. WC-1996AP) from the California Wildlife Conservation Board (WCB).

The Mark West Creek watershed has been identified by California Department of Fish & Wildlife (CDFW) and National Oceanic & Atmospheric Administration National Marine Fisheries Service (NMFS) as providing some of the best remaining habitat for coho salmon (*Oncorhynchus kisutch*) in the Russian River watershed. Several factors have been identified as limiting for coho survival in the watershed including lack of quality pool habitat, lack of winter refugia, and insufficient summer baseflows (CDFG, 2004; NMFS, 2012). Numerous restoration projects have been implemented in the watershed in recent years aimed primarily at improving pool and off-channel habitat conditions. Additional efforts have begun to address the problem of insufficient stream flow primarily through water storage and flow release projects. Successful efforts to improve streamflow conditions will require greater understanding regarding the distribution of flow conditions and the various natural and man-made controls on these flows.

The combination of frequent drought conditions, ongoing and future climate change, and increasing human demand for water make development of strategies for sustaining or improving summer streamflow conditions of paramount importance for coho recovery in the Mark West Creek watershed. The goal of this project was to conduct a comprehensive analysis of the spatial and temporal distribution of streamflow conditions throughout the watershed relative to coho habitat requirements to assist in prioritizing restoration efforts and developing strategies for protecting/enhancing summer baseflows.

Specifically, this project involved the development, calibration, and application of a distributed hydrologic model (MIKE SHE) with inputs comprised of climate, topographic, land cover, soils, water use, and hydrogeologic data for the watershed. Model outputs include estimates of the annual and seasonal water balance, simulated stream flow hydrographs, and predicted groundwater elevations and flow gradients among many other hydrologic parameters. The modeling results provided the basis for performing an analysis of streamflow, characterizing the distribution and quality of available habitat for juvenile coho, and making recommendations about restoration priorities for various sub-reaches within the study area.

Additionally, the model has been applied to evaluate potential improvements to streamflow and aquatic habitat conditions resulting from various streamflow restoration strategies including forest management, stormwater management and recharge enhancement, adjustments to surface diversions and groundwater pumping regimes, and flow releases from existing ponds. Conceptual designs were developed for two specific projects which were identified and evaluated as part of the project. The model was also used to investigate the effects of ongoing climate change on streamflow and habitat conditions. In addition to the findings and recommendations discussed in this report, the model also provides a working Decision Support System for ongoing restoration efforts and land and water management decision making and should be considered a "living" model that can be updated as new data and information become available and utilized to help answer new management questions as they arise.

Chapter 2 – Study Area Description

Overview

The Mark West Creek (MWC) watershed is part of the Coast Range Geomorphic Province draining approximately 57 mi^2 of the lower Russian River watershed discharging to the Laguna de Santa Rosa about five miles upstream of its confluence with the Russian River. MWC watershed is commonly divided into an upper watershed in the Mayacamas Mountains and a lower watershed located within the Santa Rosa Plain. Neighboring watersheds include Franz and Maacama Creeks to the north, Santa Rosa Creek to the south, and the Napa River to the east.

The study area is defined as the MWC watershed above Quietwater Road which encompasses all of the 40 mi^2 upper MWC watershed (Figure 1). The upper MWC watershed is characterized by relatively steep topography, confined channels, and bedrock aquifers. Elevations range from 180 feet at Quietwater Road to over 2,300 feet near the headwaters. The study area includes 18 river miles of MWC, several major tributaries such as Porter, Leslie, Humbug, Mill, Weeks, Alpine, and Van Buren Creeks as well as numerous smaller tributary streams. Quietwater Road was selected as the downstream boundary of the study area because it coincides with the extent of the reach identified as critical salmonid summer rearing habitat in the State Water Resources Control Board Emergency Order (WR 2015-0026-DWR). This boundary also approximately coincides with the boundary of the Santa Rosa Plain aquifer as defined by the State Groundwater Management Act (SGMA). Below Quietwater Road, MWC enters the alluvial system of the Santa Rosa Plain which has significantly different characteristics and water management issues.

Upper MWC was severely affected by the October 2017 Tubbs Fire which burned through approximately 48% of the study watershed (19.4 mi^2). Following the fire, forest management and fuel reduction have become a greater concern to many residents in the watershed. The watershed has a substantial number of existing and proposed cannabis cultivation operations which has also generated significant concern among residents, and county, state, and federal regulatory authorities regarding potential adverse impacts of cannabis cultivation on streamflow and salmonid habitat. In addition to being identified in state and federal recovery plans as a high priority watershed for restoration of endangered coho, MWC watershed was identified in the 2014 California Water Action Plan as one of five priority streams, and is the site of several ongoing studies including a CDFW Instream Flow Study and a hydrologic modeling effort by the U.S. Geological Survey (USGS) and Sonoma Water coupled to implementation of the SGMA in the Santa Rosa Plain Groundwater Basin.

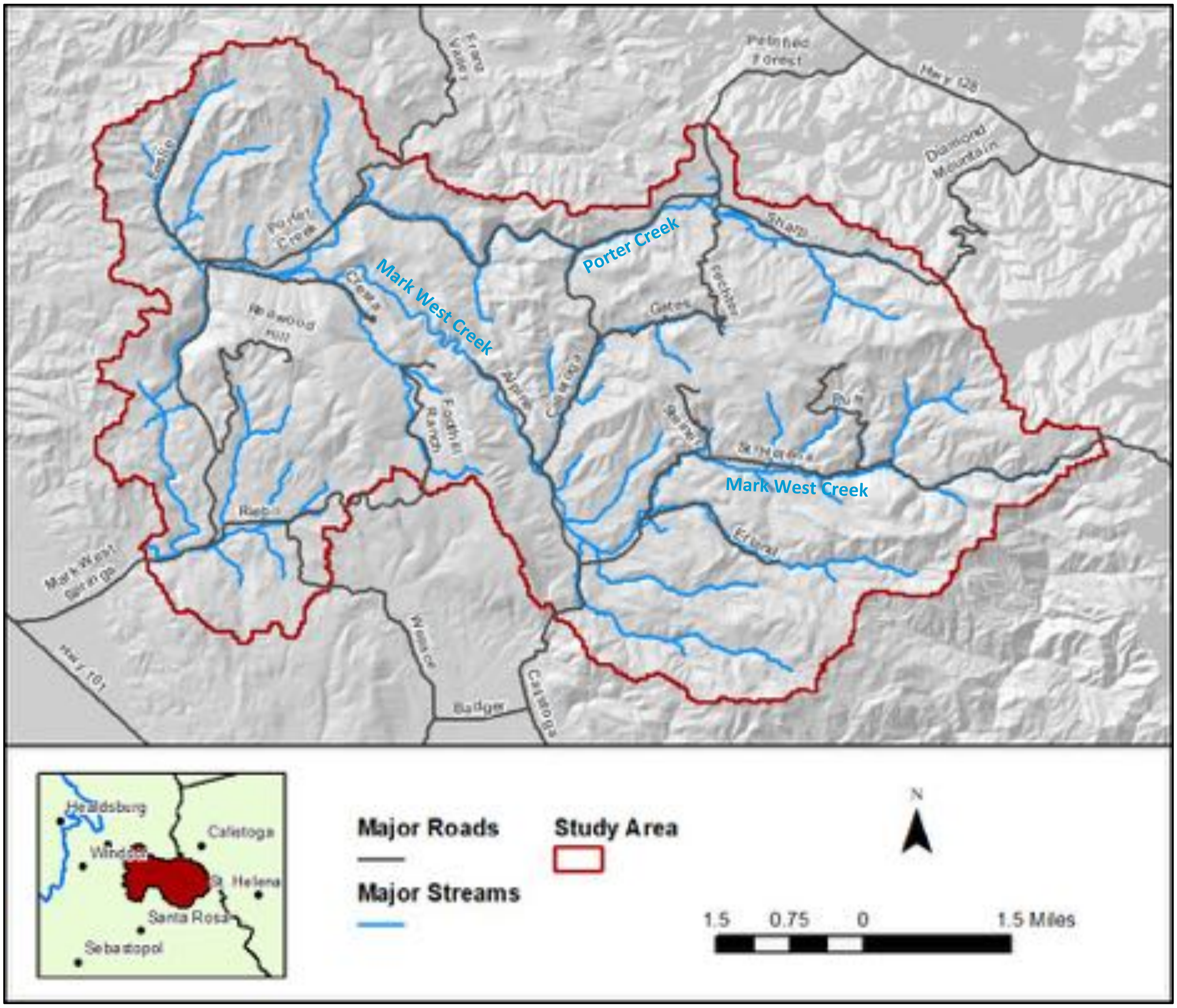


Figure 1: Map of the study area showing major roads and streams.

Climate

The upper MWC watershed has a Mediterranean climate characterized by cool wet winters and warm dry summers. Precipitation varies substantially across the study area from an average of approximately 38 inches per year near the Santa Rosa Plain to approximately 51 inches per year near the crest of the Mayacamas Mountains (Flint & Flint, 2014). For much of the year there is a strong east/west temperature gradient with warmer conditions in the higher elevations to the east relative to lower elevations to the west. This gradient is most pronounced during the daytime where mean maximum monthly temperatures are up to 6.9 °F (3.8 °C) higher at the St. Helena 4WSW climate station in the Mayacamas compared to the Santa Rosa climate station in the Santa Rosa Plain. During the winter (November – February) this gradient flattens or reverses with temperatures in the Mayacamas being the same or slightly (~1 °F) cooler than in the Santa Rosa Plain.

Land Use

Early settlement of the watershed began in earnest during the 1850s and 1860s due to reports of gold in the Russian River area and passage of the Homestead Act. During this time, land use activity in the upper portions of the watershed was focused on mining for silver and mercury, and livestock grazing. Agricultural activities were primarily focused in the lower portions of the watershed and included orchards, vineyards, and hop fields. Logging operations and associated road building also began around this time to clear fields for crops and support the demand for timber from the growing population in the Bay Area. Since World War II, agricultural development has increasingly been replaced by residential development (SRCD, 2015).

Existing land cover is primarily forest (72%), with the remainder divided between grassland (16%), shrubland (7%), developed and sparsely vegetated areas (3%), and agriculture (2%). Most of the forest areas are comprised of various species of oak (48%) and Douglas Fir (36%) with significant stands of Bay Laurel (5%), Coast Redwood (4%), and Madrone (2%) comprising most of the remainder. Ongoing forest succession has been occurring in the watershed in recent decades with expansion of Douglas Fir into Oak Woodlands. Vegetation recovery and potential changes to vegetation patterns following the October 2017 Tubbs Fire which burned about 48% of the study watershed area (20% with moderate or high burn severity) have not been well-quantified.

Land ownership in the watershed is primarily privately-owned rural residential properties with a few agricultural parcels. The Sonoma County Agricultural Preservation and Open Space District and Sonoma County Regional Parks own multiple properties including the Saddle Mountain Preserve, and the Cresta and McCullough Ranch which is slated to become the Mark West Regional Park. The Pepperwood Preserve in the northern portion of the watershed is the site of many ongoing scientific investigations and educational programs. The watershed also includes the Safari West wildlife preserve and portions of the Mayacamas Golf Club.

Geology

The geology of the Upper Mark West Creek watershed is complex and includes several distinct rock types which are offset by a series of faults and fracture zones. The northwest by southeast-trending Maacama Fault Zone bisects the study area and separates distinct geologies to the east and west. West of the Maacama Fault Zone, the study area is dominated by the early-Pleistocene and Pliocene-aged Glen Ellen Formation and bedrock units of the Pliocene and late-Miocene-aged Sonoma Volcanics (basalt and volcanic tuff). East of the fault zone, the study area is dominated by volcanic tuff and andesite of the Sonoma Volcanics and by the Cretaceous and Jurassic-aged Franciscan Complex. Other significant faults include the Larkfield, Rincon Creek, and Mark West Fault Zones to the west of the Maacama Fault Zone which form contacts between the Sonoma Volcanics and the Glen Ellen Formation. The Gates Canyon and Petrified Forest Thrust to the east of the Maacama Fault Zone place rocks of the Sonoma Volcanics in contact with older rocks of the Franciscan Formation.

Other geologic formations, including the Pliocene-aged Fluvial and Lacustrine Deposits of Humbug Creek and the Cretaceous and Jurassic-aged Great Valley Sequence occupy smaller portions of the study area. Quaternary-aged landslide and fluvial deposits are also present but are typically shallow and occupy a relatively small portion of the study area. Interpretation of subsurface geologic conditions from Well Completion Reports reveals that the landslide and fluvial deposits are generally less than 25-ft thick and that most wells are completed in underlying bedrock units. The thickest and most widespread alluvium is found along Mark West Creek near its confluence with Porter Creek where it reaches thicknesses of up to 65-ft. Examination of Well Completion Reports also revealed that the Glen Ellen Formation is generally unsaturated and relatively thin (50-100 ft). Most wells drilled in the Glen Ellen Formation extend into the underlying Sonoma Volcanics where groundwater is more frequently found.

Aquatic Habitat

Coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) are present in upper MWC and its tributaries. CDFW habitat surveys were conducted in Porter Creek in 1974 and 1996, in Humbug Creek in 1996, and in Horse Hill, Mill, Weeks, and Van Buren creeks in 1997. These surveys documented steelhead presence in Porter, Mill, Humbug, and Van Buren creeks but not in Horse Hill or Weeks Creek. Coho were not documented in any of these tributary surveys. Notable limiting factors in the tributaries included insufficient summer flows, inadequate pool habitat and riparian canopy, and a lack of quality spawning gravels.

Wild coho were observed in upper MWC in 2001 by CDFW during a snorkel survey as well as in more recent CA Sea Grant snorkel surveys. Available data from Sonoma Water and CA Sea Grant indicates that adult coho returned to spawn in MWC in water year 2011, 2012, and 2013 but not during the drought conditions of 2014. The Russian River Coho Salmon Captive Broodstock Program first released hatchery salmon into the MWC watershed in autumn of 2011; between 13,000 and 23,000 juvenile coho were released in Mark West Creek and Porter Creek each year between 2011 and 2014, and in 2016. In 2017, 6,000 fish were released only in Porter Creek. In addition to salmonids, California red-legged frog (*Rana draytonii*) and yellow-legged frog (*Rana boylii*), which are both listed as threatened, have been documented in the watershed.

Chapter 3 – Numerical Modeling Methodology

The hydrologic model of the upper Mark West Creek watershed was constructed using the MIKE SHE model (Graham and Butts, 2005; DHI 2017). Model code development activities have been ongoing since its inception in 1977 and the model has been applied successfully to hundreds of research and consultancy projects covering a wide range of climatic and hydrologic regimes around the world (Graham and Butts, 2005).

The MIKE SHE model is a fully-distributed, physically-based model capable of simulating all the land-based phases of the hydrologic cycle including overland flow, channel flow, evapotranspiration, unsaturated flow, saturated flow, and stream/aquifer interactions. The distributed nature of the model makes it well-suited for examining the hydrologic impacts of changes in climate and water management. Complex physics-based watershed models, while powerful tools, require extensive input data and should ideally be well-calibrated to observed stream flow and groundwater data spanning a number of years. It is important to bear in mind that a model is a simplification of a complex and in some ways unknowable hydrologic system and although it can provide useful estimates of various flows and storages within the system, the estimates contain uncertainty and should not be viewed as a replacement for real data or as a static condition. Such models are best updated on a periodic basis as new data become available.

Overland Flow

The overland flow component of MIKE SHE solves the two-dimensional St. Venant equations for shallow free surface flows using the diffusive wave approximation. A finite-difference scheme is used to compute the fluxes of water between grid cells on a two-dimensional topographic surface. Net precipitation, evaporation, and infiltration are introduced as sources or sinks and the model assumes that a sheet flow approximation is valid for non-channelized surface flows and that roughness is uniform over various flow depths. The primary inputs of the overland flow module include topographic information in the form of a digital elevation model (DEM) and a corresponding spatial distribution of overland roughness coefficients (Manning's n) which is generally referenced to the model's land cover categories. Sub-grid-scale depressions in the topography and barriers to overland flow are represented conceptually through use of a detention storage parameter.

Channel Flow

The channel flow component of the model calculates unsteady water levels and discharges using an implicit finite-difference formulation to solve the one-dimensional St. Venant equations for open channel flow. The model is capable of simulating ephemeral stream conditions and backwater effects and includes formulations for a variety of hydraulic structure types including bridges, weirs, and culverts. Either a no-flow or a discharge boundary can be used as the upstream boundary condition, and the downstream boundary can be represented using a stage or stage discharge relation. Other than boundary conditions, the primary inputs for the channel flow model include channel geometry information and roughness coefficients for channelized flow (Manning's n).

Channel Flow Interactions

Interaction between the channel flow and overland flow components for the model is driven by the gradient between the overland water depths in a given grid cell and the head in a corresponding computational node in the channels and is computed using a broad crested weir equation. Depending on the direction of the gradient, the channel flow component of the model can either receive overland flow during runoff events or release water back into the floodplain as overland flow. The model is also capable of simulating backwater effects onto the overland flow plane due to restricted channel flow.

Evapotranspiration and Interception

Evapotranspiration (ET) is handled in the model using a two-layer water balance approach which divides the unsaturated zone into a root zone from which water can be transpired and a lower zone where it cannot. The model computes actual evapotranspiration (AET) as a function of potential evapotranspiration (PET) and the available water content in the vegetation canopy, overland flow plane, and the unsaturated zone. The model first extracts water from interception storage which is based on vegetation properties including leaf area index (LAI) and an interception storage coefficient. Next, water is extracted from ponded water on the land surface and, finally, from within the unsaturated zone or, if the rooting depth exceeds the depth to water for a given timestep, the saturated zone. PET can be adjusted for each land cover category in the model through use of a crop coefficient (Kc). The simulated position of the water table along with the specified rooting depth determines the thickness of the zone of transpiration.

Unsaturated Flow

The unsaturated flow component of MIKE SHE functions with the two-layer water balance method described above. The method considers average conditions in the unsaturated zone and tracks available soil moisture to regulate ET and groundwater recharge using a one-dimensional (vertical) formulation. A soil map Is used to distribute the primary soil properties used to drive the model, including saturated hydraulic conductivity (K_{sat}) and moisture contents (Θ) at saturation, field capacity, and wilting point. The unsaturated flow component of the model interacts with the overland flow component by serving as a sink term (infiltration) and with the groundwater flow component by serving as a source term (recharge).

The unsaturated zone component of the model does not explicitly represent lateral movement through and discharge from the unsaturated zone commonly referred to as interflow. In the MWC watershed, interflow occurring at or near the contact between soils and underlying bedrock is expected to be an important process. Because interflow is often associated with a temporary increase in groundwater elevations during and following precipitation events, interflow processes can be approximated in MIKE SHE with a saturated zone drainage function.

Saturated Flow

The groundwater component of the model solves the three-dimensional Darcy equation for flow through saturated porous media using an implicit finite difference numerical scheme solved using the preconditioned conjugate gradient (PCG) technique which is nearly identical to that used in MODFLOW, a widely used U.S. Geological Survey groundwater model. The primary inputs to the model are horizontal and vertical hydraulic conductivity, specific yield, storage coefficients, and the upper and lower elevation of each layer(s) considered in the model. External boundary conditions can be no-flow, head, or gradient boundaries and pumping wells can be added as internal sinks. The lower boundary of the model is zero-flux or a specified flux-boundary, and the upper boundary condition is a flux term calculated by the unsaturated flow component of the model (recharge). If the water table reaches land surface, the unsaturated flow calculations are disabled and the groundwater component of the model interacts directly with the overland flow plane.

Chapter 4 – Model Construction

Model Overview

The Upper Mark West Creek hydrologic model is defined as the Mark West Creek watershed upstream of Quietwater Road. The model is discretized into over 50,000 45-meter by 45-meter (0.5-acre) grid cells covering a 40.2 mi^2 area. The grid resolution was selected to represent the watershed in as much detail as possible consistent with the overall resolution of input data while enabling reasonable computation times (about 100 hours).

The model simulates a continuous 10-yr period from 10/1/2009 through 9/30/2019 (Water Years 2010 - 2019). This period was selected because it corresponds to the period with the most data available for model calibration, is representative of long-term average precipitation conditions, and includes a wide variety of precipitation conditions ranging from the very dry Water Year (WY) 2014 when annual precipitation at the Santa Rosa and St. Helena 4SW climate stations was 14.9 and 28.9 inches respectively to the very wet WY 2017 when annual precipitation at the two stations was 50.2 and 74.0 inches respectively (Figures 2 & 3). Based on the long-term precipitation record for Santa Rosa from 1906 – 2019, WY 2014 was the 4th driest year on record and WY 2017 was the 5th wettest (Figure 2). The 2-yr rainfall total for WY 2013-2014 was the second driest on record (14.9 inches versus 12.8 inches for 1976-1977). Mean annual precipitation at the Santa Rosa climate station for the simulation period was 31.1 inches, which is similar to both the 1906-2019 and 1981-2010 averages of 30.2 and 32.1 inches respectively (Figure 2).

A longer streamflow record is available for the upper watershed, but streamflow data from the lower watershed (developed for this project to facilitate model calibration) is only available for WY 2018 and 2019. Although simulation of post-fire hydrologic impacts and subsequent recovery from the Tubbs Fire was not part of the scope of this project, given the timing and scale of the October 2017 fire event just prior to collection of streamflow data, it was necessary to incorporate a simplistic representation of the post-fire landscape into the model to facilitate calibration. Post-fire hydrologic effects are complex and adjust rapidly in the years following disturbance. An ongoing USGS is underway to better understand the effects of the fire on soil hydrologic conditions, and preliminary findings suggest highly localized effects and that recovery to pre-fire characteristics occurs rapidly (Perkins, personal communication).

We did not attempt to represent the long-term effects of fire or recovery; rather, we developed a version of the model representing the short-term effects (first and second year after disturbance) of the fire exclusively for calibration purposes, and maintained the pre-fire landscape for the primary simulation of existing conditions and future scenarios. This decision acknowledges that the available data describing vegetation in the watershed was collected prior to the fire and that the long-term recovered landscape is likely to more closely resemble the pre-fire landscape than the short-term post-fire landscape, and thus represents a more appropriate basis for evaluating management decisions.

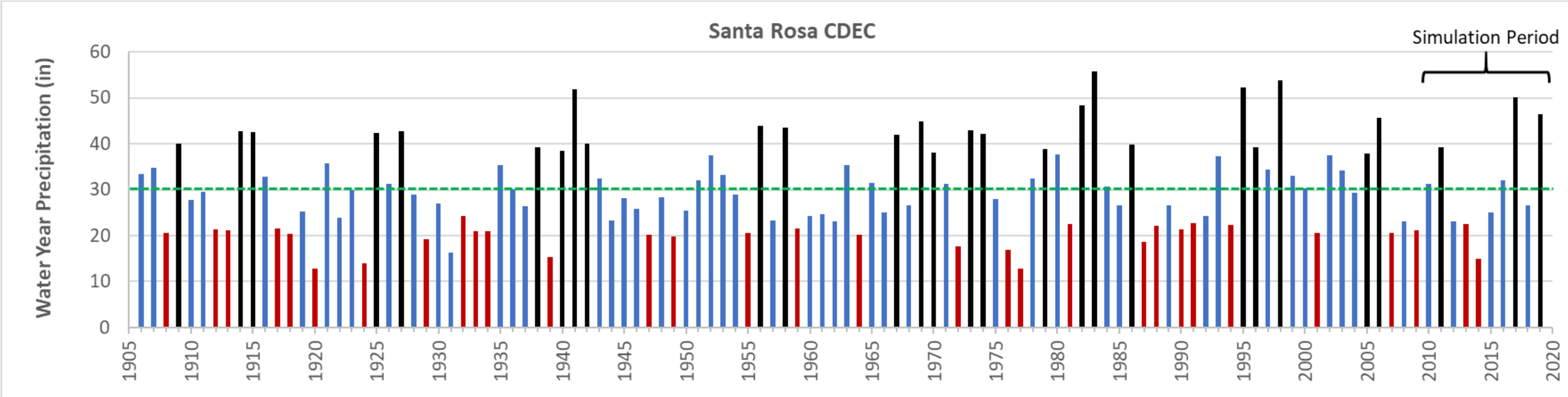


Figure 2: Long-term annual precipitation record for the Santa Rosa CDEC climate station (black and red values indicate wet and dry years defined as +/- 25% of the long-term average as shown with the dashed line).

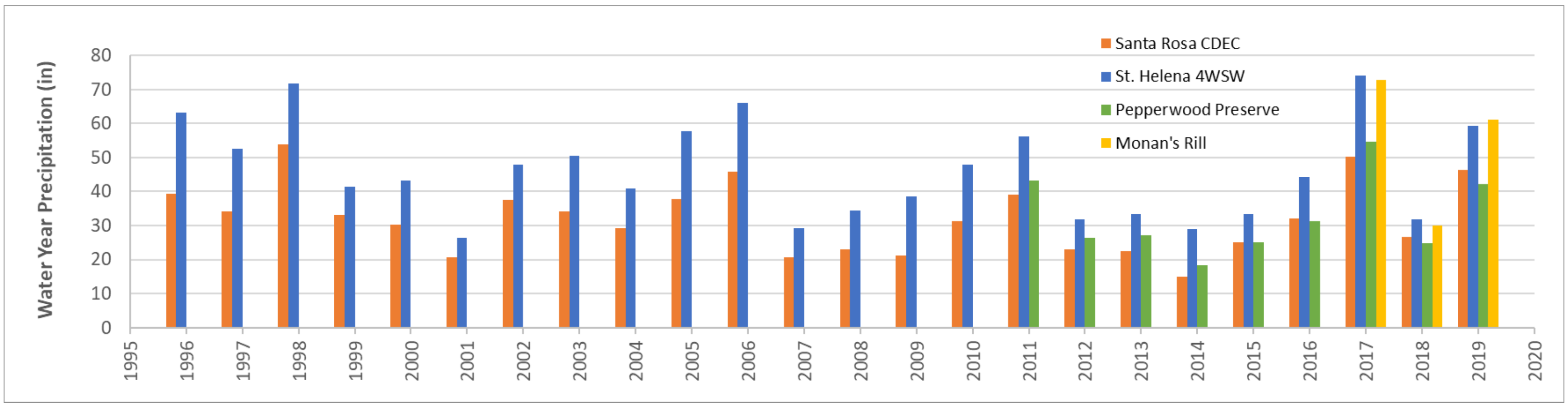


Figure 3: Annual precipitation records for various climate stations in and around the MWC watershed.

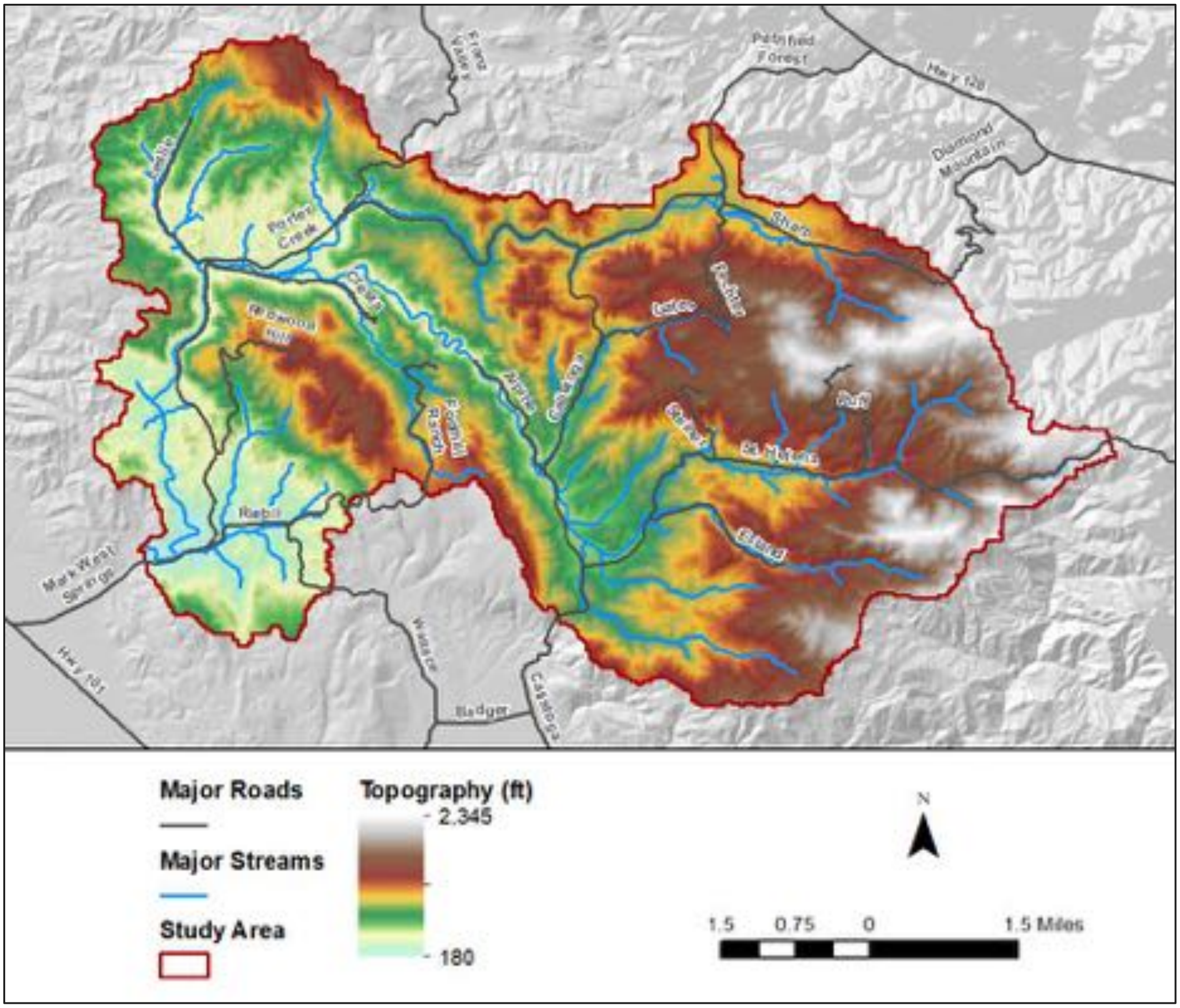


Figure 4: Topography used in the MWC hydrologic model.

Topography

Model topography is based on the 3-foot resolution Sonoma County LiDAR dataset (WSI, 2016) which was resampled to conform to the 45-meter grid cells used in the model. Elevations in the model domain range from 180 feet near Quietwater Road to 2,345 feet on Diamond Mountain near the border between Sonoma and Napa Counties (Figure 4).

Climate

Precipitation and Potential Evapotranspiration (PET) are the primary climatic inputs to the model; both are represented on a daily timestep. Based on the Basin Characterization Model (BCM) (Flint et al., 2013; Flint & Flint, 2014) which provides gridded estimates of average annual precipitation for the 1980-2010 period throughout California, a significant east-west gradient in precipitation exists across the watershed. Mean annual precipitation is estimated to increase from 38 in/yr near the Santa Rosa Plain to 51 in/yr near the crest of the Mayacamas Mountains. Based on analysis performed for this study (as described below) PET varies primarily with aspect and is estimated to range from 30 to 52 in/yr. To account for the spatial variability in climate, the model domain was divided into 1-inch interval precipitation and PET zones (Figures 5 & 6).

Precipitation

There are several weather stations within the Upper Mark West watershed and surrounding areas (Figure 5). A long-term daily precipitation record dating back to Water Year (WY) 1906 is available from the Santa Rosa station operated by Sonoma County and located southwest of the watershed in the Santa Rosa Plain (Figure 2). A shorter but significant precipitation record dating to WY 1996 is available from the St. Helena 4WSW station operated by the California Department of Water Resources (DWR) and located southeast of the watershed along the ridge separating Sonoma and Napa County. Another significant record dating to WY 1991 is available from the Windsor station operated by the California Irrigation Management Information System (CIMIS) and located near the Town of Windsor. The Pepperwood Preserve has the longest operating precipitation station in the watershed dating to WY 2011. CRWI operated two stations at the Monan's Rill community in the upper watershed beginning in WY 2017. Three additional stations were installed by Sonoma Water in the watershed in February 2018 including Mark West Creek at Michelle Way, Mark West Creek at Porter Creek Road, and Mark West Regional Park (Figures 3 & 5).

The model domain is divided into 14 precipitation zones to account for the west to east gradient in precipitation (Figure 5). These zones are based on 1-inch annual isohyets derived from the BCM 1981-2010 mean annual precipitation data which is available at a 270-meter spatial resolution (Flint and Flint, 2014). Each zone was assigned to a rainfall station and precipitation was scaled up or down based on the ratio of the mean annual precipitation in the zone to the mean annual precipitation at the corresponding weather station. The station assignments vary throughout the simulation period as more stations became available during more recent time periods. For 10/1/2009 through 10/4/2010, all zones utilized the St. Helena 4WSW station. For the period 10/5/2010 to 11/15/2016, all zones utilized the Pepperwood station, and for the period 11/16/2016 to 2/1/2018, the 38 to 44-inch zones utilized the Pepperwood station and the 45 to 51-inch zones utilized the Monan's Rill station. For the most recent time period from 2/2/2018 to 9/30/2019, the 38 and 39-inch zones utilized the Michelle Way station, the 40 to 42-inch zones utilized the Pepperwood station, the 43 to 45-inch zones utilized the Mark West Regional Park station, and the 46 to 51-inch zones utilized the Monan's Rill station (Table 1 & Figure 7).

Comparisons between the BCM long-term average precipitation and the long-term average precipitation at the Santa Rosa and St. Helena 4WSW gages suggest that the BCM may over-predict rainfall by ~15-20%. Nevertheless, the magnitude of the gradient across the MWC watershed as predicted by the BCM agrees well with the station data, and the BCM provides the

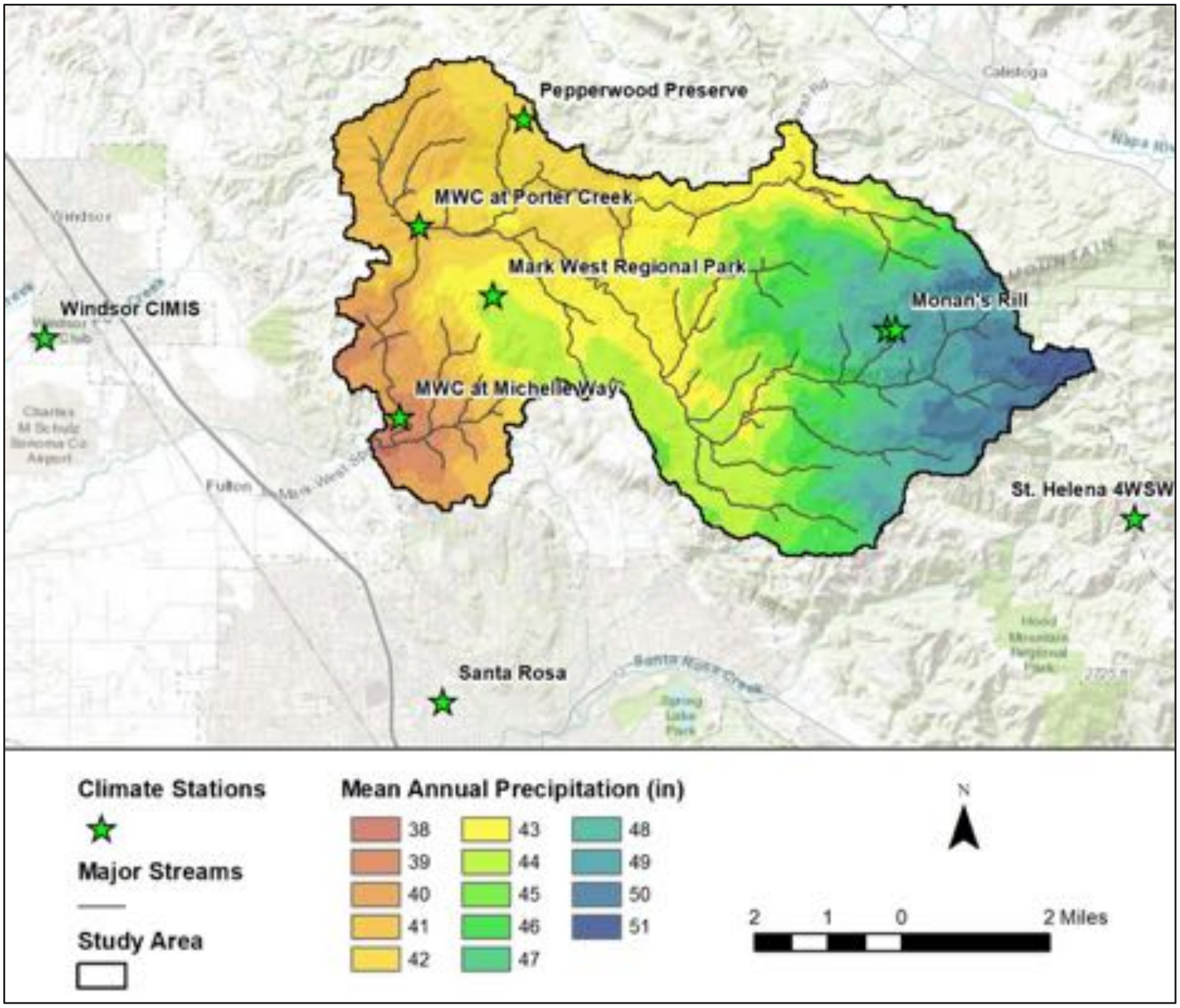


Figure 5: Precipitation zones and climate stations used in the MWC hydrologic model.

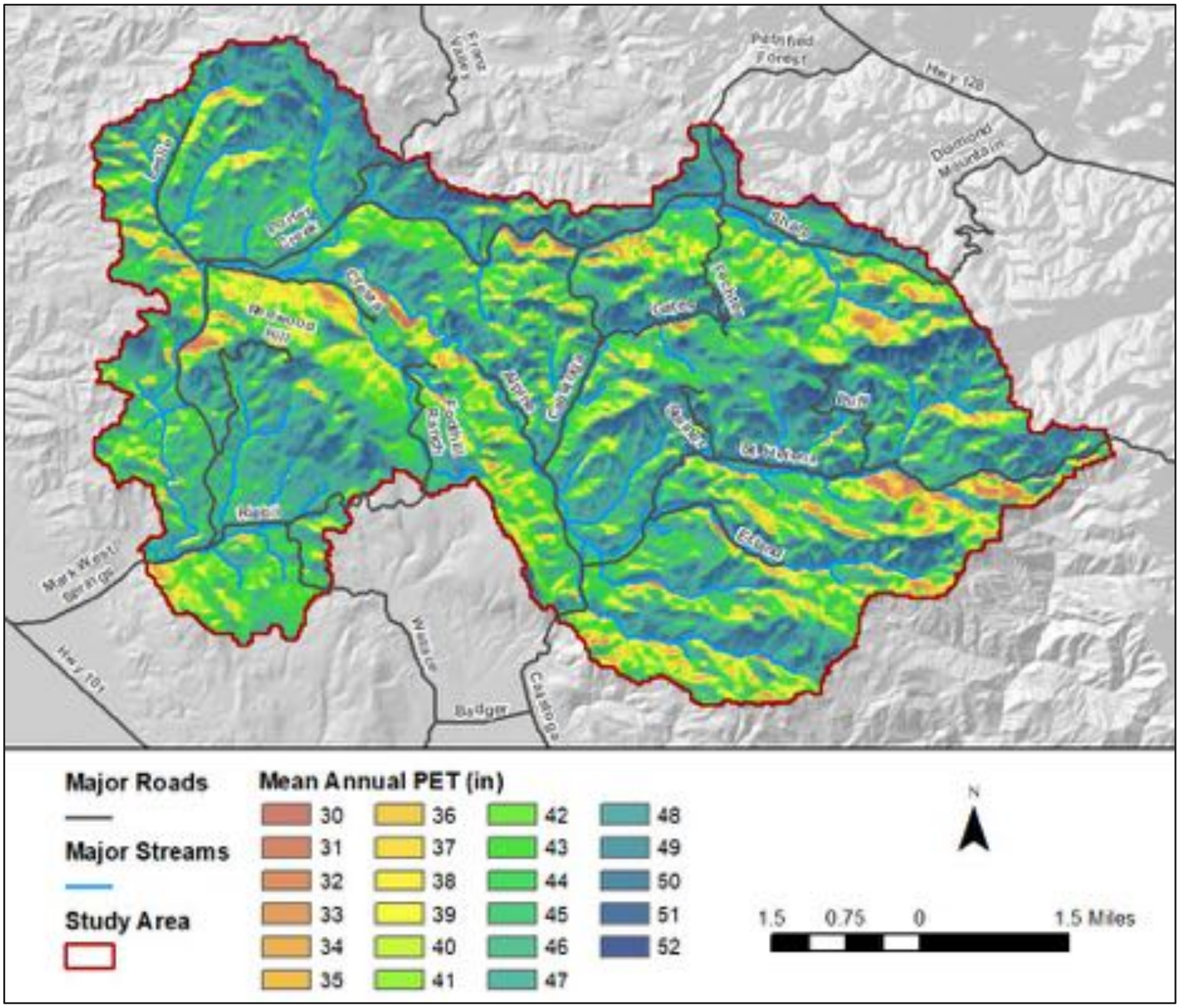


Figure 6: PET zones used in the MWC hydrologic model.

Table 1: Precipitation station assignments used for various time periods. Station codes and associated BCM mean annual precipitation values are as follows: MW – Michelle Way 38.5-in, PEP – Pepperwood 41.5-in, MWRP – Mark West Regional Park 43.8-in, MR – Monan's Rill 48.5-in, SH – St. Helena 4WSW 49.7-in.

	Precipitation Zone													
Time Period	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
10/1/2009 - 10/4/2010	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH	SH
10/5/2010 - 11/15/2016	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP	PEP
11/16/2016 - 2/1/2018	PEP	PEP	PEP	PEP	PEP	PEP	PEP	MR	MR	MR	MR	MR	MR	MR
2/2/2018 - 9/30/2019	MW	MW	PEP	PEP	PEP	MWRP	MWRP	MWRP	MR	MR	MR	MR	MR	MR

best means to spatially distribute the available rainfall station data across the watershed. The actual 10-yr simulation period mean rainfall in the model varies from 30.8 inches/yr to 43.3 inches/yr consistent with the long-term mean from the available gauging data, whereas the BCM shows this variation as 38 to 51 inches.

Potential Evapotranspiration (PET)

Daily PET data from the Windsor CIMIS station was used to derive the PET timeseries used in the model (Figures 6 & 8). A gridded distribution of mean annual PET was created using the Hargreaves-Samani equation (Hargreaves and Samani, 1982). The calculations were performed using gridded solar radiation data from the National Solar Radiation Database (NSRDB, 2010) and average monthly minimum and maximum temperatures for the 1980 -2010 period from the BCM dataset (Flint & Flint, 2014). The empirically derived KT coefficient was calibrated based on reported PET from the Santa Rosa and Windsor CIMIS Stations. A KT value of 0.152 was selected, consistent with KT values of 0.15 to 0.16 previously proposed for the Bay Area.

From this annual distribution, the model domain was divided into zones, each corresponding to a one-inch range in average annual PET. Scaling factors were calculated for each zone as the ratio of PET at the Windsor CIMIS gage and the PET for a given zone. These scaling factors were then applied to the daily CIMIS data and applied to each zone in the model. From February 2013 to March 2017 PET was not reported at the Windsor CIMIS gage. This gap was filled using scaled data from the Santa Rosa CIMIS gage located west of Sebastopol. Smaller gaps and missing days of data were also filled using Santa Rosa data.

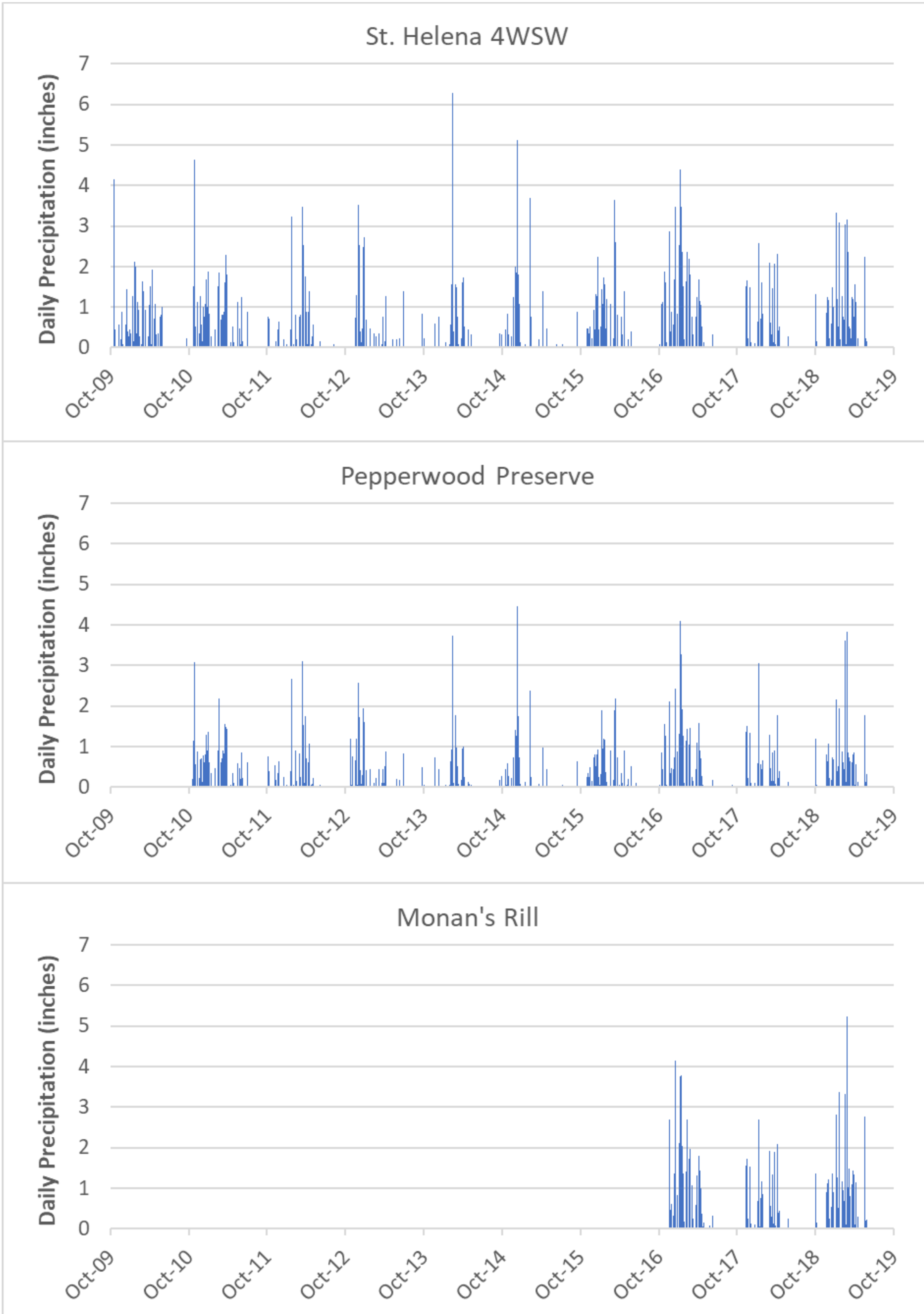


Figure 7: Daily precipitation at the five climate stations used in the MWC hydrologic model for the WY 2010 – 2019 simulation period.

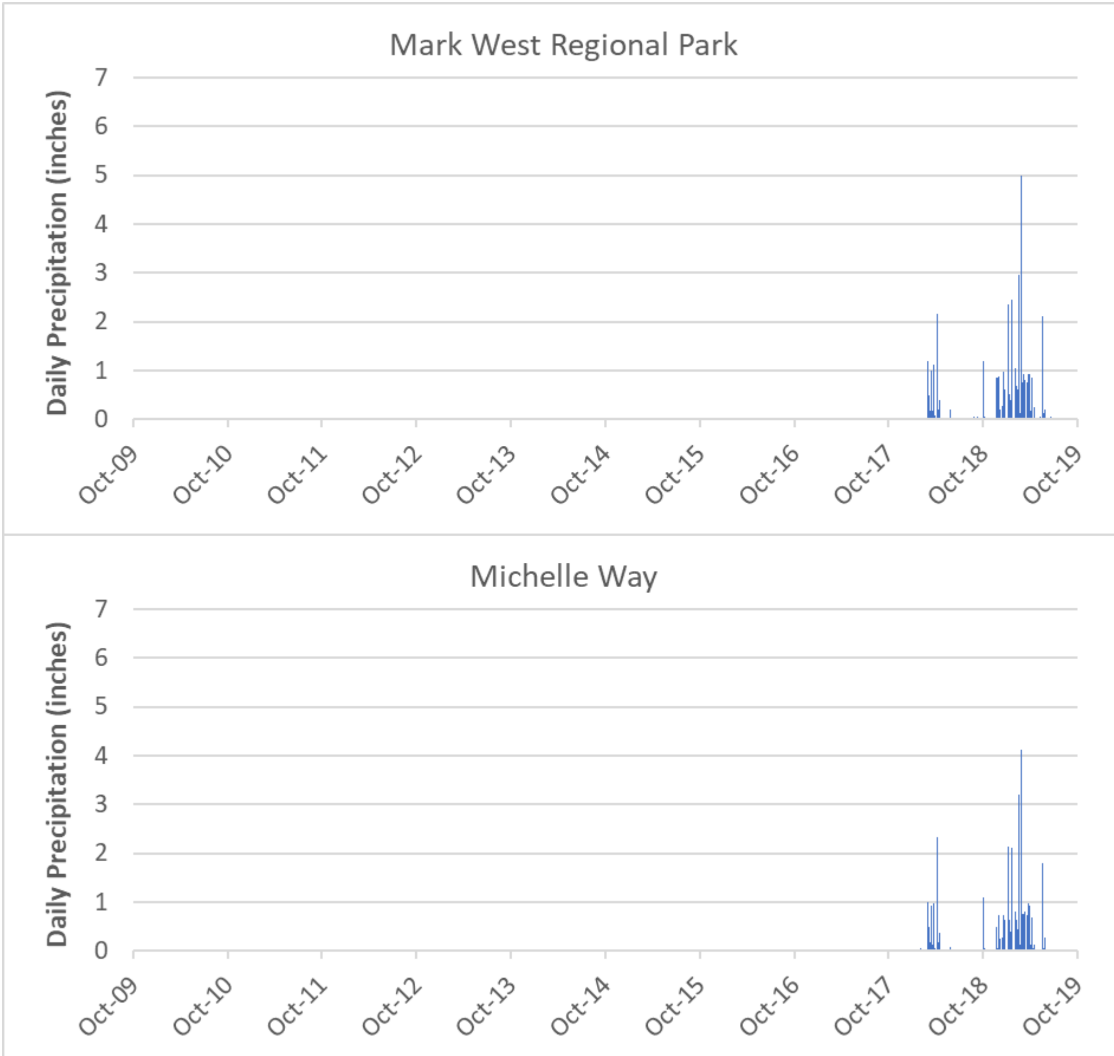


Figure 7 (continued)

Land Cover

Within the upper Mark West watershed, coniferous and deciduous forest are the dominant landcover types with grasslands making up much of the remaining area (Table 2). Land cover varies significantly with elevation in the watershed. Downstream of St. Helena Road, Mark West Creek and several other tributaries including Leslie, Porter, Riebli, and Weeks Creeks contain predominately oak woodland interspersed with other deciduous woodlands and grasslands. Upstream of St. Helena Road, Mark West Creek has several tributaries including Alpine, Humbug, and Van Buren Creeks; these tributary watersheds are dominated by coniferous forest including Coastal Redwoods and Douglas Fir. Several vineyards are located along the mainstem of Mark West Creek as well as along Porter and Riebli Creeks. Much of the Riebli Creek watershed, as

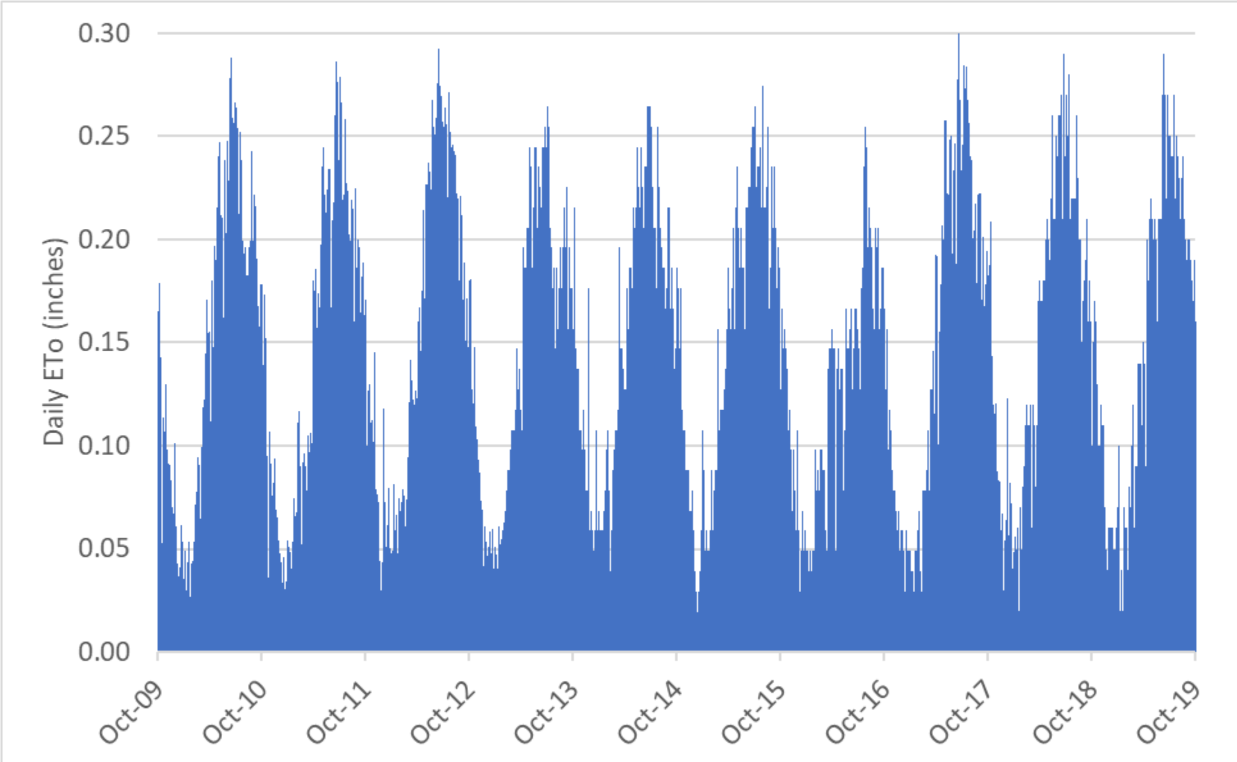


Figure 8: Daily PET at the Winsor CIMIS station used in the MWC hydrologic model for the WY 2010 – 2019 simulation period.

well as small portions of the uppermost Mark West Creek and Humbug Creek watersheds, contain relatively dense rural residential development.

The model domain was discretized into 28 land cover zones based on vegetation classes from the Sonoma County Vegetation Mapping & LiDAR Program's Fine Scale Vegetation and Habitat Map (Figure 9) (SCVMLP, 2015). This map was generated for the Vegetation Mapping & LiDAR Program using automated processing of returns from the 2013 countywide LiDAR flight and interpretation of aerial imagery by the modelers (SCVMLP, 2015). It includes a detailed accounting of dominant species including several species of oak and conifer and is intended for use at a scale of 1:5000 or smaller. Land cover zones that represent less than 0.3% of the model domain (approximately 0.1 mi^2) are grouped with similar or adjacent cover types. Because these land cover zones are based on 2013 data, they do not reflect changes caused by the 2017 Tubbs Fire which were accounted for separately as described below.

A unique combination of model parameters was assigned to each of the 28 land cover zones. These parameters include Leaf Area Index (LAI), Rooting Depth, Manning's Roughness Coefficient for overland flow, and Detention Storage. For land cover types with a deciduous vegetation component, the Leaf Area Index and Rooting Depth vary seasonally based on an assumed growing season of April 15th to October 15th with gradual parameter transitions occurring from March 15th to April 15th and from October 15th to November 15th. Dormant season values for deciduous land

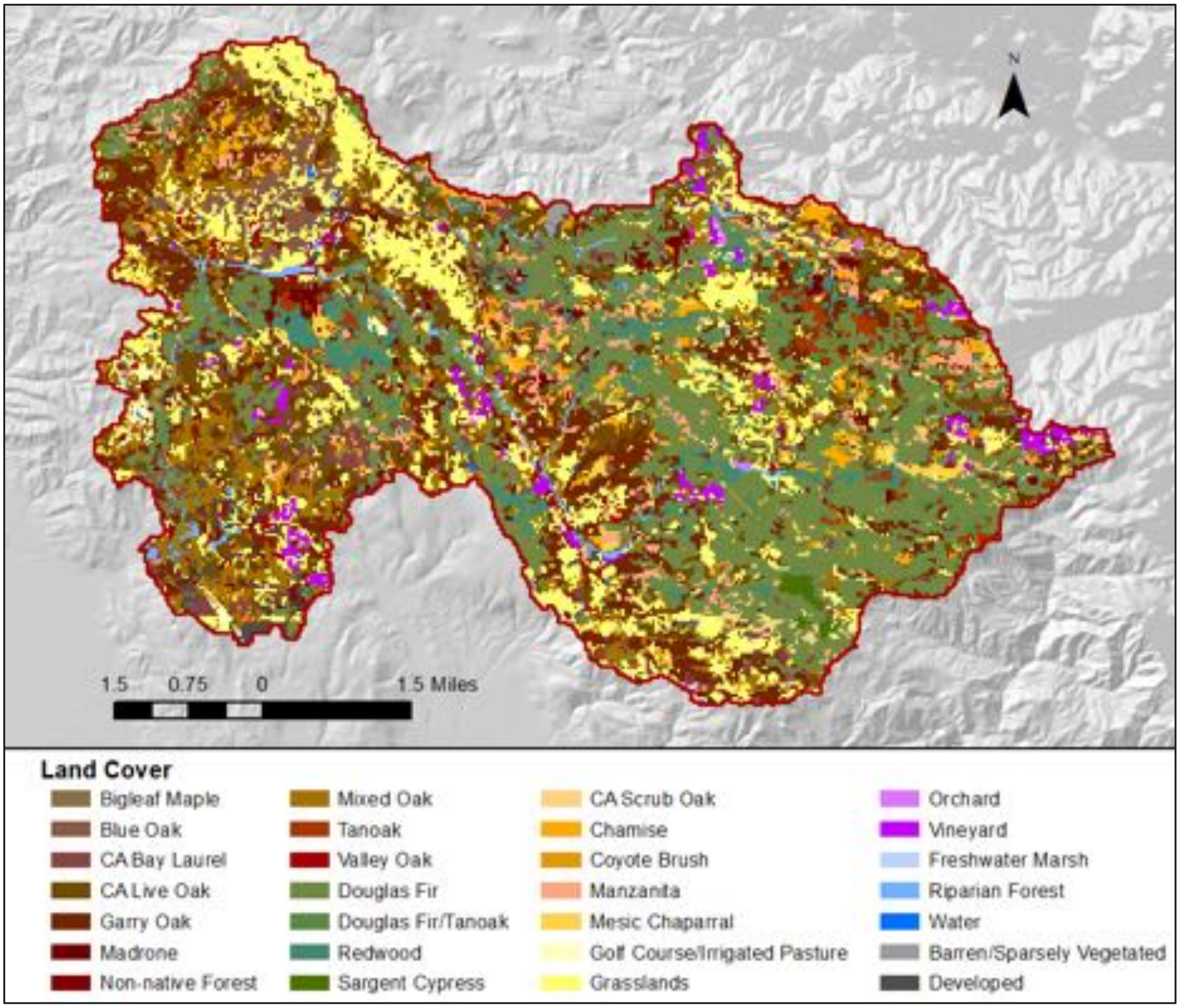


Figure 9: Land cover categories used in the MWC hydrologic model.

cover types were assumed to be equivalent to grassland values. For grasslands, the growing season was assumed to occur from December 15th to May 15th and the dormant season was assumed to occur from July 1st to October 15th with gradual parameter transitions in between. Many of these parameters are difficult to measure in the field and site-specific values are generally unavailable. With the exception of LAI, land cover parameters were initially estimated from literature values (e.g. Allen et al., 1988; TNC, 2018) and then adjusted within the range of reasonable limits as part of the calibration process (Table 2).

LAI was estimated for each vegetation zone using a spatially distributed LAI dataset created by the University of Maryland (Tang, personal communication, Tang, 2015) (Figure 10). This dataset was created using vegetation returns from the countywide LiDAR dataset and has a 3-foot spatial resolution. The remotely sensed LAI values in this dataset represent a combination of the canopy properties of individual plants and the density and spacing of those plants. This differs from LAI

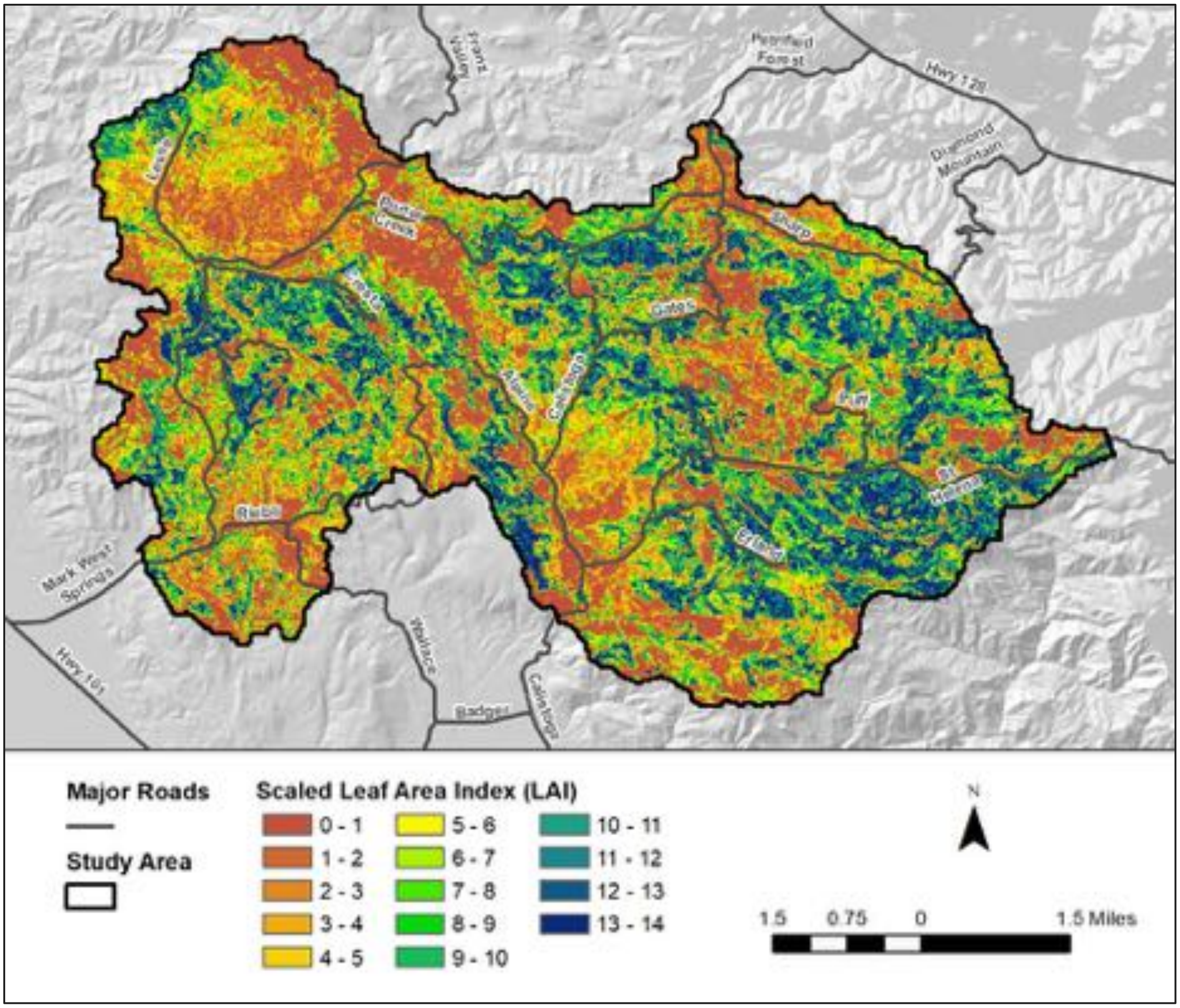


Figure 10: Distribution of LiDAR-derived Leaf Area Index (LAI).

Table 2: Land cover types and associated hydraulic and vegetation properties used in the MWC hydrologic model.

Land Cover Category	Proportion of Model Domain	Overland Flow Mannings n	LAI	Rooting Depth (ft)	Detention Storage (in)
Bigleaf Maple	0.2%	0.60	7.4	11.5	0.9
Chamise	2.2%	0.40	2.7	6.4	0.3
Madrone	1.3%	0.60	9.8	8.6	0.9
Manzanita	3.0%	0.40	4.3	6.6	0.3
Coyote Brush	0.8%	0.40	1.5	6.5	0.3
Barren/Sparsely Vegetated	0.2%	0.04	0.3	0.5	0.0
Grasslands	15.4%	0.24	0.4	2.1	0.3
Mesic Chaparral	1.5%	0.40	4.1	5.0	0.3
Sargent Cypress	0.3%	0.60	4.5	5.6	0.9
Irrigated Pasture	0.4%	0.24	0.4	3.1	0.3
Non-native Forest	0.2%	0.60	3.7	7.6	0.9
Tanoak	0.9%	0.60	1.5	15.0	0.9
Orchard	0.2%	0.24	11.3	6.7	0.9
Douglas Fir/Tanoak	0.9%	0.60	(8.0 - 14.7)	9.4	0.9
Douglas Fir	25.6%	0.60	(7.2 - 15.1)	3.7	0.9
Mixed Oak	8.4%	0.60	(4.0 - 10.1)	19.5	0.9
CA Live Oak	11.3%	0.60	(5.0 - 10.2)	24.0	0.9
Blue Oak	2.1%	0.60	(2.7 - 9.0)	15.0	0.9
CA Scrub Oak	0.3%	0.60	2.8	15.0	0.9
Garry Oak	11.3%	0.60	(4.0 - 10.8)	15.0	0.9
Valley Oak	0.9%	0.60	(3.9 - 9.8)	24.0	0.9
Redwood	3.2%	0.60	11.2	11.1	0.9
CA Bay Laurel	3.9%	0.60	8.1	3.0	0.9
Riparian Forest	1.1%	0.60	6.0	7.3	0.9
Vineyard	1.7%	0.24	1.0	4.9	0.3
Water	0.1%	0.04	1.0	0.5	0.0
Marsh	0.1%	0.04	0.5	1.3	0.0
Developed	2.3%	0.04	2.9	5.9	0.0

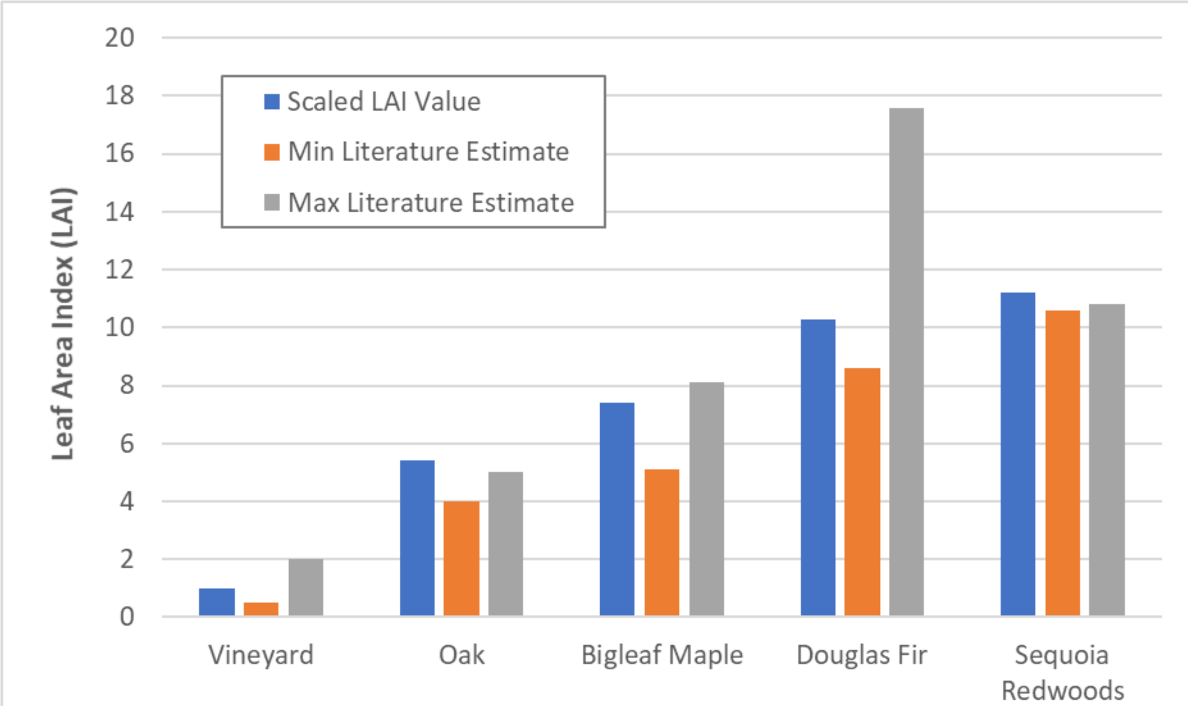


Figure 11: Comparison between scaled LAI values used in the MWC hydrologic model and estimates from the literature for various vegetation types.

values representing individual plant specimens which is the standard convention for empirical evapotranspiration equations used in our model. We compared the remotely sensed LAI values for various vegetation classes with individual specimen values from the literature (Iio & Ito, 2014; Johnson, 2003; Karlik & McKay, 2002; Scurlock et al., 2001) and translated the LiDAR-derived values to specimen values consistent with the literature by applying a uniform scaling factor to the LiDAR-derived LAI (Figure 11). LAI values were calculated for each of the vegetation zones in the model by calculating the mean LAI for each zone from the scaled LAI dataset (Table 2). For Douglas Fir, Douglas Fir/Tanoak, and the various types of Oaks, we further subdivided the LAI estimates into areas requiring no forest treatment, minor treatment, and major treatment based on LAI thresholds we defined from plot-scale forest mapping performed in the upper watershed as described in greater detail in the Chapter 8.

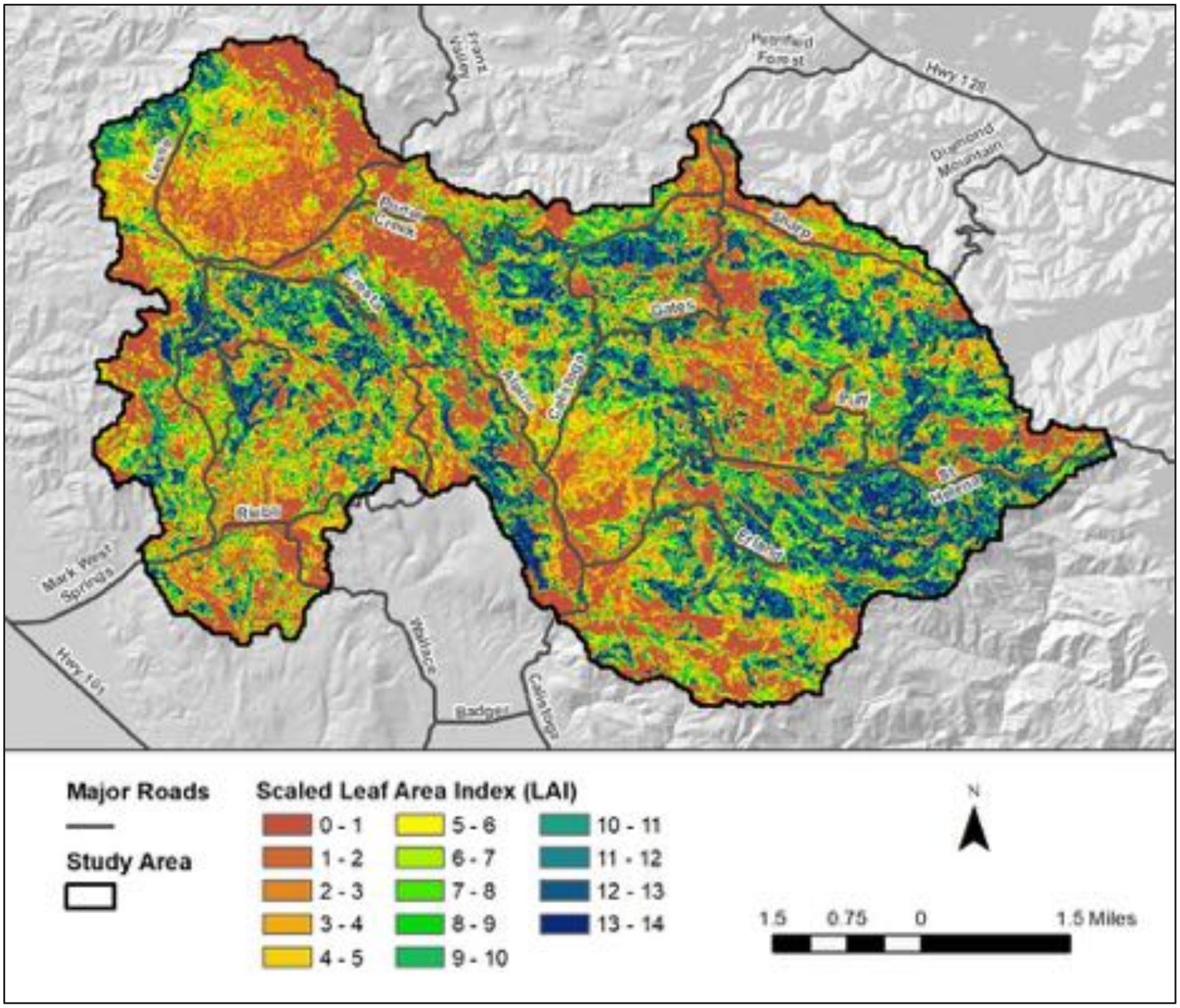


Figure 10: Distribution of scaled LiDAR-derived Leaf Area Index (LAI).

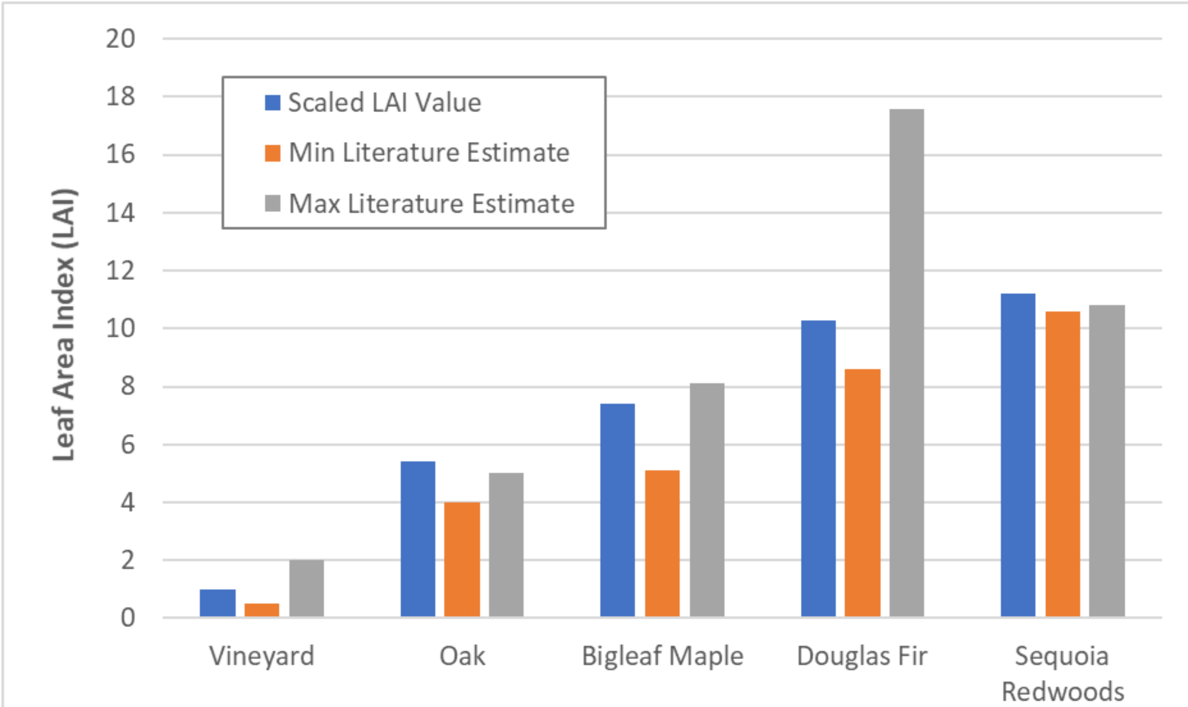


Figure 11: Comparison between scaled LAI values used in the MWC hydrologic model and estimates from the literature for various vegetation types.

Land Cover Adjustments for the Tubbs Fire

As discussed at the beginning of this chapter, we developed a second version of the model incorporating the short-term effects of the Tubbs Fire to facilitate calibrating the model to post-fire streamflow data collected within the burn area at Michelle Way. The canopy-damage raster dataset generated by SCAPOSD (Green & Tuckman, 2018) and Soil Burn Severity dataset generated by the U.S. Forest Service (USFS, 2018) were used to identify the portions of the watershed where we judged that the fire was severe enough to result in significant short-term changes in evapotranspiration. These areas included forested lands where canopy damage was >80% and non-forested lands where soil burn severity was classified as moderate or severe (Figure 12). The delineated area of hydrologically-significant vegetation damage is about 18% of the upper MWC watershed evaluated in this study and approximately 42% of the total identified burn area.

Post-fire vegetation data or Leaf Area Index (LAI) mapping is not available, therefore a simple means of adjusting vegetation parameters was employed for the subset of the burn area judged to have hydrologically significant fire damage. The vegetation in the burn area was assumed to have LAI and rooting depth properties mid-way between the original cover type (undisturbed) and grasslands (full conversion). This simple representation is intended to approximate the short-term effects (1-2 yrs) of the fire on evapotranspiration but is not intended to reflect long-term landscape recovery. A CalFire parcel-based shapefile identifying burned structures was used to identify wells and surface water diversions within the burn area to turn off in the model.

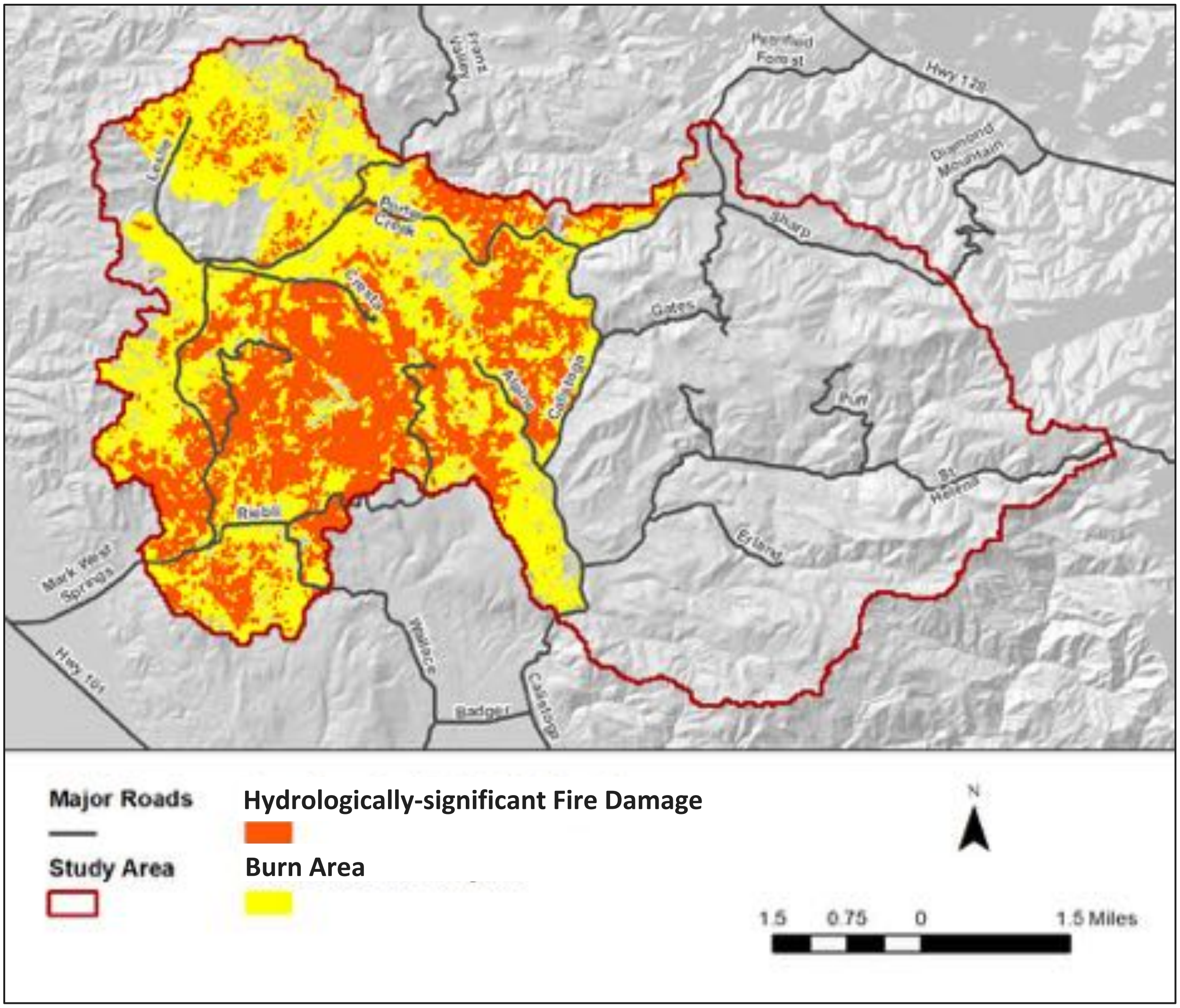


Figure 12: Footprint of the 2017 Tubbs Fire and the severely burned portion of the burn area where vegetation properties were adjusted in the MWC hydrologic model to reflect the fire for the purposes of model calibration.

Short-term fire effects on overland roughness and detention storage or soil hydraulic conductivities were not considered.

The version of the model with these adjustments to land cover values was used for model calibration only. The pre-fire representation of cover was retained for model simulations of existing conditions and scenario evaluations since the long-term effects of the fire on vegetation patterns are unknown and future vegetation is expected to resemble pre-fire conditions more so than immediate post-fire conditions.

Surface Water

Channelized flows are represented using a detailed stream network derived from the 3-foot resolution Sonoma County LiDAR dataset (WSI, 2016). This network includes all major perennial streams and many smaller tributaries as well as all major on-stream ponds. Off-channel ponds, some intermittent streams, and ephemeral tributaries are not explicitly represented in the stream network. In total, 79 river miles of stream and 18 on-stream ponds are included and represented by approximately 3,300 cross-sections in the surface water hydraulics component of the model.

Streams

The stream network includes all channels with a drainage area of more than 0.2 mi^2 and a stream length of at least 500 feet. These limits were designed to maximize the extent of the channel network within the limits of the ability of the LiDAR data to accurately represent channel geometry and to avoid excess computational burden. These thresholds allow for inclusion of all perennial streams and all reaches with slope characteristics (<7%) indicative of potential salmonid habitat suitability. In a limited number of cases, channels were extended to include on-stream ponds. Additionally, three channels with drainage areas of less than 0.2 mi^2 were included based on the presence of perennial summer baseflow as observed during stream surveys performed August 27th through August 29th, 2018 by OEI and CDFW staff.

The stream network was derived from the 3-foot Sonoma County LiDAR dataset by computing flow directions and flow accumulations using standard ArcGIS techniques. Channel-cross sections were extracted from the LiDAR DEM at 100-ft intervals for major channels and those known to contain salmonids, including Mark West, Alpine, Humbug, Leslie, Mill, Porter, Riebli, Van Buren, and Weeks Creeks. For the remaining channels, cross-sections were extracted at 200-ft intervals.

Prior to defining the stream network and extracting cross sections, a series of cross sections were surveyed in the field and compared to LiDAR-derived cross sections at various drainage areas and locations throughout the watershed. These comparisons revealed that the LiDAR dataset represents the channel geometry with acceptable accuracy at drainage areas above about 0.2 mi^2. In some cases, accuracy was reasonably high in smaller drainage areas; however, when smaller streams were incised relatively deeply the LiDAR did not capture the details of the channel geometry in sufficient detail for hydraulic modeling. Examples comparing survey- and LiDAR-derived cross sections with accuracy judged to be acceptable for purposes of hydraulic simulation in the model are shown in Figure 14.

A uniform Manning's Roughness coefficient (n) of 0.055, representative of rocky channels with brush along the banks (Chow, 1959), was applied to all cross-sections. A downstream boundary condition was defined as a rating curve established using normal depth calculations for the downstream-most cross section in the model. Because all inflows are generated by other spatially distributed components of the MIKE SHE model, upstream boundary conditions are zero-discharge inflows.

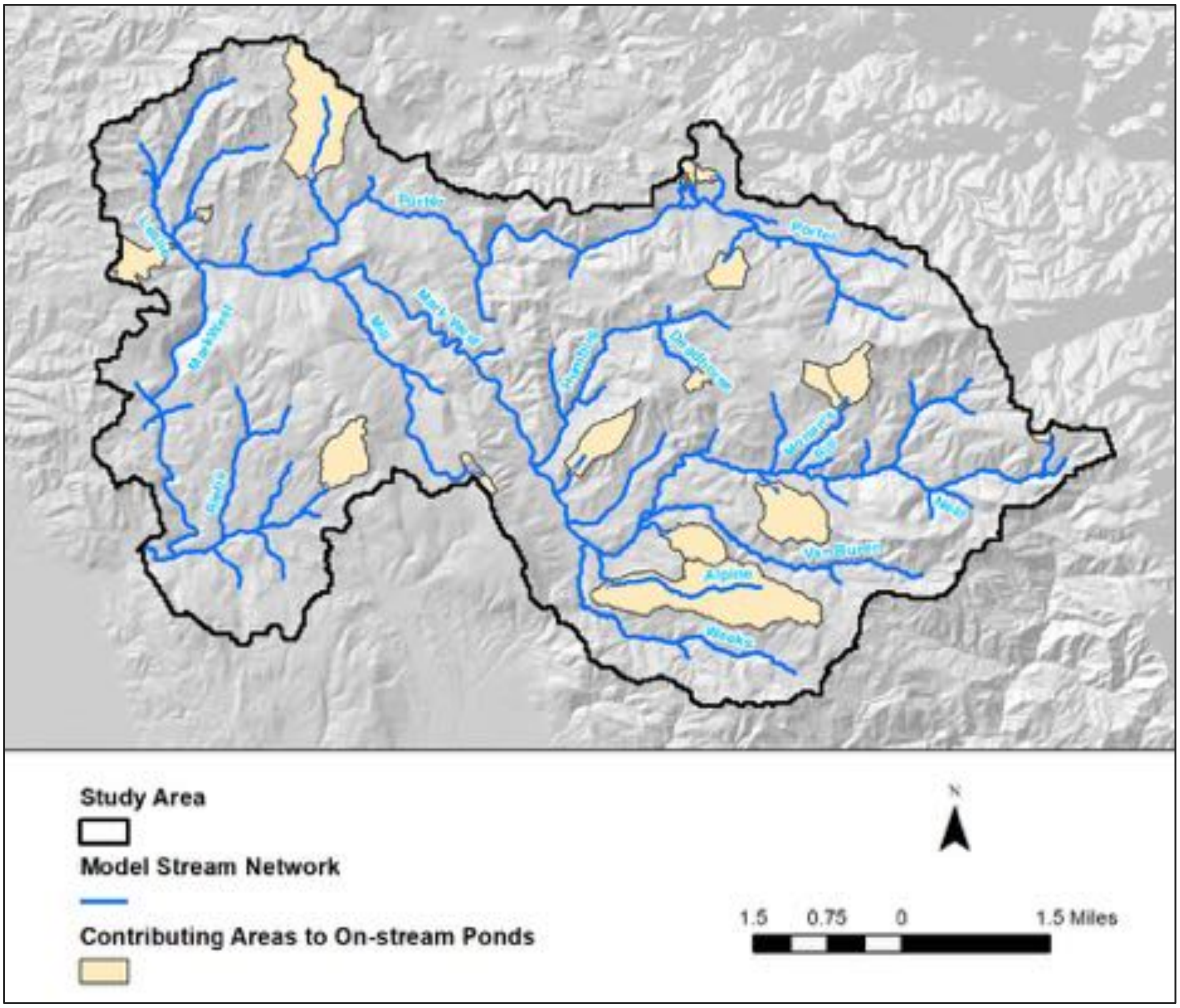


Figure 13: Stream network and on-stream ponds included in the MWC hydrologic model.

Ponds

Within the model domain, approximately 80 ponds have been identified using the 3-foot Sonoma County LiDAR DEM and aerial photography. The majority of these are small off-stream ponds which were not explicitly included in the surface water component of the model. Thirteen on-stream ponds with significant (>0.2 mi^2) contributing areas were included in the model along with five ponds with smaller contributing areas but significant reported water uses.

A stage-storage relationship for each of the 18 ponds included in the model was derived from the 3-foot Sonoma County LiDAR DEM. These data were collected in autumn 2013 and observed water surface elevations are assumed to reflect typical end-of-season storage levels in each pond. The stage-storage relationship for a given pond was associated with cross sections at the upstream and downstream edges of the pond, and cross sections were added at the pond's spillway. Water in the ponds is not explicitly represented in the model grid therefore evaporation

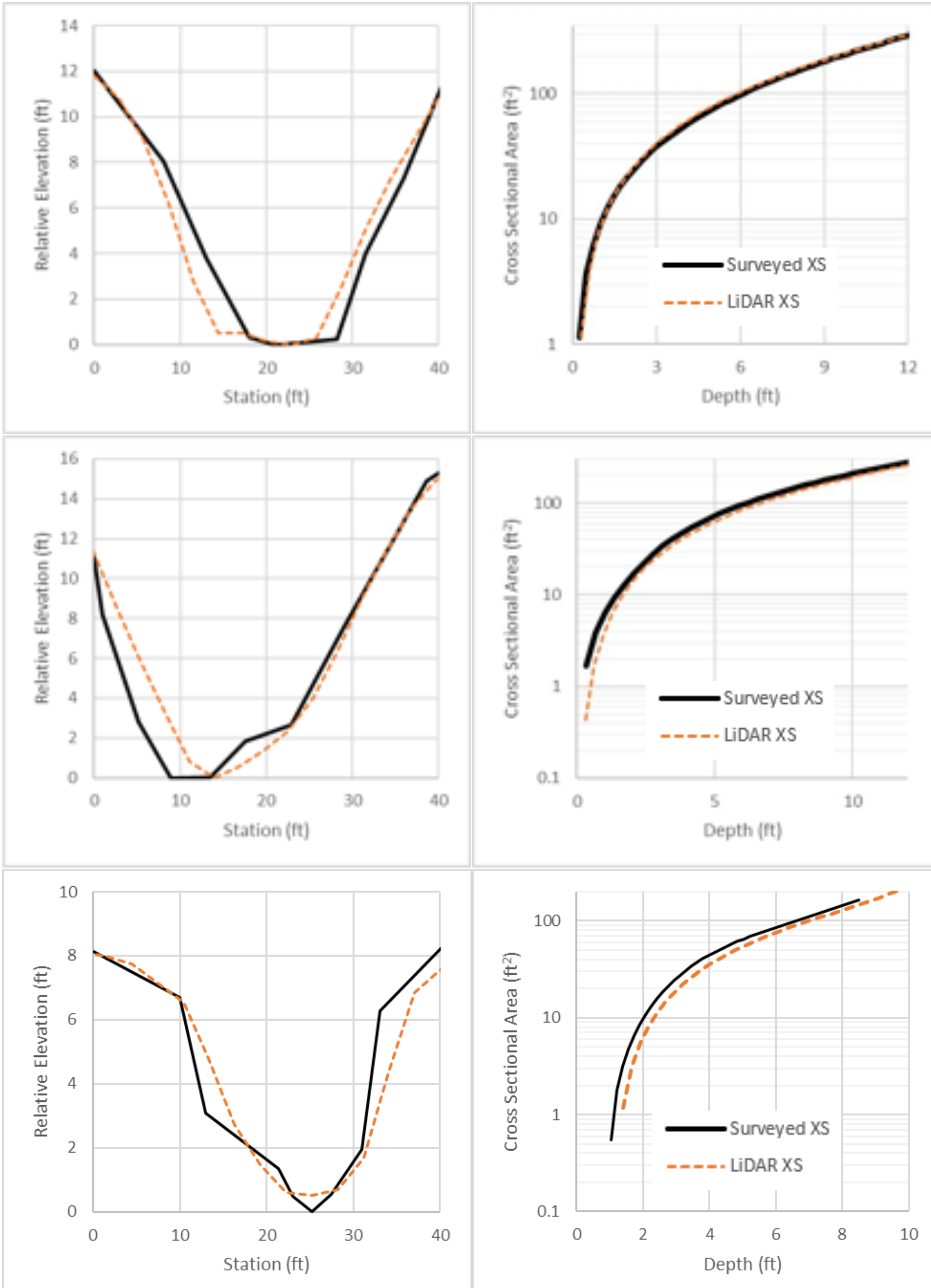


Figure 14: Comparisons between survey- and LiDAR-derived channel cross sections and corresponding depth/area relationships for an unnamed tributary to Mark West Creek with a 0.3 mi² drainage area (top), upper Mark West Creek with a 0.5 mi² drainage area (middle), and upper Porter Creek with a 2.0 mi² drainage area (bottom).

from each pond was included as a surface water boundary condition based on the surface area of the pond and the daily PET data described above.

Soils

The model domain is discretized into 23 different soil zones based on the National Resource Conservation Service's (NRCS) Soil survey Geographic Database (SSURGO) accessed through the Web Soil Survey (WSS). Where reported soil types are similar or where they represent a small portion of the model domain, they are grouped with other similar soil types.

Most soils in the model domain are loams and clay loams. The distribution of soil textures appears to be correlated with underlying geology. Loam soils generally occur in areas underlain by the Sonoma Volcanics and clay loam soils occur in areas underlain by the Franciscan Complex. A major divide in soil types is formed by the Maacama Fault Zone which runs through the central

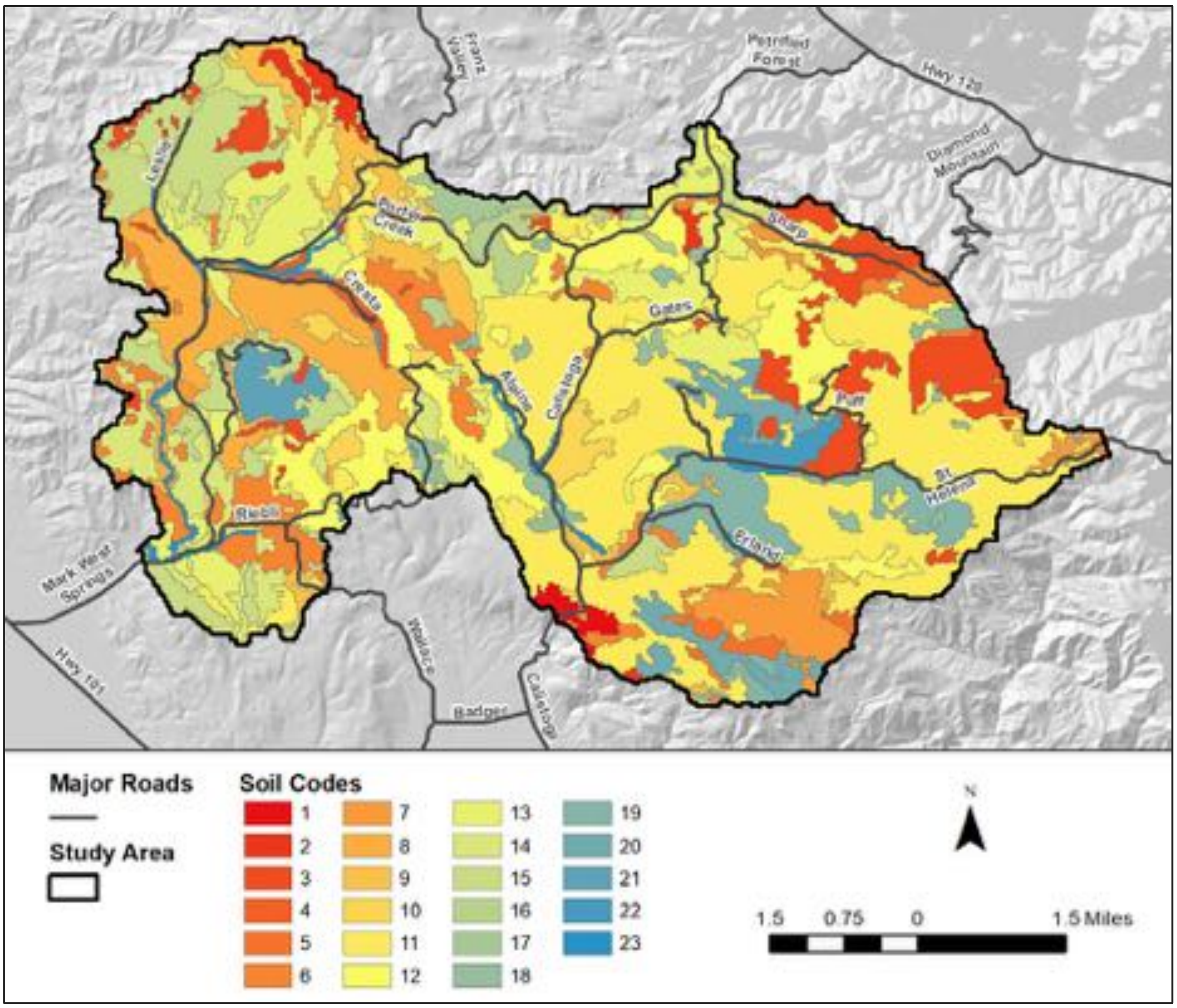


Figure 15: Soil codes used in the MWC hydrologic model (see Table 3 for associated property values).

portion of the study area intersecting Mark West Creek near the confluence with Porter Creek. Downstream of the confluence, the model domain is dominated by NRCS Hydrologic Soil Group B and C soils including the Felta Very Gravelly Loam, Laniger Loam, and Red Hill Clay Loam. Upstream of the confluence, the model domain is dominated by Group D and some Group C soils including the Boomer Loam, Goulding Clay Loam, Henneke Gravelly Loam, and Laniger Loam. Group B soils are relatively well-drained and can absorb and transmit water at relatively high rates whereas Group D soils absorb and transmit water very slowly and thus generate high runoff rates. Group C soils have hydrologic properties intermediate between B and D soils. Group A soils do not occur in the study area.

Initial estimates of the saturated hydraulic conductivity and the moisture contents at saturation, field capacity, and the wilting point for each of these soil types were derived from the physical properties report in the SSURGO database and final values have been determined through model calibration. For each zone, saturated hydraulic conductivity was initially estimated using the rate

Table 3: Final calibrated values of soil moisture contents at saturation, field capacity, and wilting point, and saturated hydraulic conductivities used in the MWC hydrologic model.

Soil Code	θsat	θfc	θwp	Ksat (ft/day)
1	0.485	0.366	0.191	0.001
2	0.483	0.220	0.175	0.001
3	0.472	0.216	0.114	0.002
4	0.464	0.271	0.150	0.002
5	0.453	0.161	0.058	0.002
6	0.458	0.301	0.157	0.003
7	0.468	0.195	0.105	0.004
8	0.457	0.304	0.135	0.006
9	0.502	0.342	0.173	0.006
10	0.453	0.270	0.125	0.007
11	0.461	0.195	0.097	0.011
12	0.460	0.224	0.109	0.011
13	0.463	0.235	0.073	0.011
14	0.468	0.103	0.056	0.011
15	0.468	0.139	0.076	0.011
16	0.483	0.232	0.071	0.013
17	0.463	0.186	0.075	0.013
18	0.423	0.246	0.145	0.014
19	0.479	0.254	0.120	0.026
20	0.457	0.280	0.132	0.026
21	0.498	0.350	0.177	0.050
22	0.463	0.168	0.049	0.079
23	0.377	0.019	0.002	0.116

reported for the most limiting layer of each soil. Initial values for water content at field capacity and wilting point were estimated using the weighted average for all horizons within each zone. Saturated water content is not reported by SSURGO and initial values were estimated using the reported average bulk density for each zone and an assumed soil particle density of 2.65 g/cm^3.

The initial values for soil moisture contents were not adjusted significantly. Excluding the alluvial soils which have significantly different properties, soil moisture content at saturation, field capacity, and the wilting point ranged from 0.42 to 0.50, 0.10 to 0.37, and 0.05 to 0.19 respectively. Successful calibration required significantly lower Ksat values relative to the SSURGO estimates. This can be attributed to the model's simplified 2-layer water balance approach which does not account for variations in Ksat as a function of soil moisture, and thus typically requires lower Ksat values to represent overall infiltration dynamics. Additionally, the unsaturated zone in much of the watershed is relatively thick and comprised of soil strata plus underlying weathered and unweathered bedrock, therefore this parameter reflects an average Ksat value for the full unsaturated zone derived from calibration rather than a true soil property. The calibrated saturated hydraulic conductivity values ranged from 0.01 ft/day for clay soils to 0.12 ft/day for alluvial soils (Table 3).

Interflow

As described in Chapter 3, interflow is represented in the model with a saturated zone drainage function. Drain levels and time constants were derived through calibration and primarily influence the springtime flow recession. A time-varying drain level tied to precipitation patterns was required to adequately reproduce the springtime flow recession. A spatially uniform drain level of 20-ft below land surface was used to activate the drainage process during and following

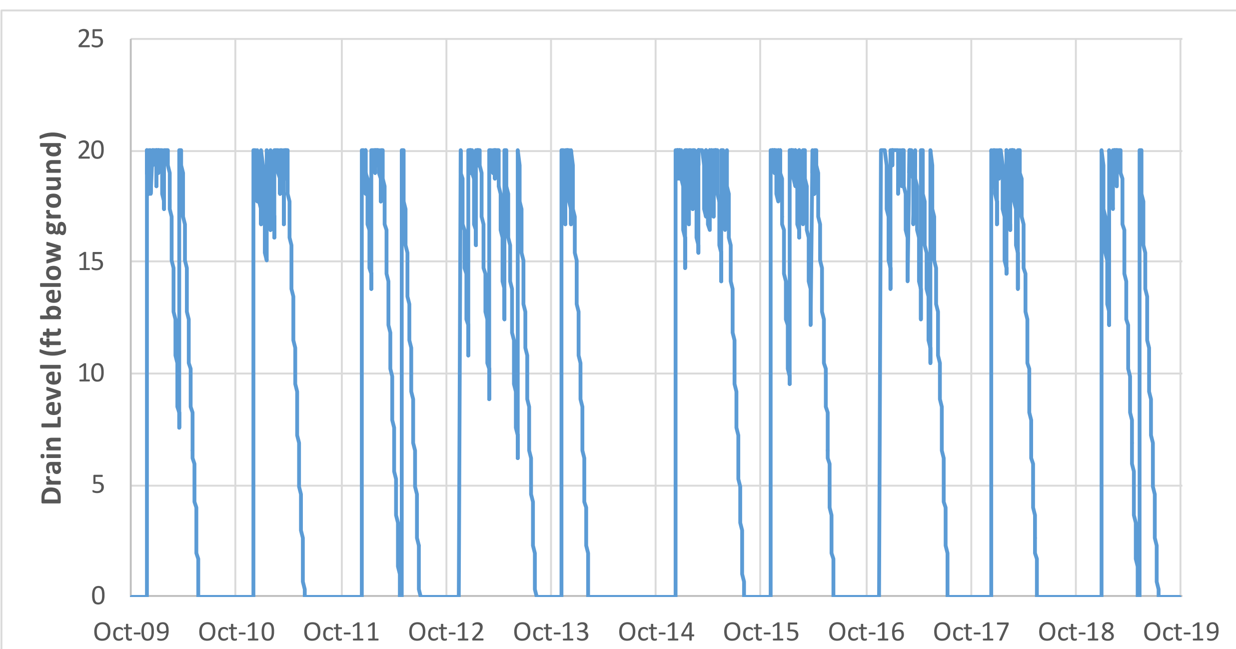


Figure 16: Timeseries of drain levels used to represent interflow in the MWC hydrologic model.

significant precipitation events (defined here as >0.2 in/day). On the third consecutive day with no significant precipitation, drain levels were decreased towards zero at a uniform rate of 0.33 ft/day until a subsequent precipitation event triggered levels to be reset to 20-ft. To account for the delay in the onset of interflow due to low antecedent soil moisture at the beginning of each wet season, drainage was only activated when 2.5 inches of precipitation had fallen over the preceding 21 days (Figure 16).

Hydrogeology

Model Discretization and Boundary Conditions

The geology in the MWC watershed is complex and much of the watershed is characterized by alternating layers of more permeable tuffaceous materials and less permeable basalt and andesite of the Sonoma Volcanics. These layers have varying extents and thicknesses and in some areas are mantled by younger rocks of the Glen Ellen Formation and/or Quaternary Alluvium. As described in detail below, substantial subsurface information could be gleaned from available geologic logs included in Well Completion Reports (WCRs) and aquifer test data obtained from pump test data collected as part of Sonoma County's regulatory requirements for development in water-scarce areas that culminate in Well Yield Certification (WYC).

Despite the available data, it was not possible to accurately delineate individual layers or lenses of geologic materials to use in developing the vertical discretization of the model layers. Given this complexity, we discretized the model into six layers, with layer elevations defined relative to the surface topography. Layers 1-5 generally having a uniform 100-ft thickness and Layer 6 has a uniform 300-ft thickness for a total thickness of 800-ft. The only variation in layer thickness is associated with the alluvium where Layer 1 ranges in thickness from 25- to 50-ft and gradually increases to 100-ft outside of the alluvial body. Where Layer 1 thickness is less than 100-ft, Layer 2 thickness is correspondingly greater than 100-ft such that the base of Layer 2 is 200-ft below land surface (Figure 17 & Table 4).

The base of Layer 6 is defined as a no flow boundary as are the lateral boundaries around the model domain. Available groundwater elevation data is very limited and insufficient for characterizing any groundwater inflows/outflows that may occur across the watershed boundaries. In most areas the no flow boundary assumption (equivalent to assuming a groundwater divide occurs coincident with surface topography) is likely reasonably accurate, however some groundwater outflow likely occurs along portions of the south and southwest watershed divides where more permeable units of the Sonoma Volcanics may contribute flow to alluvial materials in the Santa Rosa Plain down-gradient from our study area. We did not attempt to quantify this component of the groundwater budget as part of our analysis owing to a lack of available data and our focus on processes within the upper watershed.

With the exception of pumping wells which are described in the Water Use section below, all other saturated zone boundary conditions such as infiltration recharge, ET from groundwater, and stream/aquifer interactions are calculated internally by the model through the coupling to other components of the model rather than specified as model inputs.

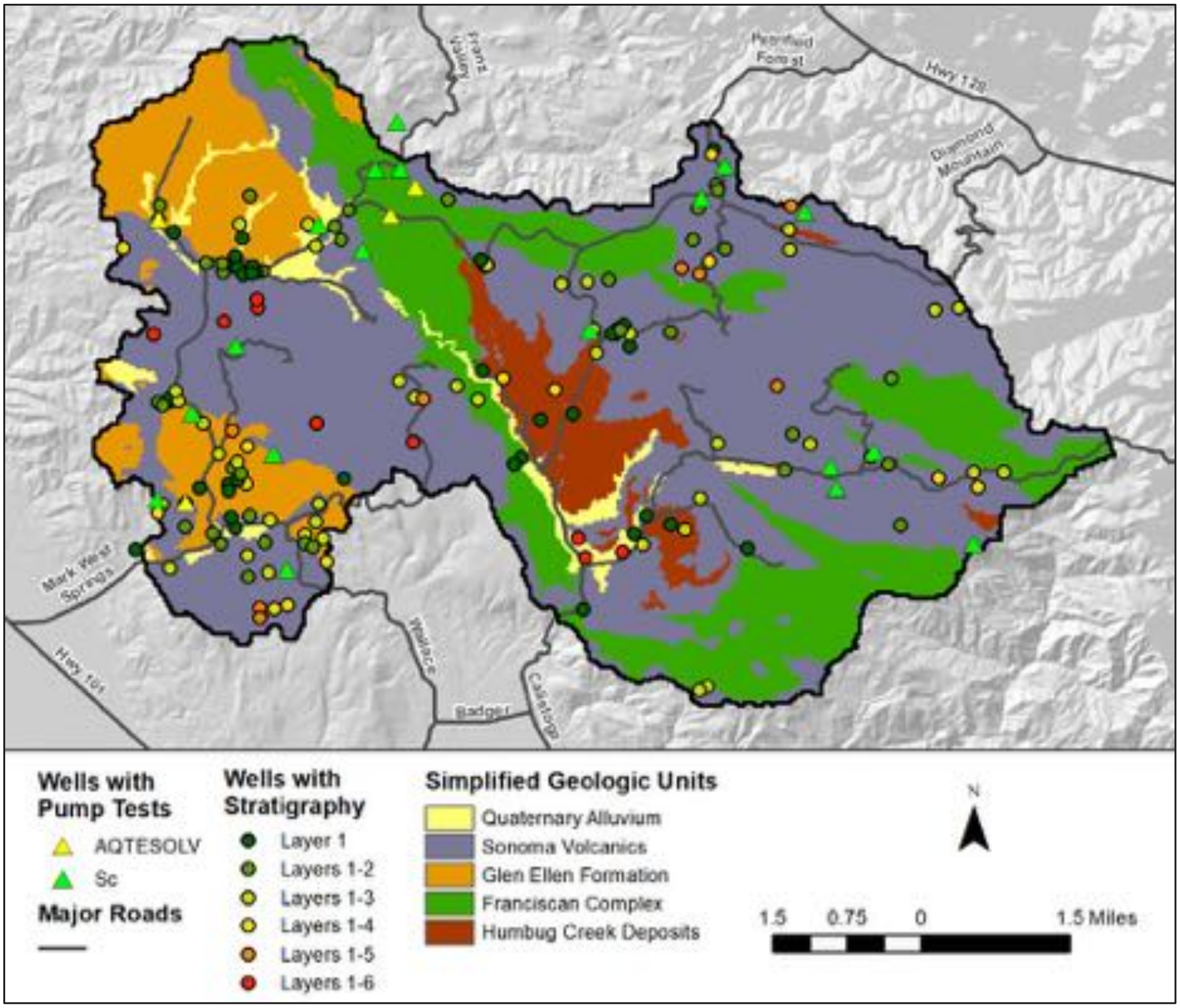


Figure 17: Simplified geologic map and locations of wells where pump test data was available and locations of wells where stratigraphic data was available.

Table 4: Layer thicknesses used in the groundwater component of the MWC hydrologic model.

Layer	Thickness (ft)
1	25 - 100
2	100 - 175
3	100
4	100
5	100
6	300

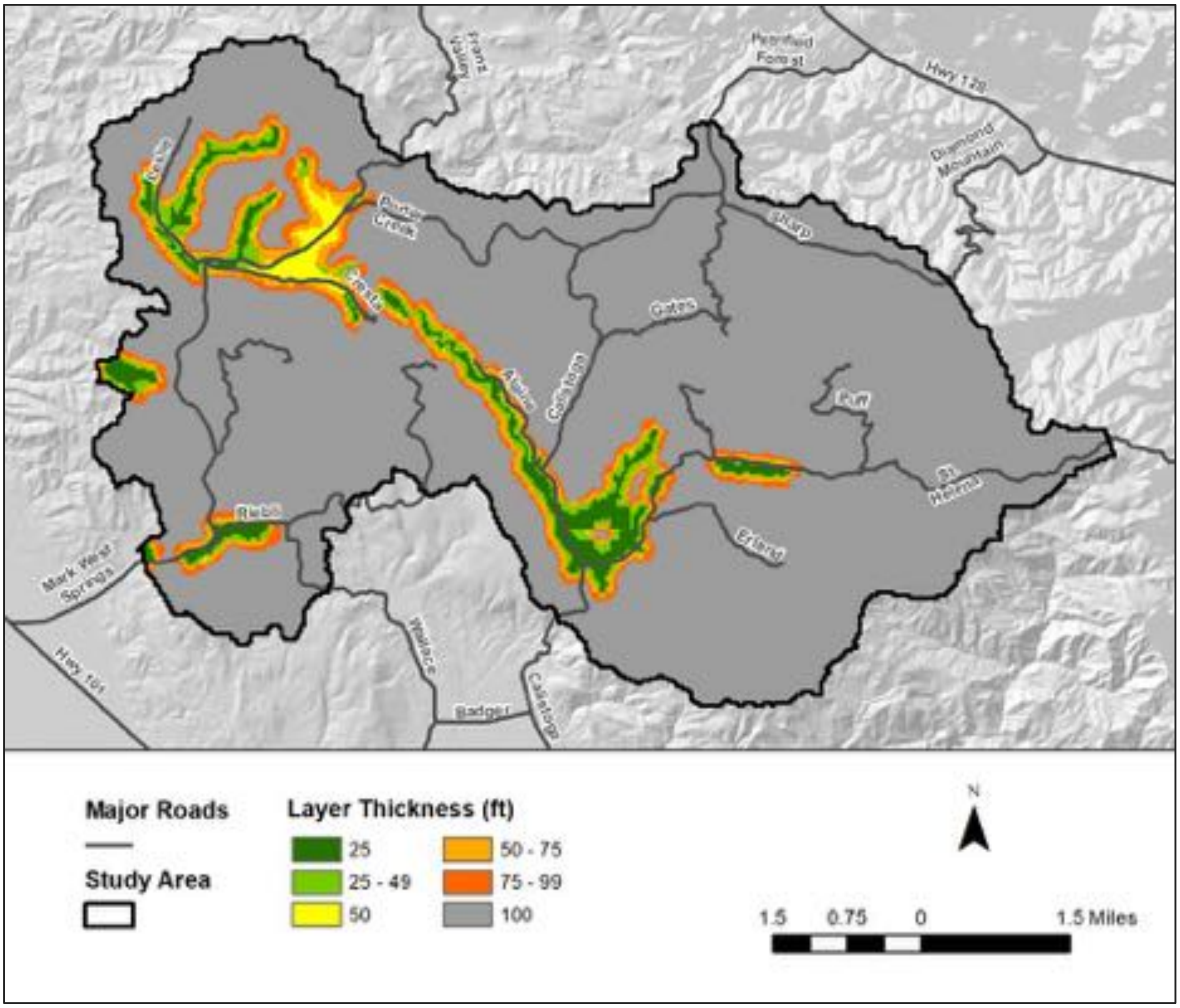


Figure 18: Thickness of groundwater model Layer 1.

Despite the available data, it was not possible to accurately delineate individual layers or lenses of geologic materials to use in developing the vertical discretization of the model layers. Given this complexity, we discretized the model into six layers, with layer elevations defined relative to the surface topography. Layers 1-5 generally having a uniform 100-ft thickness and Layer 6 has a uniform 300-ft thickness for a total thickness of 800-ft. The only variation in layer thickness is associated with the alluvium where Layer 1 ranges in thickness from 25- to 50-ft and gradually increases to 100-ft outside of the alluvial body. Where Layer 1 thickness is less than 100-ft, Layer 2 thickness is correspondingly greater than 100-ft such that the base of Layer 2 is 200-ft below land surface (Figure 18; Table 4).

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With the exception of pumping wells which are described in the Water Use section below, all other saturated zone boundary conditions such as infiltration recharge, ET from groundwater, and stream/aquifer interactions are calculated internally by the model through the coupling to other components of the model rather than specified as model inputs.

Distribution and Description of Geologic Materials

WCRs were obtained for more than 350 wells in the watershed and a subset of these had both detailed descriptions of geologic materials as a function of depth (geologic logs contained in WCRs) to provide useful stratigraphic information and reliable location information to associate the well with a parcel or a specific location. Geologic contacts (vertical boundaries between significantly different rock types) were identified in the logs depending on the geologic materials intersected.

Sonoma Volcanics

Most geologic logs from wells in the Sonoma Volcanics (SV) identify alternating layers of tuffaceous material and other volcanic rocks with andesite being the dominant material in the eastern portion of the watershed and basalt in the western portion. Contacts between tuffaceous materials and other volcanic rocks were delineated where a relatively clear interpretation could be made from the geologic log. Approximately 148 wells provided stratigraphic information within the SV (Figure 17). Within each 100-ft to 300-ft thick model layer interval penetrated by a given well, the geologic materials were classified as predominately (>80% of a given interval) tuffaceous material, predominately basalt or andesite, a combination of materials (<80% of either material), or underlying Franciscan Formation. In most portions of the watershed rocks of the SV extend through the full 800-ft sequence represented in the model. The interpretation becomes less certain with increasing depth from Layer 1 through Layer 6 as the number of wells penetrating a given interval decreases from 148 in Layer 1 to 74 in Layer 3 to just 9 wells in Layer 6 (Figure 17).

Glen Ellen Formation

In and near the Leslie and Riebli Creek subwatersheds, the contact between the Glen Ellen Formation and the underlying Sonoma Volcanics was delineated at 15 wells (Figure 17). These wells revealed that the Glen Ellen Formation ranges in thickness from approximately 130-ft in the upper Leslie Creek watershed to less than 50-ft in the lower watershed and in the Riebli Creek watershed exposure. Static water levels reported in these WCRs revealed that the formation is generally unsaturated and that all the wells are screened predominately in the underlying

Sonoma Volcanics where groundwater is available. The Leslie Creek watershed exposure is much coarser than the materials in Riebli Creek with the former typically described as sand and gravel or sandstone, and the latter typically described as clay or sandy clay. The spatial extent of the available data is insufficient for interpolating an isopach map, therefore a highly simplified representation of the Glen Ellen thickness was developed based on the available information. The Glen Ellen is only present in Layer 1 where we assumed 50-ft thickness in the Riebli Creek and lower portions of the Leslie Creek exposures and 100-ft thickness in the portions of the Leslie Creek exposure above 700-ft in elevation.

Franciscan Complex and Great Valley Sequence

A contact between the Sonoma Volcanics and the underlying rocks of the Franciscan Complex was delineated in a few wells located in the vicinity of the surficial contact between the units. The orientation of these contacts is unknown and the model generally assumes a vertical contact between these materials that extends across the full 800-ft thickness of the model consistent with the deepest available geologic logs which show both of these materials extending to considerable depth. Although hydrogeologic properties may vary substantially within the Franciscan, these variations are expected to depend upon the degree and interconnectivity of fracturing which cannot be characterized from the available data. Owing to the lack of data and the typically low permeability of the Franciscan relative to other geologic materials in the watershed, this unit was assigned uniform hydrogeologic properties. No available wells were located within the exposures of Great Valley Sequence materials in the watershed, consistent with the general experience in the region indicating that that this geologic unit provides poor aquifer material. These materials account for only a small portion of the study area and were treated as equivalent to the Franciscan Complex.

Quaternary Alluvium

A total of 35 WCRs were located within alluvial materials in the watershed (Figure 17). Water level data from the WCRs indicate that the alluvium is unsaturated at about half of these well locations and generally thin (< 25-ft at 22 of the 35 wells), only exceeding 50-ft in the vicinity of the Porter Creek/Mark West Creek confluence where the maximum reported thickness was 60-ft. The alluvium does not appear to be a significant source of water to wells and all of the wells are screened predominately within the underlying geologic materials where groundwater is available. The available geologic logs indicate the alluvium consists of primarily sand, gravel, and boulders with lesser quantities of clay and sandy clay.

The spatial extent of the data is insufficient for interpolating an isopach map, therefore a simplified representation of alluvium thickness was developed based on the available information. Using available surficial geologic mapping, topographic expressions interpreted from LiDAR data, and the subsurface thicknesses as described in WCRs, we reduced the extent of alluvium so as to exclude areas where thicknesses are too small to represent in the model. The alluvium falls entirely within Layer 1, and for most of the revised alluvium extent we assumed a 25-ft thickness, except for the area upstream of the confluence of Mark West and Porter Creeks where we assumed a 50-ft thickness (see Figure 17 for extent & Figure 18 for thickness).

Humbug Creek Lacustrine Deposits

Only a few of the available wells penetrated the Humbug Creek Lacustrine Deposits. They indicate that this material is generally around 25-ft thick and very fine-grained. It is typically described as clay and is generally unsaturated with wells screened in underlying geologic materials. We represented this material in model Layer 1 and assumed a uniform 25-ft thickness based on the extent of the mapped surface exposure.

Aquifer Properties

Hydraulic Conductivity Values

We compiled available pump test data from Well Yield Certifications obtained from the County of Sonoma. A subset of four tests was selected for aquifer analysis based on those tests where 1) the well completion details were known, 2) the test was performed for at least eight hours with a relatively constant pumping rate, 3) drawdowns and pumping rates were reported frequently enough to generate a detailed time-drawdown curve, and 4) the drawdown had stabilized by the end of the test (Figure 17). For the four tests meeting all criteria, the time drawdown data was analyzed using AQTESOLV software and a type-curve matching approach was used to derive estimates of the aquifer Transmissivity (T). The Storage Coefficient (S) cannot be estimated from single-well test data, therefore we solved for T using a range of reasonable estimates of S from the literature and from our previous experience evaluating aquifer test data in similar geologic materials in the region. Depending on the aquifer conditions and drawdown responses, a variety of solutions were used including radial solutions such as the Theis and Cooper-Jacob solutions (Theis, 1935; Cooper & Jacob, 1946), as well dual-porosity solutions such as the Moench slab blocks solution (Moench, 1984). Where more than one solution provided an equally valid description of the data, final T values used in the model were derived by averaging the estimates from the individual solutions.

An additional 19 tests also met the afore-mentioned criteria with the exception of the time-drawdown data which was not detailed enough for type-curve matching to drawdown data (Figure 17). For these tests, the Specific Capacity (Sc) was calculated and used to estimate T using an empirical relationship (Driscoll, 1986). We found good agreement between the T values estimated in AQTESOLV and the T values derived empirically using Sc suggesting that the simplified Sc-based approach is capable of providing reasonable estimates of T (Table 5). The dual-porosity solutions yield an estimate of the Hydraulic Conductivity (K) directly, and T values from the radial solutions were converted to K estimates using the aquifer thickness as derived from the test data and well completion details (Table 6).

We grouped the test data into five categories based on the dominant lithology as interpreted from available WCRs. Test data were classified as representative of Franciscan Complex or one of four categories within in the Sonoma Volcanics: predominately tuff, predominately basalt, predominately andesite, or a mixture of tuffaceous and other volcanics. There are obvious contrasts in well completion details and responses to pumping between the various lithologies with shallower wells (mean of 158-ft) and limited drawdowns (mean of 1.7-ft) within the tuff and deeper wells (mean of 387-ft) and larger drawdowns (mean of 9.9-ft for basalt and 48-ft for andesite) in the hard rock volcanics. Wells in the Franciscan Complex were also generally deeper (mean of 331-ft) and experienced much larger drawdowns (mean of 214-ft) (Table 6).

We calculated the geometric mean of the K estimates for the Sonoma Volcanics for each lithologic category and found that K values varied by nearly two orders of magnitude between the various volcanic materials. The highest value, 23 ft/day, was found for the tuff, followed by the mixed volcanics (3.7 ft/day), and the basalt (0.94 ft/day) and andesite (0.37 ft/day). In the Franciscan Complex, K values were an order of magnitude lower than the andesite (geometric mean of 0.029 ft/day) (Table 6).

No pump test data was available for wells screened entirely within the Glen Ellen Formation, the Humbug Creek Lacustrine Deposits, or the Quaternary Alluvium. This is not surprising given that our analysis showed that few if any wells are completed in these materials which are generally thin and often unsaturated. We relied on descriptions of the geologic materials as described in geologic logs on available WCRs to estimate K values for these materials from literature values (Domenico & Schwartz, 1990). Our initial estimates of K for the coarse-grained northern exposure of the Glen Ellen Formation was 30 ft/day and 0.038 ft/day for the fine-grained southern exposure and for the Humbug Creek deposits. Initial estimates for the alluvium were 30 ft/day in most of the study area and 120 ft/day for the thicker alluvial body delineated upstream of the confluence of Mark West and Porter Creek.

As described in Chapter 5, the initial K estimates were adjusted within reasonable limits to obtain a good fit between measured and simulated potentiometric surface elevations measured at monitored wells and baseflows as described from stream gauge data. Within the Sonoma Volcanics, values were adjusted using a uniform scaling factor in order to maintain the degree of contrast between materials as described from the pump test analyses. The final calibrated values are ~3.8% of the original estimates within the Sonoma Volcanics, the Glen Ellen Formation, and the Humbug Creek deposits. Final values for the Franciscan are ~3.2% of the original estimates, and final values for the alluvium were left unchanged (Table 7). The differences between the original and final values are generally within an order of magnitude of the range of estimates from individual pump tests. These differences are significant but also relatively modest considering that K varies by at least six orders of magnitude in the various materials in Sonoma County and that K estimates for individual pump tests evaluated in this project vary by more than four orders of magnitude. It is plausible that values derived from pump tests over-estimate bulk K values for the large sequences of geologic materials represented by the model layers since most drillers of production wells seek to preferentially screen wells within tuffaceous or highly fractured bedrock intervals to maximize well production and efficiency. Anisotropy in the form of the ratio between horizontal and vertical K was derived through calibration, and the final value was 94 in all units except the alluvium which was parameterized as isotropic.

Specific Yield and Storage Coefficient Values

Previous estimates of the Specific Yield (Sy) for the Sonoma Volcanics range from less than 0.01 to 0.05 and estimates for the Glen Ellen Formation range from 0.03 to 0.20 (Cardwell, 1958; Herbst et al. 1982). Our final calibrated value for Sy in the Sonoma Volcanics was 0.05, and we

Table 5: Comparison of estimates of Transmissivity (T) derived from pump test data analyzed in AQTESOLV and calculated based on the Specific Capacity (Sc).

Material	AQTESOLV T (ft^2/day)	Sc Derived T (ft^2/day)
Sonoma Volcanics	350	710
Sonoma Volcanics	930	1200
Franciscan Complex	1.2	4.9
Franciscan Complex	16	11

Table 6: Pump test and well completion details and estimates of aquifer Hydraulic Conductivity (ft/day).

	Well Depth (ft)	Drawdown (ft)	Test Length (min)	Average Pumping Rate (gpm)	Aquifer Thickness (ft)	Sc (gpm/ft)	K (ft/day)	Source
Sonoma Volcanics Tuff	100	1.7	480	11.4	118	6.7	15	Sc
	150	2.0	480	17.0	138	8.5	16	Sc
	260	2.0	510	25.3	177	13	19	Sc
	70	1.8	480	10.7	61	5.9	26	Sc
	210	1.1	480	14.2	70	13	49	Sc
	158	**1.7**	**486**	**15.7**	**113**	**9.3**	**23**	
Sonoma Volcanics Basalt	807	6.0	510	4.0	177	0.67	1.0	Sc
	420	13.0	480	11.6	215	0.89	1.1	Sc
	200	10.8	500	13.7	140	1.3	2.4	Sc
	476	**9.9**	**497**	**9.8**	**177**	**0.94**	**1.4**	
Sonoma Volcanics Andesite	320	86.0	510	5.0	144	0.06	0.11	Sc
	460	49.0	600	5.0	209	0.10	0.13	Sc
	420	47.0	480	45.3	386	1.0	0.67	Sc
	80	10.0	1440	3.5	91	0.35	1.0	Sc
	320	**48.0**	**758**	**14.7**	**208**	**0.37**	**0.31**	
Sonoma Volcanics Undifferentiated	260	20.0	1530	7.5	91	0.38	1.1	Sc
	220	8.0	1230	21.2	229	2.6	1.5	AQTESOLV
	320	25.0	720	30.0	143	1.2	2.2	Sc
	200	4.8	540	8.9	181	1.9	2.7	Sc
	305	2.0	540	4.4	79	2.2	7.4	Sc
	380	2.0	520	6.5	95	3.3	9.2	Sc
	76	3.3	730	14.7	65	4.4	14	AQTESOLV
	252	**9.3**	**830**	**13.3**	**126**	**2.3**	**3.7**	
Franciscan Complex	540	428.0	720	7.8	614	0.018	0.0019	AQTESOLV
	280	175.0	480	6.0	270	0.034	0.034	Sc
	245	209.9	875	8.3	296	0.040	0.054	AQTESOLV
	260	40.9	510	4.4	152	0.11	0.189	Sc
	331	**213.5**	**646**	**6.6**	**333**	**0.050**	**0.029**	

Table 7: Final hydrogeologic properties used in the calibrated MWC hydrologic model.

Material	Present in Layers	Kh (ft/day)	Kh/Kv	Sy	S (ft^{-1})
Sonoma Volcanics	1 to 6	0.0082 - 0.60	94	0.05	2.0E-04
Franciscan	1 to 6	0.00090	94	0.10	1.1E-05
Glen Ellen	1 to 2	0.0010 - 0.79	94	0.04 - 0.20	1.0E-04 - 5.4E-04
Humbug Creek	1	0.001	94	0.04	5.4E-04
Alluvium	1	30 - 120	1	0.30	1.5E-04

Table 8: Range and average Hydraulic Conductivity (K) values for the Sonoma Volcanics in model Layers 1 through 6.

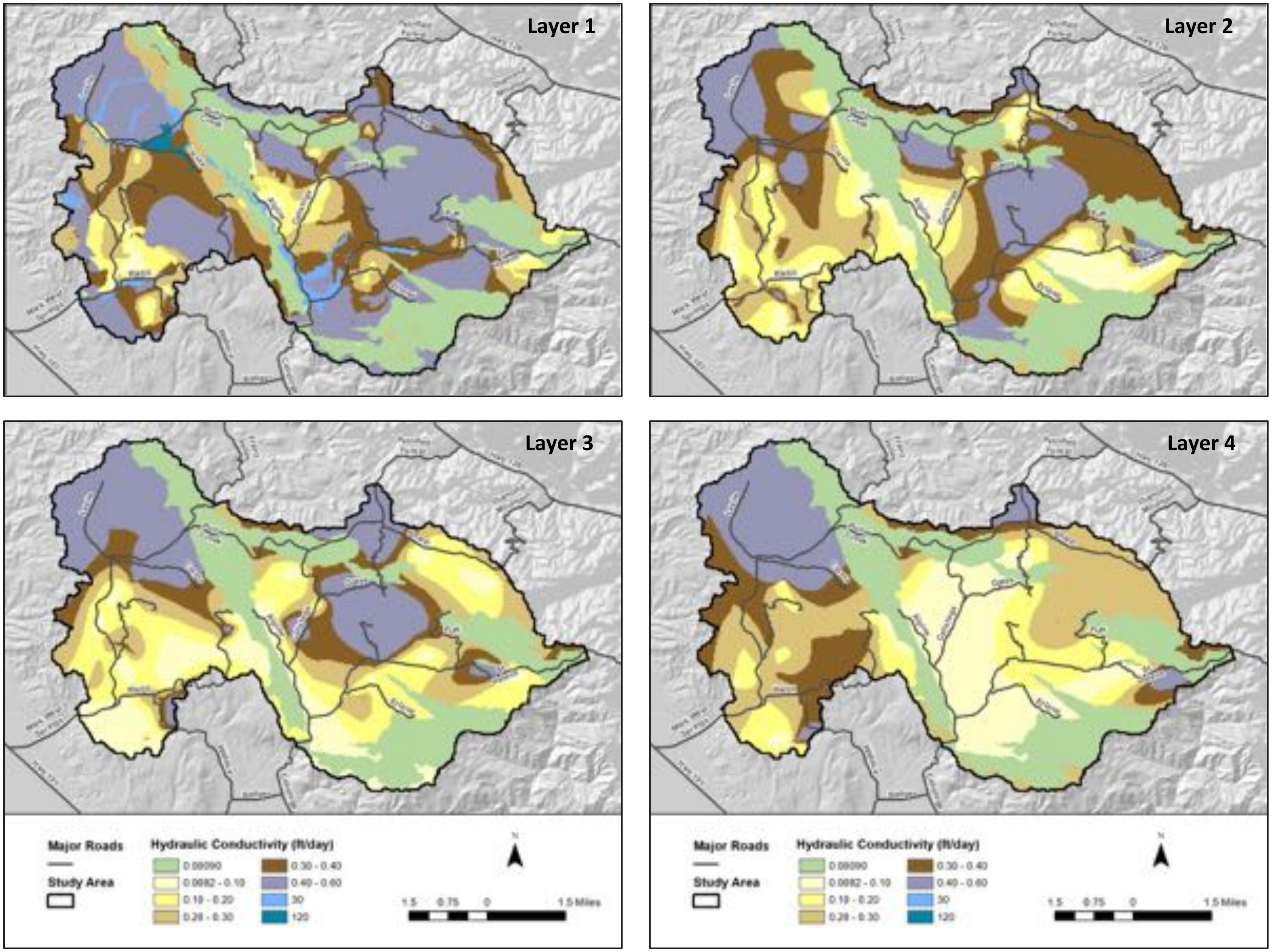
Layer	Sonoma Volcanics Kh (ft/day)	
	Range	Mean
1	0.0082 - 0.60	0.40
2	0.0082 - 0.60	0.29
3	0.0082 - 0.60	0.28
4	0.0082 - 0.60	0.24
5	0.0082 - 0.60	0.21
6	0.0082 - 0.32	0.10

used a value of 0.04 in the fine-grained Reibli Creek exposure of the Glen Ellen and 0.20 in the coarser Leslie Creek exposure (Table 7). No estimates of Sy were available for the Franciscan Complex, the Humbug Creek Deposits, or the Alluvium in the study area, thus estimates were based on literature values from similar materials (Freeze & Cherry, 1979; Domenico & Schwartz, 1990). We used values of 0.04, 0.10, and 0.30 for the Humbug Creek, Franciscan, and alluvium respectively (Table 7). Johnson (1977) estimated a value for the Storage Coefficient (S) for the Sonoma Volcanics of 1.6E-04 (ft^{-1}). No estimates of S are available for the other geologic materials in the watershed; therefore, estimates were based on literature values from similar materials (Domenico & Mifflin, 1965). Values ranged from 1.1E-05 (ft^{-1}) for the Franciscan Complex to 5.4E-04 (ft^{-1}) for the Humbug Creek Deposits (Table 7).

Hydrogeologic Property Distributions

As described above under the heading Distribution and Description of Geologic Materials, we classified geologic materials within the Sonoma Volcanics in each vertical interval corresponding to one of the six model layers using the same four categories examined with the pump test analyses. We assigned each of the well locations with available stratigraphic information the corresponding geometric mean K value from the pump test analyses and interpolated K distributions for each layer in a GIS using kriging (Figure 19). K values for the other materials were assumed to be homogeneous and these materials were assigned corresponding K values from literature estimates as described above. The model layering was constructed such that the base of Layer 1 corresponded to the base of the Quaternary Alluvium; therefore, K estimates were used directly in the model for areas of Layer 1 with alluvium. For the Humbug Creek deposits and lower portions of the Glen Ellen Formation which do not penetrate the full thickness of Layer 1, we calculated a depth-averaged K value based on the relative thicknesses of these materials and underlying formations (Figure 19).

The interpolated K maps for the Sonoma Volcanics reveal that tuffaceous material is widespread in the watershed and that the proportion of tuffaceous versus other volcanic rocks (principally andesite and basalt) generally decreases with depth as is apparent from the mean K value for the volcanics which decreases from 0.40 in Layer 1 to 0.10 in Layer 6 (Figure 19). A significant block of primarily tuffaceous material is present in the upper Mark West and Humbug Creek watersheds, and the interpreted WCRs indicate that the volcanics become dominated by andesite below about 300-ft (Figure 19). Another significant block of primarily tuffaceous material underlies the Glen Ellen Formation in the Leslie Creek watershed where it extends from the base of the Glen Ellen to about 400-ft below land surface and becomes more basaltic-dominated material at greater depths. A third relatively thin block of tuff occurs at greater depth (400 to 500-ft below land surface) in portions of the lower watershed, and less widespread and generally thin blocks of tuff are also present in other portions of the upper Mark West and Porter Creek watersheds (Figure 19).


Layer 1
Layer 2
Layer 3
Layer 4
Major Roads
Study Area
Hydraulic Conductivity (ft/day)
0.00090
0.0082 - 0.10
0.10 - 0.20
0.20 - 0.30
0.30 - 0.40
0.40 - 0.60
30
120
N
1.5 0.75 0 1.5 Miles
Major Roads
Study Area
Hydraulic Conductivity (ft/day)
0.00090
0.0082 - 0.10
0.10 - 0.20
0.20 - 0.30
0.30 - 0.40
0.40 - 0.60
30
120
N
1.5 0.75 0 1.5 Miles

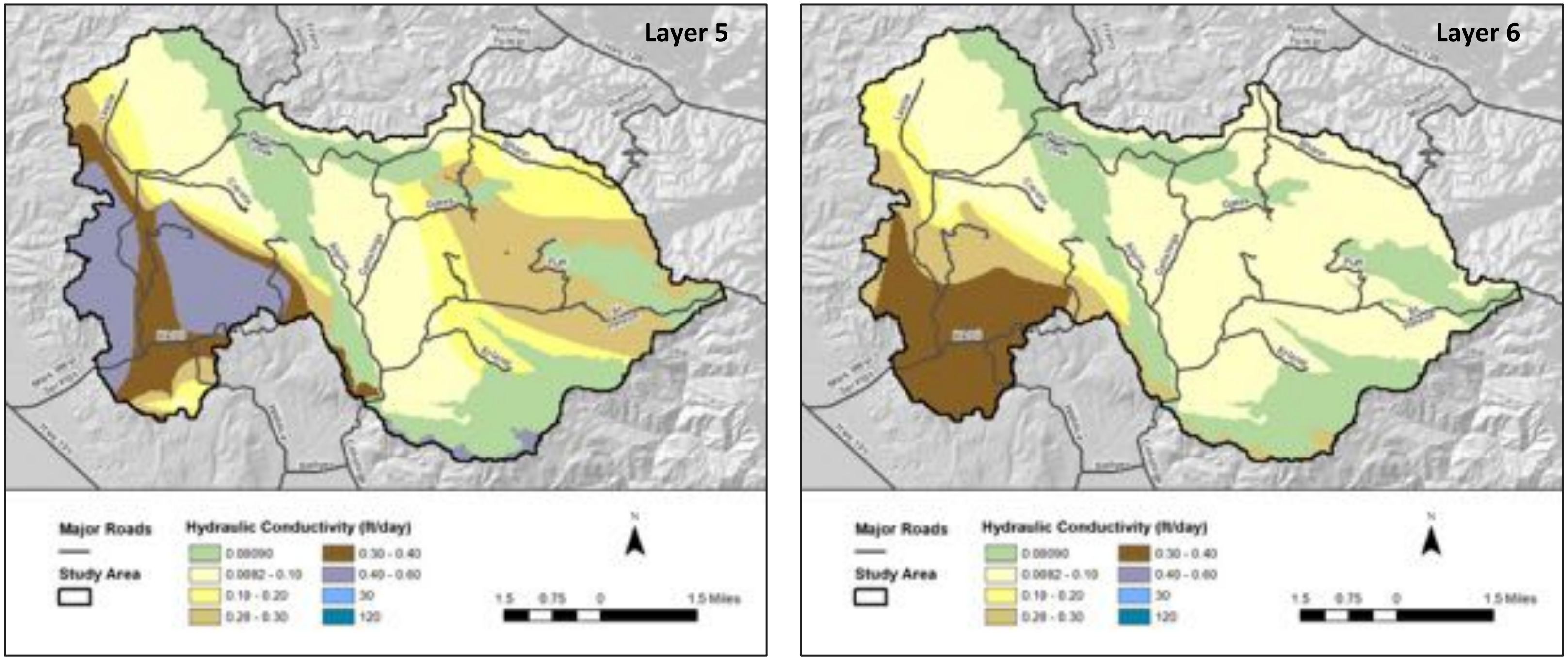


Figure 19: Horizontal Hydraulic Conductivity distributions for model Layers 1 through 6.

Water Use

Water Use Categories and Spatial Distribution
Water uses were calculated on a parcel by parcel basis. We identified the following use categories: Residential, Vineyard Irrigation, Pasture Irrigation, Cannabis Irrigation, Irrigation of Other Miscellaneous Crops, Vineyard Frost Protection, Winery Production and Visitation Use, and Miscellaneous Industrial Uses. The water uses on each parcel were identified using a variety of remotely sensed data and other datasets provided by various governmental entities. Acreages of vineyard, pasture, and other croplands were obtained from the Sonoma County Vegetation Mapping & LiDAR Program's Fine Scale Vegetation and Habitat Map (SCVMLP, 2015). Satellite imagery was reviewed to verify the accuracy of the identified agricultural lands and to identify vineyards planted after 2013 when the underlying LiDAR dataset on which this map is based was collected. In total we found 442.4 acres of vineyard and 12.8 acres of irrigated pasture and other crops (primarily olives).

All vineyards with frost protection systems that use water are required to register with the Sonoma County Agricultural Commissioner's office. Most vineyards in the model domain are located on ridgetops and hillsides where vineyards in Sonoma County are generally less likely to require frost protection than vineyards located on valley bottoms. Additionally, some vineyards may also have permanent or portable fans or heaters for frost protection. A review of the Sonoma County Frost Protection Registration database revealed that three parcels within the model domain are registered as using water for frost protection. One additional parcel with vineyard in the model domain indicated in the SWRCB's 2015 Russian River Information Order (SWRCB Information Order) that they also use water for frost protection. One of these vineyards obtains water from ponds located outside the watershed and three use groundwater from within the watershed. The three vineyards using water from within the watershed for frost protection total 16.9 acres.

Existing cannabis cultivation operations were identified from registration and permit records from the NCRWQCB and the County of Sonoma. It is common knowledge that many existing operations are not identified in the permit system. To account for water use by unregistered cannabis cultivators, we reviewed publicly-available satellite imagery and identified the size and location of all visible cultivation sites in the watershed. In total we identified 47 parcels with outdoor and mixed-light cannabis operations totaling approximately 9.8 acres of cultivation area. Indoor operations could not be identified by aerial imagery and thus this component of cannabis irrigation use may be under-estimated.

The number of residences on each parcel was obtained from the County of Sonoma's parcel GIS coverage. Seven small mutual water companies and the City of Santa Rosa each serve a small area in the southwest portion of the watershed. Information about the well locations and number of residences supplied by each well was obtained from the SWRCB's State Drinking Water Information System (SDWIS) and used to adjust the residential use estimate to account for residences supplied by water from outside the watershed and residences not in the watershed but supplied by water from within the watershed. Census block data from the 2010

U.S. Census provided an estimate of the total population served by water from the watershed. When combined with the corresponding number of residences, this yields an estimate of the average number of people per residence (2.09) which could then be used along with per capita use rates to calculate the total residential use for each parcel. In total there are approximately 2,518 people served by water obtained from within the watershed.

Winery production volumes and annual guest visitation totals were obtained from a GIS dataset provided by the County of Sonoma. Total winery production for the eight wineries in the watershed is approximately 44,300 cases per year. There are only two primary industrial users in the watershed which were handled on a case-by-case basis. Quarterly water use volumes for Mark West Quarry were obtained from reports submitted to the County of Sonoma, and monthly groundwater pumping volumes for Safari West were obtained from the SWRCB Information Order. No use for the Mayacama Golf Club was included since productions wells for the golf club and associated residences are located outside the study area.

Standard Use Rates

Standard use rates were established for the various use categories in the study area using data from the SWRCB Information Order, local municipalities, and literature sources. We examined rates and use categories from the SWRCB Information Order and identified those entries in and around the study area where rates were reported to be based on physical measurements such as totalizer readings or pump fuel usage. In most cases, the method of use estimation was unknown or not based on physical measurements. Given the uncertainty in the accuracy of these estimates, we only relied on those estimates based on physical measurements. In many cases, the reported uses contained a mix of use types (e.g. vineyard irrigation and residential) which prohibited calculation of per acre irrigation or per capita residential use. After careful examination of the data, we were only able to identify four parcels where residential use could be reliably estimated and three parcels where vineyard irrigation use could be estimated.

Total annual per capita use calculated for the four residential parcels in the Mark West Creek watershed for 2014/2015 averaged approximately 23,100 gallons (0.071 acre-ft/yr). We compared the annual use estimates to data from the nearby Town of Windsor. Based on the available data from the SWRCB's Water Conservation and Production Reports from 2014 to 2018, the average annual per capita use was approximately 26,700 gallons (0.082 acre-ft/yr) which is in reasonably good agreement with the Mark West data. Due to the small sample size of the local data, the calculated monthly averages are heavily influenced by individual users, whereas the Windsor data is based on thousands of connections and is therefore expected to provide a better estimate of typical use in the area. We relied on the average per capita monthly data from the Town of Windsor to generate use estimates for the model (Table 9 & Figure 20); it is acknowledged that this method may over- or under-estimate actual residential use in the study area.

Total annual vineyard irrigation use for the three parcels in the Mark West Creek watershed for 2014/2015 (totaling 80 acres of vineyard) ranged from 0.21 to 0.53 ac-ft/ac/yr. As part of a parallel project in the Mill Creek Watershed, we obtained recycled water delivery data for

2017/2018 from the City of Healdsburg for four parcels in the Dry Creek Valley totaling 142 acres which provided a very accurate means of estimating vineyard irrigation rates for the region and validating the estimates derived from the SWRCB Information Order data. The Dry Creek data showed very similar annual rates ranging from 0.17 to 0.55 ac-ft/ac/yr, and the average annual total calculated from the Mark West parcels (0.32 ac-ft/ac/yr) was nearly identical to the average annual total calculated in Dry Creek (0.31 ac-ft/ac/yr). To provide a more robust estimate of the temporal distribution of vineyard irrigation we calculated monthly mean rates from the three parcels in Mark West plus the four parcels in Dry Creek for use in the model, which yields mean annual use of 0.32 ac-ft/ac/yr (Table 9 & Figure 20). In the model, vineyards are irrigated from May through October with irrigation peaking at 0.09 acre-ft/acre/month in June (Figure 20).

Based on guidance provided by the University of California Davis and Sonoma RCD, the timing of water use for frost protection is based on the wet-bulb temperature (Snyder, 2000; Minton et al., 2017). Wet bulb temperature was calculated on an hourly timestep using air temperature and relative humidity data from the Windsor CIMIS station (Stull, 2011). Frost protection is assumed to occur any time the hourly wet bulb temperature is 0.5°C or lower during the typical March 15th – May 15th frost protection season. The rate at which each parcel uses water for frost protection was calculated as the product of vineyard acreage and reported sprinkler and micro-sprinkler application rates as described in the Sonoma County Frost Protection Registration database (Table 9). Based on these assumptions, the annual number of hours of frost protection ranged from one in 2013 to 25 in 2011, the average annual application rate was 0.069 ac-ft/ac/yr, and the maximum rate was 0.18 ac-ft/yr.

Table 9: Standard water use rates and summary of total water use for the various use categories represented in the MWC hydrologic model.

Use Category	Unit Definition	Use per Unit (ac-ft/yr)	# of Units	Total Use (ac-ft/yr)
Residential	Person	0.082	2,518	206.5
Vineyard Irrigation	Acre	0.32	442.4	141.6
Vineyard Frost Protection	Acre	0.069	16.9	1.2
Pasture/Other Irrigation	Acre	2.00	12.8	25.6
Outdoor Cannabis	Acre	1.34	5.9	7.9
Hoop-house Cannabis	Acre	1.53	3.9	6.0
Winery	1,000 Cases of Wine	0.073	44	3.2
Misc. Industrial	Lump Sum	-	-	38.8
Sum				**430.7**

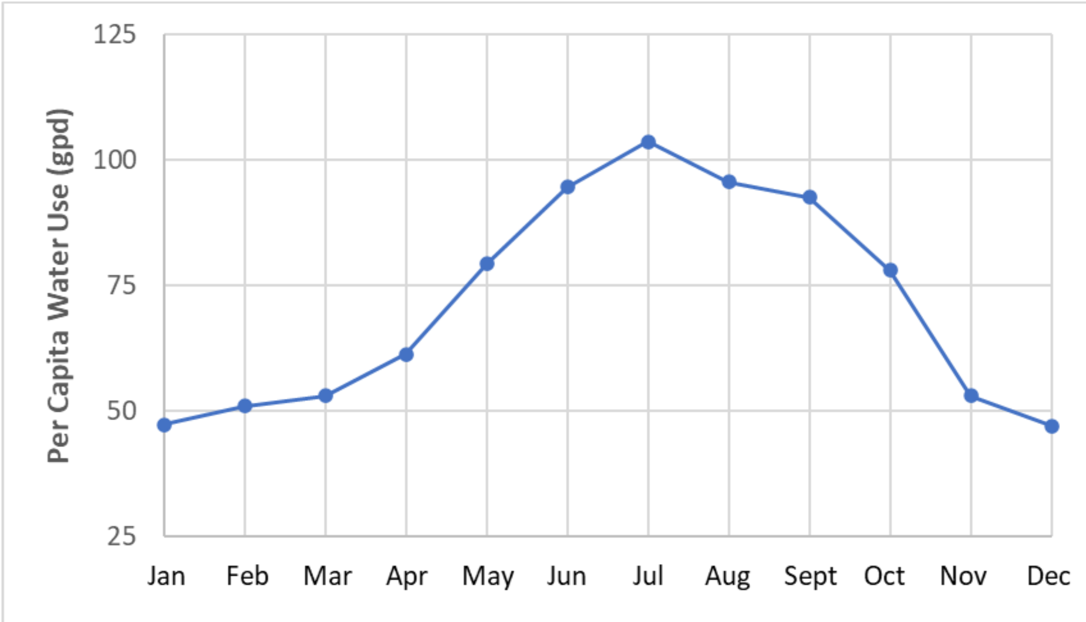


Figure 20: Mean (2014-2018) monthly per capita residential use from the Town of Windsor used to calculate residential use in the MWC hydrologic model.

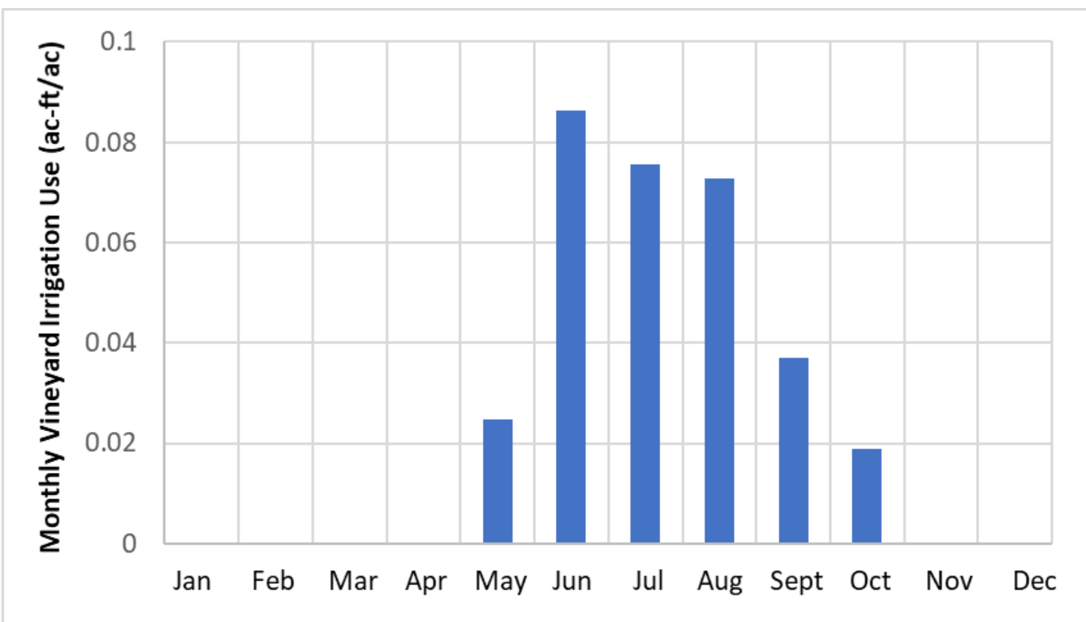


Figure 21: Mean (2014-2015 and 2017-2018) monthly per acre vineyard irrigation use compiled from Information Order data in the Mark West Creek watershed and recycled water delivery data in the Dry Creek Valley and used to calculate vineyard irrigation use in the MWC hydrologic model.

No reliable pasture irrigation rates could be determined from the available data, therefore we relied on a regionally-appropriate value of 2.0 ac-ft/ac/yr (County of Napa, 2015). Based on field reconnaissance and review of available aerial imagery and GoogleEarth Street View products, most orchards within the study area are mature walnut and apple orchards which are typically dry-farmed in Sonoma County. Less than 2 acres each of olive orchard and vegetable crops were identified and were assumed to be irrigated at rates similar to pasture. The total acreage of irrigated pasture, olive orchard, and vegetable crops in the study area is only 12.8 acres.

Cannabis use rates are based on cannabis irrigation data collected by the NCRWQCB for Humboldt, Mendocino, and Sonoma Counties. Typical irrigation rates of 1.34 ac-ft/acre/yr for outdoor cultivation and 1.53 ac-ft/acre/yr for hoop-house cultivation were selected based on a presentation summarizing this data which also provided a monthly distribution of use (Dillis, 2018) (Table 9).

Winery production, employee, and guest water use rates were based on the County of Napa's Water Availability Analysis Guidance Document (County of Napa, 2015) (Table 9). The monthly distribution of winery production was taken from the Winery Wastewater Handbook (Chapman et al., 2001). Winery guest use, which is relatively minor within the study area, was assumed to be constant throughout the year (Table 9). As discussed above Industrial use was based on parcel-specific reported rates from Sonoma County and the SWRCB Information Order rather than on standard rates.

Water Sources

Parcels with surface water diversions were identified from the SWRCB Electronic Water Rights Information Management System (eWRIMS) and the SWRCB Information Order. For unpermitted cannabis cultivation operations where the water source was unknown we assumed surface water use if there was a perennial stream, spring, or pond located on the parcel, which was the case for 9 of the 47 cannabis operations in the study area. For all other parcels we assumed groundwater use. Where multiple wells are located on a given parcel, we divided the total use for the parcel between the various individual wells. When eWRIMS or the SWRCB Information Order indicated that a parcel has both surface water and groundwater supplies, surface water diversions were subtracted from groundwater pumping.

After consolidating duplicate records from the various sources, we excluded diversions reported as inactive or with zero use, as well as those where the SWRCB Information Order states use; however, the reported uses are for evaporation losses and recreation or aesthetics rather than for consumptive uses. We only identified two off-channel ponds with small reported consumptive uses estimated to total approximately 1.3 ac-ft/yr which were accounted for as groundwater use given that the model does not explicitly represent off-stream ponds. For spring diversions, we attribute the location of the diversions to the nearest stream in our model, thus treating it as equivalent to a direct diversion. There are a total of 52 surface water diversions in the model, 24 of these are direct stream diversions, 19 are spring diversions, and 9 are diversions from on-stream ponds represented in the model (Diversion timeseries are based on average monthly diversion volumes. Where possible, reported diversion volumes from eWRIMS and the

SWRCB Information Order were used. If reported diversion volumes from the SWRCB Information Order were not based on physical measurements or if no diversion volumes were reported, volumes were calculated using the standard use rates for the uses on a given parcel.).

Where possible, wells were located at specific locations on a given parcel from location information available on WCRs, the SWRCB Information Order, and in some select cases site visits. The SWRCB Information Order was especially helpful in this regard by providing a means of tying many more wells to specific locations than would have otherwise been possible. Nevertheless, many of the locations reported in SWRCB Information Order data proved to be parcel centroids and it is not possible to locate all wells at a level of detail beyond the parcel scale. More specific location data was used for 458 of the 792 wells in the model. We initially placed all the remaining wells at parcel centroids, but review of the parcels along upper Mark West Creek and Humbug Creek revealed that residences in these areas are generally located much closer to the creek than the centroid of the parcel. There are certainly many exceptions, but wells are often placed in relatively close proximity to the areas they serve, so to avoid over-estimating the distances between wells and streams, we placed theses stream-side parcel wells along upper Mark West Creek and Humbug Creek at the centroids of the residences as indicated by the impervious areas delineated in the Sonoma County fine-scale vegetation mapping data (SCVMLP, 2017).

Well completion details could be determined from WCRs for 189 wells and we associated the wells without WCRs with the nearest well with a WCR within the same geologic terrain to estimate well depth and screened interval information for all wells in the model. About 47% of the wells are screened at least partially within the upper 100-ft of aquifer material but most of these are screened to greater depths with only 5% of the wells screened entirely in the upper 100-ft. About 34% of the wells are screened entirely within the upper 200-ft of aquifer material and about 78% are screened entirely within the upper 400-ft with the remainder screened within the upper 700-ft (Figure 22).

Water Use Timeseries

Surface Water Diversions

Diversion timeseries are based on average monthly diversion volumes. Where possible, reported diversion volumes from eWRIMS and the SWRCB Information Order were used. If reported diversion volumes from the SWRCB Information Order were not based on physical measurements or if no diversion volumes were reported, volumes were calculated using the standard use rates for the uses on a given parcel. The monthly volumes calculated for each diversion are used to calculate a diversion timeseries. These timeseries were calculated on a 6-hour timestep and account for pumps shutting on and off and the estimated capacities of these pumps. A 6-hour timestep was selected to provide a reasonable representation of sub-daily variability while maintaining reasonable computational efficiency. Separate pumping regime assumptions are made for direct diversions and for spring and pond diversions.

Direct diversions were assumed to fill storage tanks completely and then resume once these tanks had been partially emptied. Based on storage tank sizes reported in the SWRCB

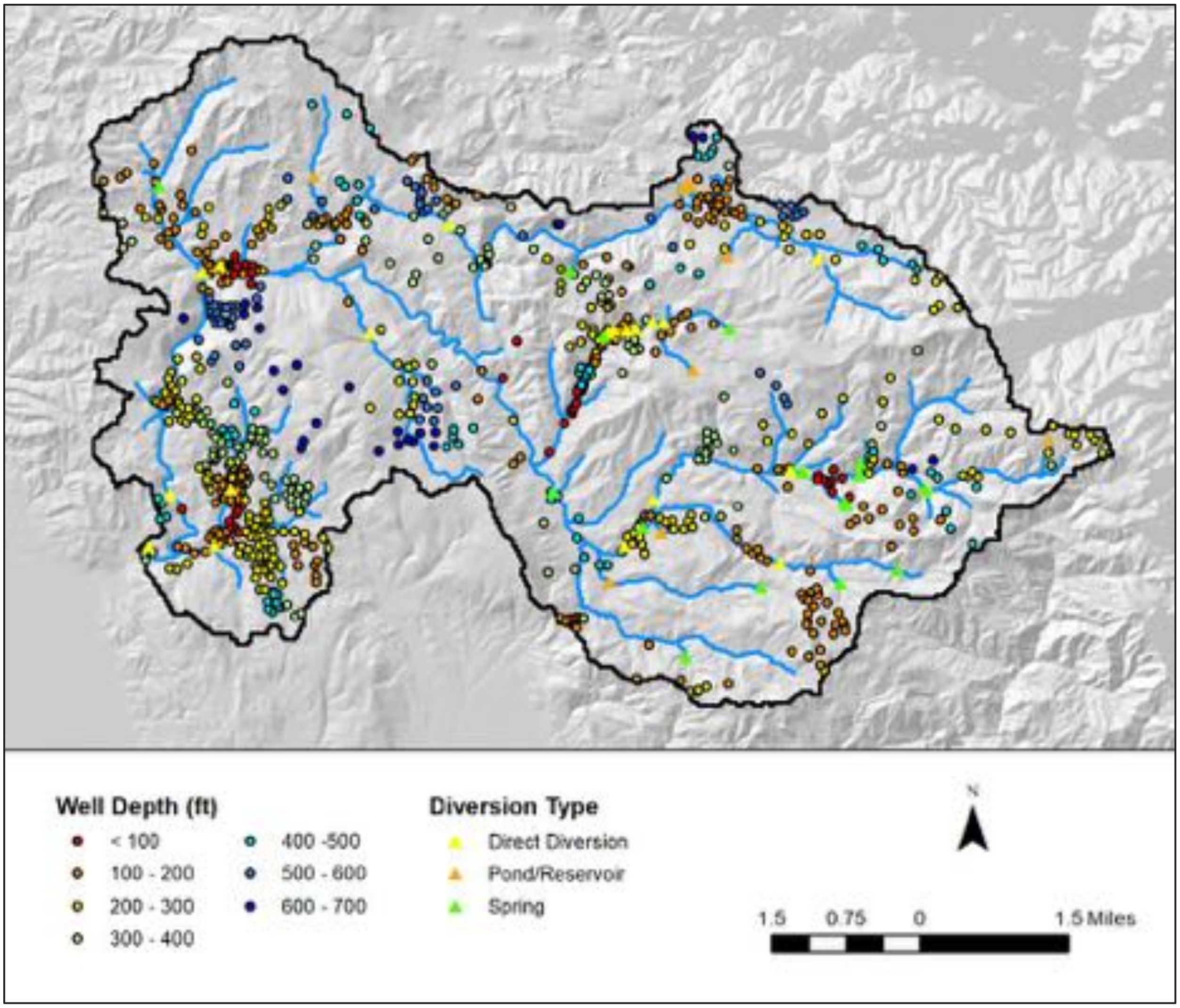


Figure 22: Locations of surface water diversions and groundwater wells in the MWC hydrologic model.

Information Order, the typical tank size for a residence with a direct diversion is approximately 3,000 gallons. Such a tank would need to be filled completely twice a month to supply a typical residence, or approximately four times per month if the tank were only partially emptied. Less data is available for agricultural tank sizes but the limited data supports use of a similar pumping frequency. Consequently, direct diversions were assumed to divert a fraction of the monthly volume on the 1st, 8th, 15th, and 22nd of each month. Some diversion volumes were met using the assumed pumping rates with less than four pumping events per month, in which case they are only active 1-3 times per month depending how quickly the demand is met for each month. For larger demands, the four per month diversion periods were assumed to continue for as long as necessary based on the diversion rate. Typical spring and pond diversions deliver water in near real-time and thus do not require large storage tanks. This results in more frequent, shorter-duration pumping intervals relative to direct diversions. Therefore, daily use was calculated from the monthly volumes and all daily use was considered to be supplied during a single 6-hour timestep.

In addition to developing estimates of the frequency and duration of diversions, it is necessary for modeling to assume a start time. There is likely little to no coordination between diverters regarding the timing of pump activation, and probably some general tendency for coincident pumping due to coincident timing of irrigation demands and work schedules. We made the conservative assumption that all diversions start simultaneously at the beginning of the day, and the diversions on weekly schedules all occur on the same days. These various assumptions result in a maximum instantaneous diversion rate on the 1st of each month, and spikes in rates at regular intervals which is considered to represent a 'worst case' diversion timing scenario (Figure 25).

Where possible the diversion rates used to calculate the diversion timeseries were obtained from eWRIMS or the SWRCB Information Order. However, most diversions rates were either not reported or the reported rates were not realistic given the reported units. Where specific rates were not available, standard rates were used as derived from reported rates in the SWRCB Information Order that were based on actual physical measurements. Standard rates were derived for two diversion types: domestic/small agricultural operations and larger agricultural operations. We combined our analysis of the SWRCB Information Order data for Mark West Creek with analysis of the data for Mill Creek where we are completing a parallel modeling study, and we also restricted the selected entries to include only those based on physical measurements. Based on twelve diversions from the Mark West and Mill Creek Watersheds, the typical residential and small agricultural diversion rate is estimated to be 2.69 gpm (0.006 cfs). Diversion rates for larger agricultural operations varied greatly but typically ranged between 0.01 and 0.03 cfs and a typical diversion rate of 9.0 gpm (0.02 cfs) was used. A monthly timeseries of the total direct and spring diversion volumes and the total pond diversion volumes in the model is shown in Figure 23 and Figure 25, and an example of the 6-hr interval total direct and spring diversion timeseries for July 2010 is shown in Figure 25.

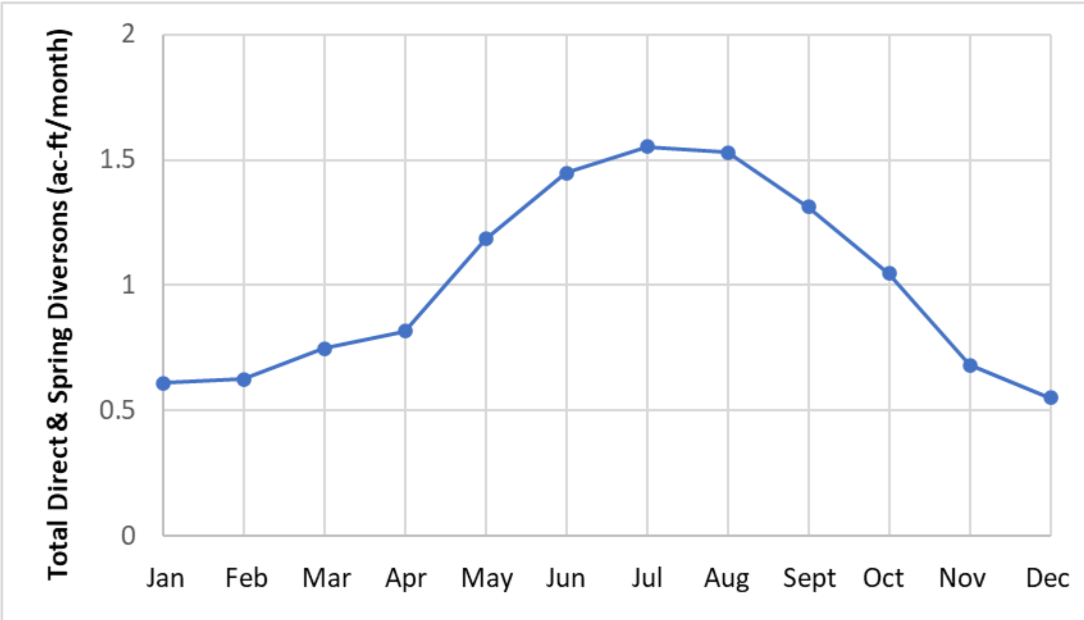


Figure 23: Total monthly direct and spring diversion volumes used in the MWC hydrologic model.

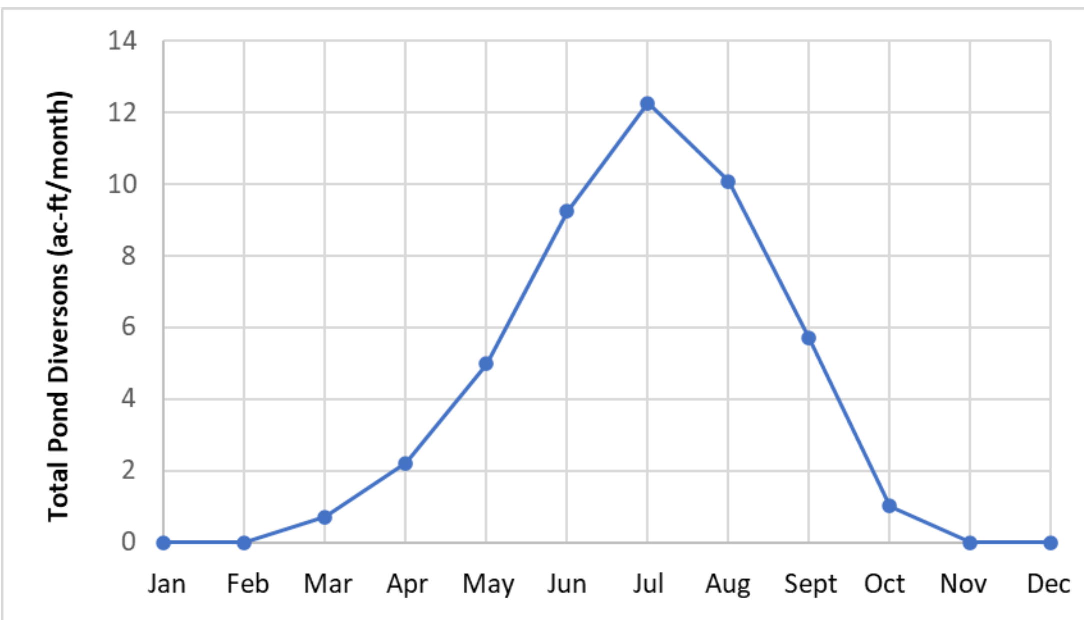


Figure 24: Total monthly pond diversion volumes used in the MWC hydrologic model.

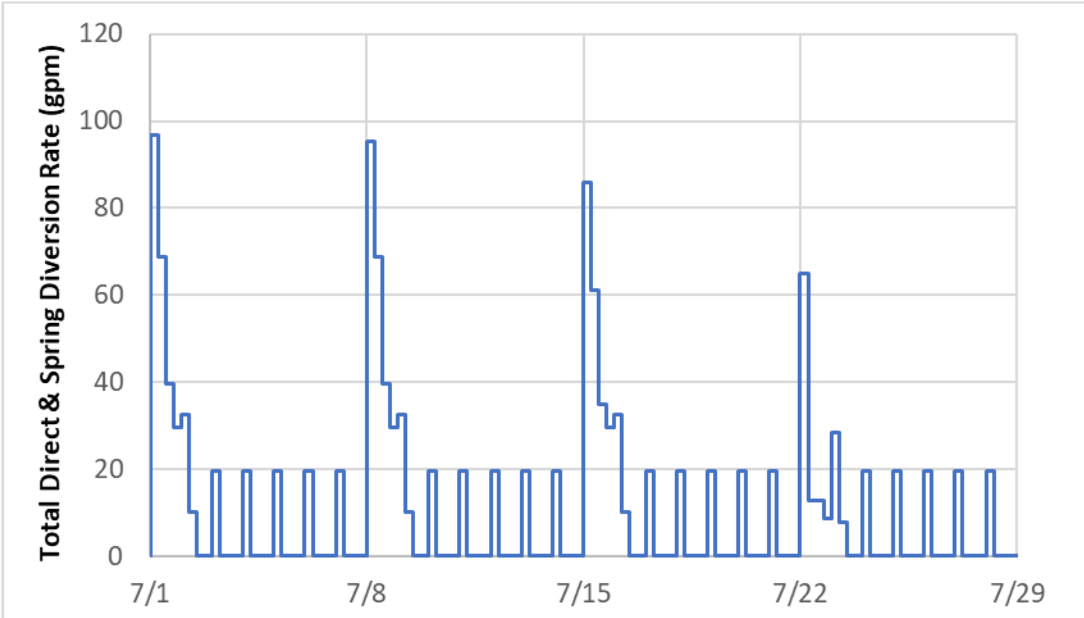


Figure 25: Example of the 6-hr interval timeseries of total direct and spring diversions used in the MWC hydrologic model for July of 2010.

Groundwater Wells

Wells are assumed to be pumped on a daily basis, either supplying water in real-time or topping off a tank. The groundwater pumping timeseries was calculated by converting estimated monthly volumes to a daily demand and pumping each well at its estimated yield until this daily demand was met. This timeseries was calculated on an hourly timestep consistent with the hourly timestep used to drive the groundwater component of the model. Estimated yields are based on pump test data associated with Well Yield Certifications obtained from the County of Sonoma as analyzed and discussed in the Aquifer Properties section above. Typical yields of 13.7 gpm and 6.6 gpm were calculated for the Sonoma Volcanics and the Franciscan Complex respectively (Table 6). Other geologic materials in the watershed including the Quaternary Alluvium, the Glen Ellen Formation, and the Humbug Creek Deposits are not a significant source of water to wells as discussed above under the heading Distribution of Geologic Materials.

Wells supplying large vineyards, used for frost protection, or supplying multiple connections as mutual water company wells are likely have higher than average yields. To account for this, the maximum daily pumping duration is capped at 6 hours per day. If a well cannot supply the required daily volume within this 6-hour window, the pumping rate was increased until it could. The pumping rates used for these wells, up to 78 gpm in the Sonoma Volcanics and up to 37 gpm in the Franciscan, are still within the range of reasonable values for these formations.

The only component of pumping that varies in the model from year to year is the frost protection pumping which accounts for a relatively small component of the total pumping. A monthly timeseries of the total groundwater pumping volumes applied in the model is shown in Figure 26 and an example of the hourly total pumping timeseries for 1 3-day period in early July is shown in Figure 27.

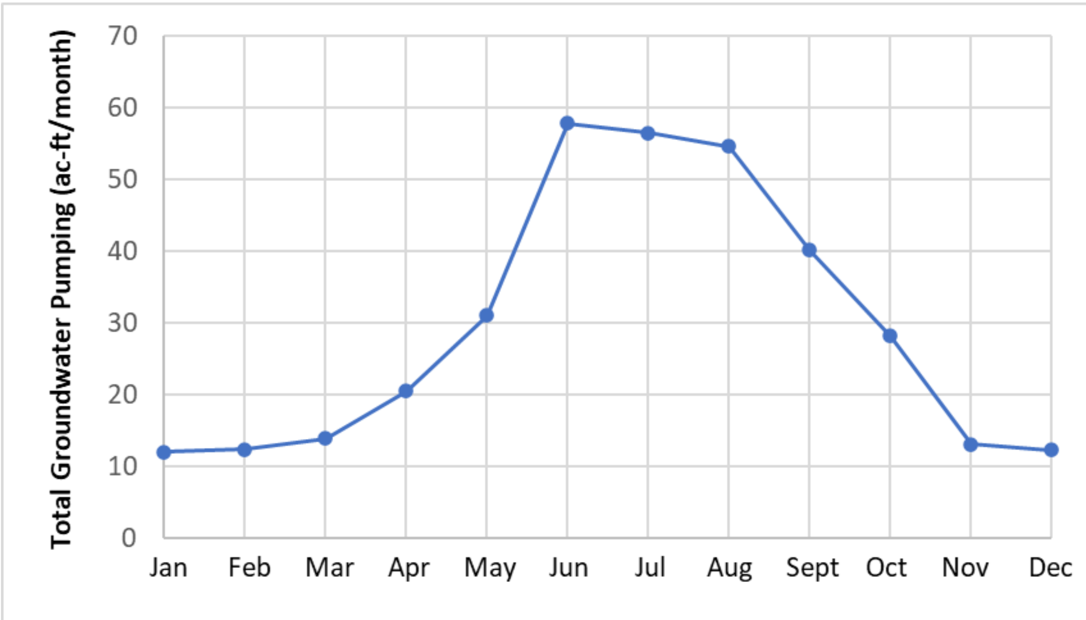


Figure 26: Total monthly groundwater pumping volumes used in the MWC hydrologic model.

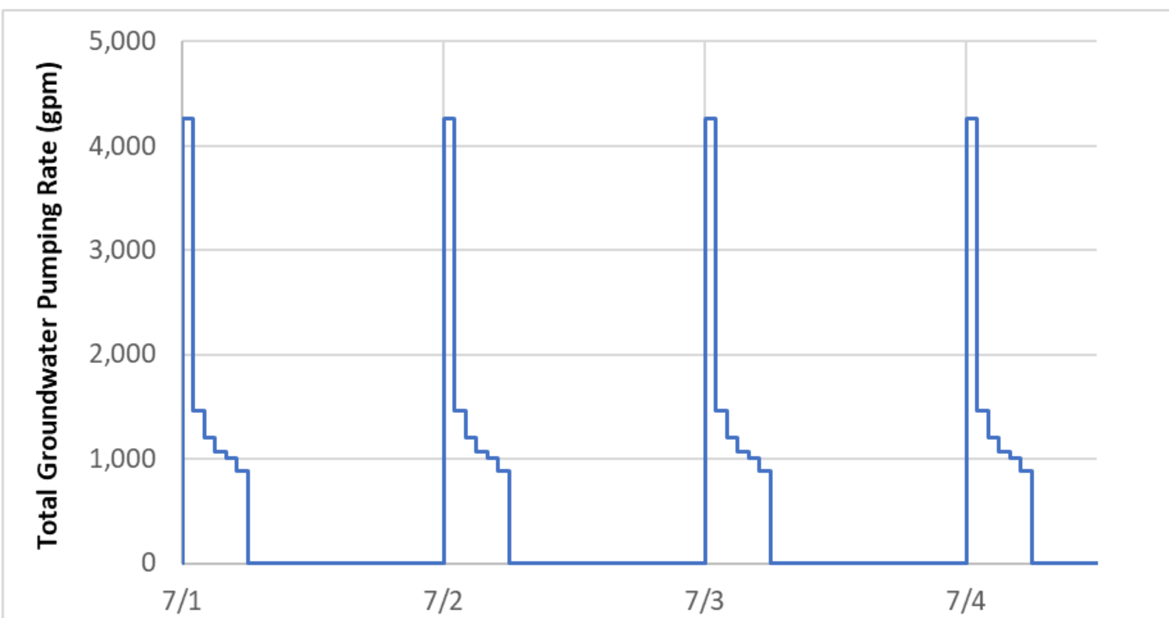


Figure 27: Example of the 1-hr interval timeseries of total groundwater pumping in the MWC hydrologic model for a 4-day period in early July.

Water Use Summary

Total water use from all sources in the watershed is estimated to be approximately 430.7 ac-ft/yr. The largest uses are residential and vineyard irrigation which account for about 48% and 33% of the total water use (Table 9; Figure 28). Industrial uses account for the next largest fraction at about 9%. The remaining 10% consists of irrigation for pasture and other crops (6%), irrigation of cannabis (3%), winery use (<1%), and vineyard frost protection (<1%) (Table 9; Figure 28). About 85% (367.1 ac-ft/yr) of the total use in the watershed is from groundwater with the remaining 15% (63.6 ac-ft/yr) coming from surface water sources. About 81% (51.5 ac-ft/yr) of the total surface water use comes from pond storage, 10% (6.7 ac-ft/yr) comes from direct stream diversions, and 9% (5.4 ac-ft/yr) comes from springs.

Direct stream and spring diversions are concentrated in Humbug Creek, and upper Mark West Creek in and upstream of Van Buren Creek (Figure 22). The highest concentration of wells occurs in the Reibli Creek subwatershed which is generally more urbanized given its proximity to the City of Santa Rosa. Higher concentrations of wells also occur in upper Mark West Creek, upper Porter Creek, and the lower Leslie Creek area (Figure 22). The pattern of development in the watershed has tended to occur along the stream corridors as can be seen in the well distribution with 50% of the wells located within 500-ft of a stream and 73% located within 1,000-ft (based on the modeled stream extent).

Irrigation

The water extracted from wells and surface water diversions for irrigation of vineyards, pasture, and other crops is applied to the land surface as irrigation in the model (see Figure 9 for locations of irrigated crops in the model). The monthly application volumes match the standard use rates as discussed above. Based on previous work with vineyard operators in Sonoma County, vineyards are typically irrigated at intervals of about one week to one month. We assumed a twice-monthly irrigation schedule and developed our irrigation timeseries by distributing the monthly volumes between the two irrigation events each month. We assumed a similar irrigation frequency for pasture and other irrigated crops in the model. Although many vineyard operators use a block rotation schedule for irrigation, the twice-monthly schedule accounts for the temporal effects of irrigation on soil moisture and is decoupled in time from the extraction of that water which is based on assumed pumping rates and tank storage volumes as discussed above. We did not apply water used for cannabis as irrigation in the model since cultivation areas are generally smaller than the 0.5-acre grid scale and many cultivators use pots or fabric bags which limit the potential for interaction with surrounding soils. Water for frost protection of vineyards was also applied back to the land surface as irrigation in the model in real-time based on the calculated demand as discussed above.

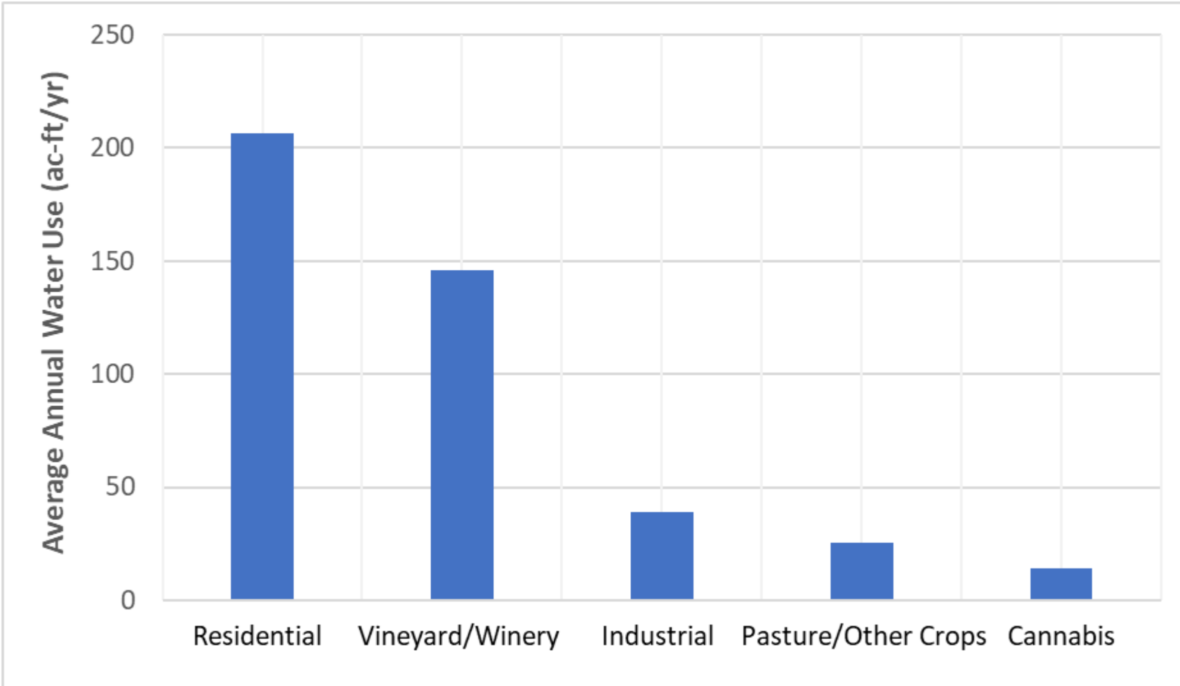


Figure 28: Breakdown of total water use in the MWC hydrologic model by use category.

Chapter 5 – Model Calibration

Calibration of a distributed hydrologic model like MIKE SHE is complicated by the large number of inter-related process and parameters involved. Previous modeling experience has indicated that results are most-sensitive to a relatively small subset of the model parameters including the overland flow Detention Storage and Roughness, unsaturated zone Saturated Hydraulic Conductivity and moisture contents, interflow Drain Levels, groundwater Hydraulic Conductivity, and the streambed Leakage Coefficient. The calibration focused on adjusting these seven parameters within a range of plausible values (to maximize the fit between observed streamflow and groundwater data and mapping information.

Available Data

Several stream gauges have been operated in the watershed at various times over the past ten years including a series of gauges installed in 2010 by the Center for Ecosystem Management and Research (no longer in existence); some of which were re-established by Trout Unlimited (TU) in 2018. In 2018, Sonoma Water established several new gauges to serve as a warning system for potentially hazardous post-fire runoff events and the CRWI installed a gauge on lower Monan's Rill in the upper watershed. Additionally, OEI installed two gauges on upper Monan's Rill tributaries in 2017 and gauging in and near Humbug Creek has also been undertaken by CDFW in recent years.

Despite the relatively large number of stage sensor records available, most of the available data is only from the past few years and only relatively limited development of rating curves and discharge records has occurred. CEMAR and TU collected streamflow measurements and developed low flow (summer baseflow) rating curves at their sites, however rating curves have not been developed for the Sonoma Water sites. Even at the CEMAR/TU sites, no discharge measurements of storm runoff were previously collected, thus prior to this study no continuous rating curves or streamflow records had been developed in the watershed.

We selected three sites for additional streamflow gauging and rating curve development, the CRWI site on Monan's Rill, one of the TU stations in the upper watershed at Rancho Mark West, and one of the Sonoma Water stations in the lower watershed at Michelle Way (Figure 29). We measured discharges at the three sites at approximately monthly intervals between March 2018 and August 2019. For lower flows we used standard wading techniques and a topset rod and flow meter, and for higher flows we used a bridge crane and a flow meter. For all gauging efforts we followed standard USGS stream gauging protocols (USGS,2010).

We obtained the discharge measurements collected by CEMAR for the previous installation at the Rancho Mark West site which operated from March 2010 to December 2014. The original pressure transducer was still installed in the channel near the new instrument that TU installed in February 2018, allowing the older and newer stage records to be combined by applying an elevation offset between the instruments as measured in the field. This made it possible to combine the older CEMAR record from 2010-2014 with data collected from 2018-2019 to develop continuous rating curves and flow records for this site from 3/11/2010 – 12/10/2014 and 2/23/2018 – 7/25/2019.

At Michelle Way, we developed rating curves from our discharge measurements which allowed for the development of continuous flow records from 2/27/2018 – 9/30/2019. We also developed rating curves at Monan's Rill; unfortunately, an instrument malfunction resulted in a large data gap and we were only able to develop continuous flow records for 5/1/2018 – 12/13/2018 and 3/25/2019 – 9/30/2019 which excludes most of the larger runoff events that occurred in 2018/2019. Given the paucity of runoff events captured at this gauge, we focused on the May through September time period for calibration at this location.

In addition to streamflow data, other supplemental sources of calibration data include locations of known springs and perennially-flowing tributaries and wet/dry mapping data collected by CA Sea Grant, CDFW, and Sonoma Water. We compiled the locations of springs and seeps mapped in the field along main-stem Mark West Creek by OEI and CDFW staff in August 2018, spring locations from the National Hydrography Dataset (NHD), springs indicated in the SWRCB's Information Order, springs identified during field reconnaissance and from landowner information, and springs mapped by Pepperwood staff on the Pepperwood Preserve. We also compiled the locations of all flowing tributaries from the August 2018 survey. These data represent all known locations of springs (a groundwater discharge output in the model), but is not a complete inventory of springs and is biased towards showing more springs in locations where detailed spring mapping has been completed such as along main-stem Mark West Creek

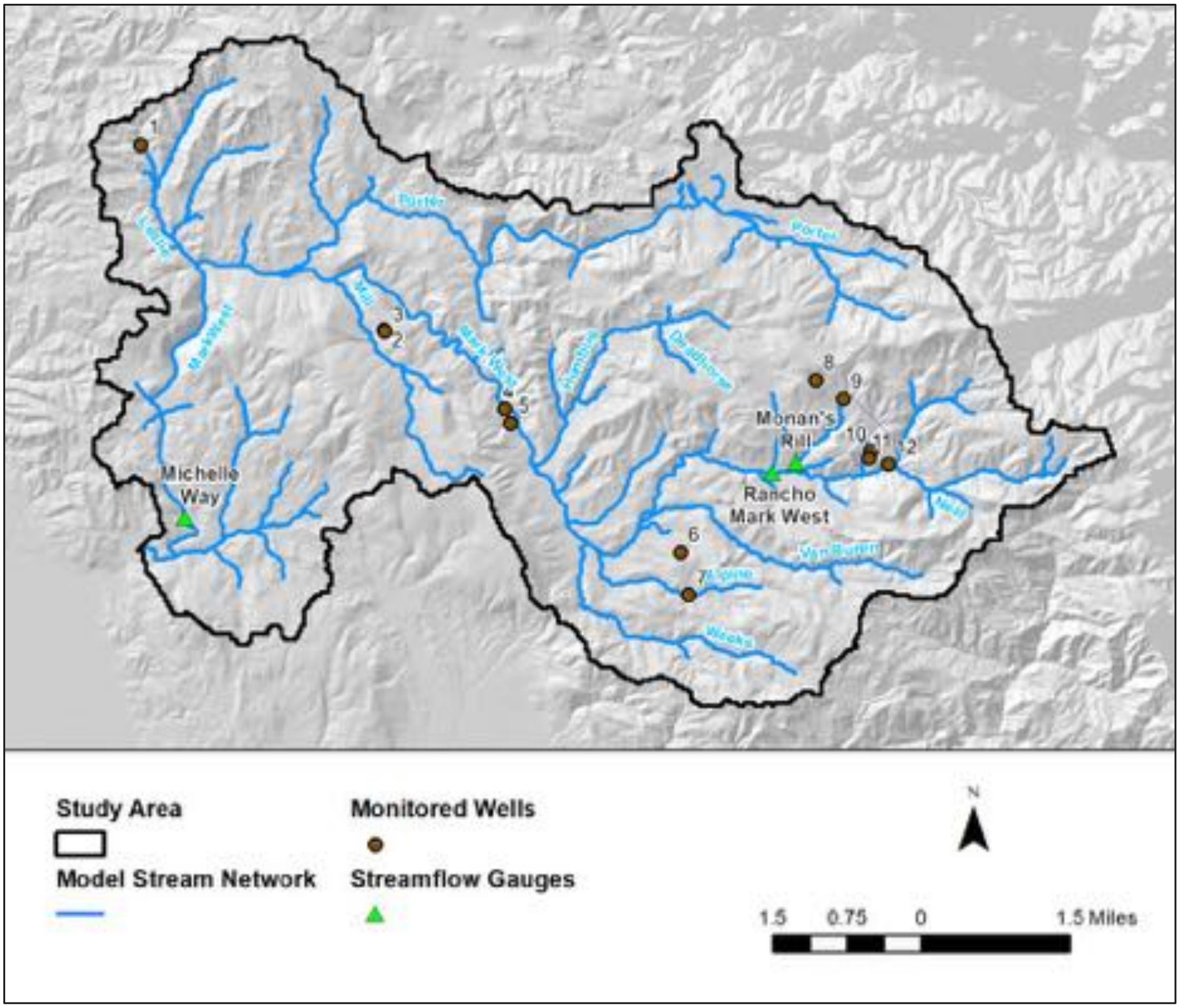


Figure 29: Locations of streamflow gauges and groundwater wells used for calibration of the MWC hydrologic model.

and at the Pepperwood Preserve. Wet/dry mapping data is available for 2012 – 2018 and we focused on the years with the most complete spatial coverage, 2015 – 2018. For purposes of this comparison we considered flows less than 0.01 cfs as equivalent to a field condition of dry and flows less than 0.10 cfs as equivalent to a field condition of intermittent.

Except for a few wells at the Pepperwood Preserve and Monan's Rill, almost no existing groundwater monitoring data was available for the watershed. To develop some field-based understanding of groundwater conditions in the watershed, we established a network of landowners willing to participate in a groundwater monitoring program and collected groundwater elevation data at 16 wells at approximately 5-week intervals between May 2018 and June 2019. Wells are completed in both of the major geologic formations in the watershed, the Franciscan Complex and the Sonoma Volcanics, and they are concentrated in the upper watershed where landowner interest in participation was high. Well casing heights were measured and data was collected relative to top of casing using an electronic sounding tape.

Many of these wells are domestic water supply wells and thus measurements could potentially be influenced by drawdown associated with recent pumping. To minimize such effects, we established a regular monitoring and notification schedule and residents voluntarily abstained from pumping for 24-hrs prior to measurements. The data for four of the wells was not useful for calibration owing to a variety of factors including obvious pumping influences, one seasonally dry hole, and one well located just outside the watershed. Of the remaining 12 wells (Figure 29), we were unable to locate a Well Completion Report for three; given the lack of screened interval information for these wells, we prepared comparisons between simulated and observed water levels but excluded them from the calibration statistics owing to the uncertainty about which model layer is represented by the observations. Seven of the nine monitoring wells used for model calibration are completed in the Sonoma Volcanics and the other two (Wells 4 & 5) are completed in the Franciscan Complex. Three of the wells are screened entirely within Layers 1 & 2 (upper 200-ft), seven are screened entirely within Layers 1-3, and two are completed entirely in Layers 1-4.

Streamflow Calibration

Four goodness-of-fit statistics were used to evaluate the agreement between model simulated stream discharges and measured stream discharges. These statistics included the Mean Error (ME), Root Mean Square Error (RMSE), the total Percent Volume Error (PVE), and the Nash-Sutcliffe model efficiency coefficient (NSME) (Nash and Sutcliffe, 1970). ME, RMSE, and PVE provide an overall measure of the model bias and have been calculated separately at all three gauges for the full period of record and for the low flow season from May through September. The NSME provides an overall measure of the predictive capability of the model. A NSME value of zero indicates that model predictions are as accurate as the mean of the measured data and a value of one indicates a perfect calibration. The PVE and NSME have only been calculated for the full period of record since it they are not well-suited for describing data with limited temporal variability such as spring/summer baseflow recessions. To avoid the May through September statistics being dominated by a handful of days with storm runoff, we defined an upper threshold below which to calculate statistics more representative of the model's ability to predict flow recession and baseflow. The thresholds were 0.4 cfs, 2 cfs, and 5 cfs at the Monan's Rill, Rancho Mark West, and Michelle Way gauges, respectively.

Due to the limited period of record it was deemed appropriate to calibrate the model to all of the available data rather than divide the simulation into calibration and validation periods as is more typically done when long-term gauging data is available. Figures 30 through 32 show the comparison between model-simulated and measured discharges at the three gauging sites for the full periods of record, and Figures 33 through 35 show the comparison between model simulated and measured discharges at the three sites for just the May through September low flow season that is most critical from the perspective of salmonid habitat.

The agreement between simulated and measured stream flows was generally good at all three of the gauging locations. The model reproduces the quick flow responses in stream flow during runoff events that is characteristic of the watershed and the overall shape of rising and receding flows. Peak flows are captured reasonably well; however, large differences in peak flows do occur for certain events particularly in the older portion of the record at the Rancho Mark West station. RMSE values for the full periods of record were 13.6 and 68 cfs and NSME were 0.79 and 0.90 at the Rancho Mark West and Michelle Way gauges respectively (Table 10). The total percent volume error was -5.2% at Rancho Mark West and 8.4% at Michelle Way (Table 10). We established targets for successful calibration as a NSME value of 0.60 or greater and a PVE of +/-10% which are met at both stations.

During low flow periods most critical for understanding coho habitat, the model performance is also generally very good. The shape of the spring flow recessions is well captured but the timing of the flow recession in the upper watershed is delayed in the model by one to two weeks relative to the observed data resulting in over-predicted flows during the May/June timeframe. The flow recession timing matches the observed timing more closely in the lower watershed. Magnitudes of summer baseflow are in reasonably good agreement, but there is a tendency to over-predict late summer flow, particularly in the lower watershed. RMSE values for the May through September low flow period ranged from 0.10 cfs at the Monan's Rill gauge to 0.83 cfs at the Michelle Way gauge (Table 10).

The map of observed springs and flowing tributaries was compared to a map of spring locations and flowing tributary streams as simulated in the model for August 2018 (Figure 36). The model correctly predicts the August 2018 flow condition in all 14 tributaries in the study area greater than 0.3 mi^2 as well as in 7 of the 11 smaller tributaries (Figure 36). The spring location comparison also indicates generally good agreement with a high concentration of springs in the upper watershed in both the observed and simulated maps. The model does not show as many springs in the central reach of Mark West Creek between Porter and Humbug creeks or on the Pepperwood Preserve property as is indicated by the field data. Concentrations of springs in upper Porter, upper Humbug, and lower Mark West Creeks not shown in the observed data likely reflect lack of mapping in those areas rather than lack of springs (Figure 36). Overall, the model appears to reproduce the general locations of groundwater discharge and perennial streamflow in Mark West Creek with reasonable accuracy.

Comparison between wet/dry mapping data collected by CA Sea Grant and Sonoma Water in August and September of 2015 through 2018 and a model simulated wet/dry classification for equivalent dates indicates that both the model and the field data show flow persisting in the majority of main-stem Mark West Creek even during dry years such as 2015 (Figure 37 - Figure 40). Both the model and the field data show dry/intermittent conditions beginning at about the same location in the upper watershed as well as dry/intermittent conditions occurring upstream of the Porter Creek confluence in some water years, however the field data indicates the reach with dry/intermittent flow conditions extends upstream of Porter considerably farther than was captured in the model (Figure 37 - Figure 40).

Table 10: Streamflow calibration statistics for the MWC hydrologic model.

Period	Gauge	Drainage Area (mi^2)	# of Daily Observations	ME (cfs)	RMSE (cfs)	PVE (%)	NSME
Full Record	Rancho Mark West	4.6	2,202	-0.4	13.6	8.4%	0.79
	Michelle Way	35.8	581	-2.6	68.0	-5.2%	0.90
May - Sept	Monan's Rill	0.5	298	0.02	0.10	-	-
	Rancho Mark West	4.6	1,017	0.15	0.28	-	-
	Michelle Way	35.8	290	0.32	0.83	-	-

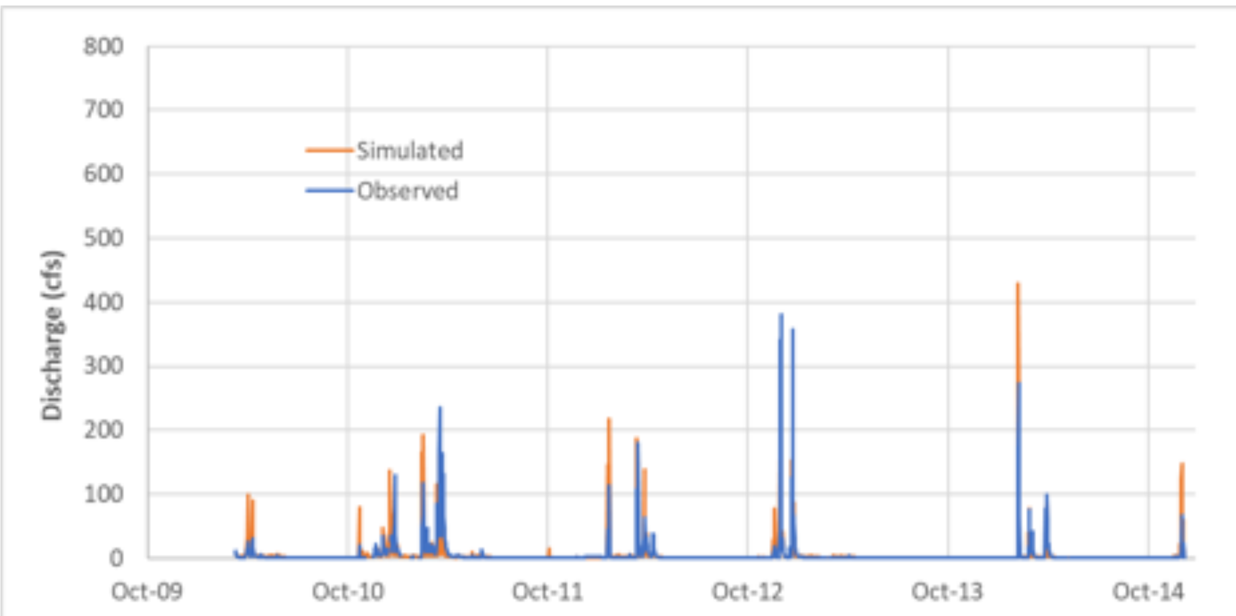


Figure 30: Comparison between model simulated and observed streamflow for the 2010 – 2014 period of record at the Mark West Creek at Rancho Mark West gauge.

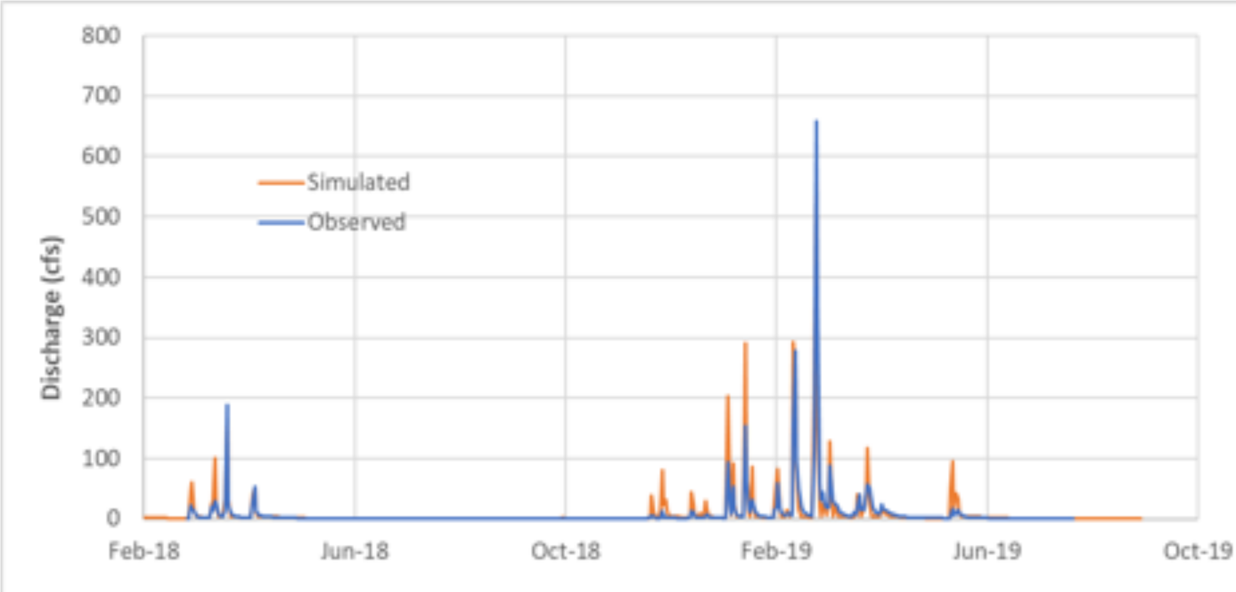


Figure 31: Comparison between model simulated and observed streamflow for the 2018 – 2019 period of record at the Mark West Creek at Rancho Mark West gauge.

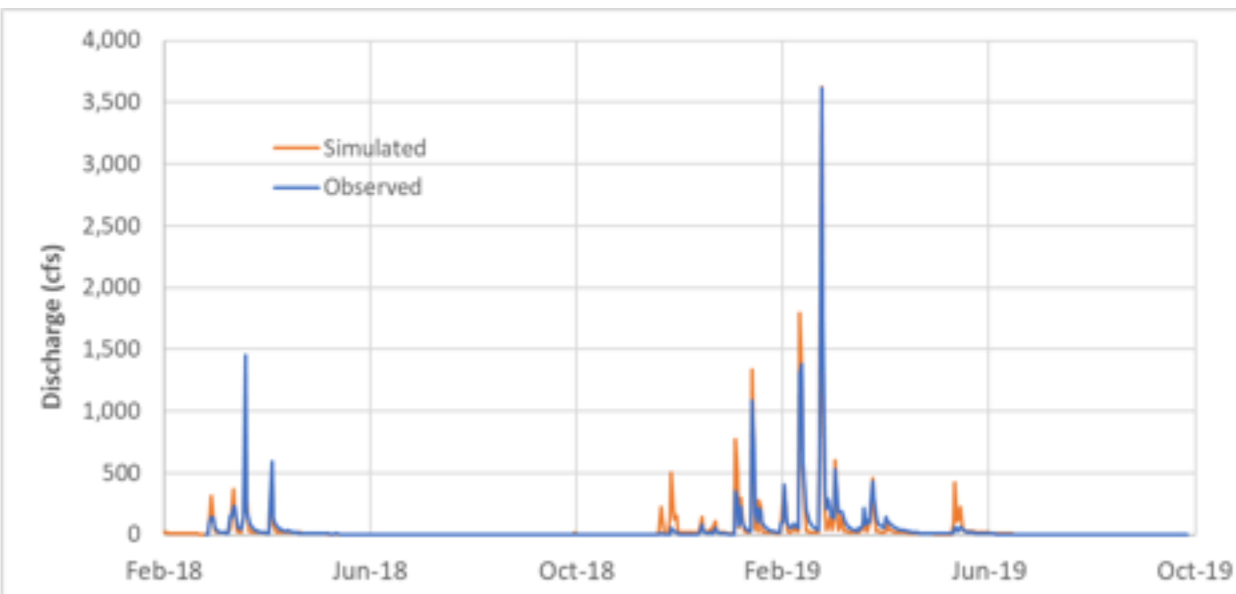


Figure 32: Comparison between model simulated and observed streamflow for the 2018 – 2019 period of record at the Mark West Creek at Michelle Way gauge.

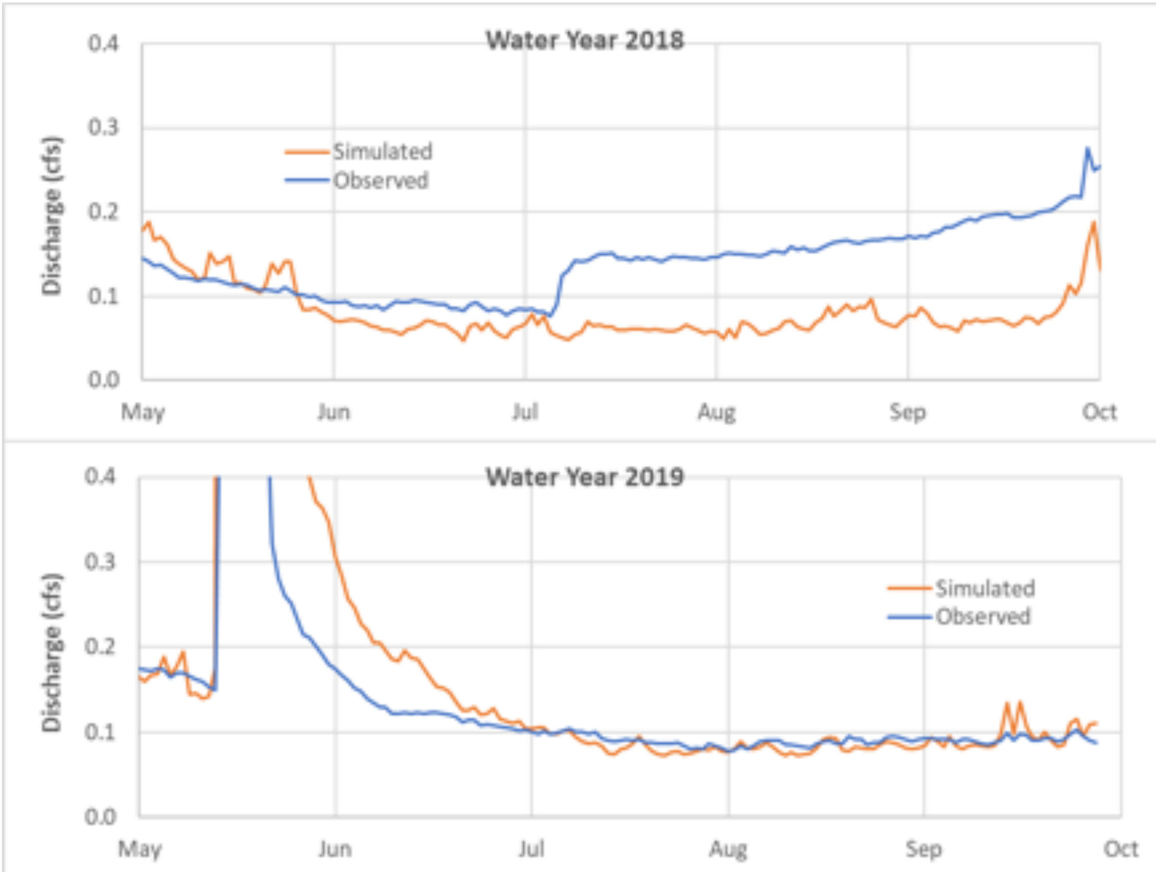
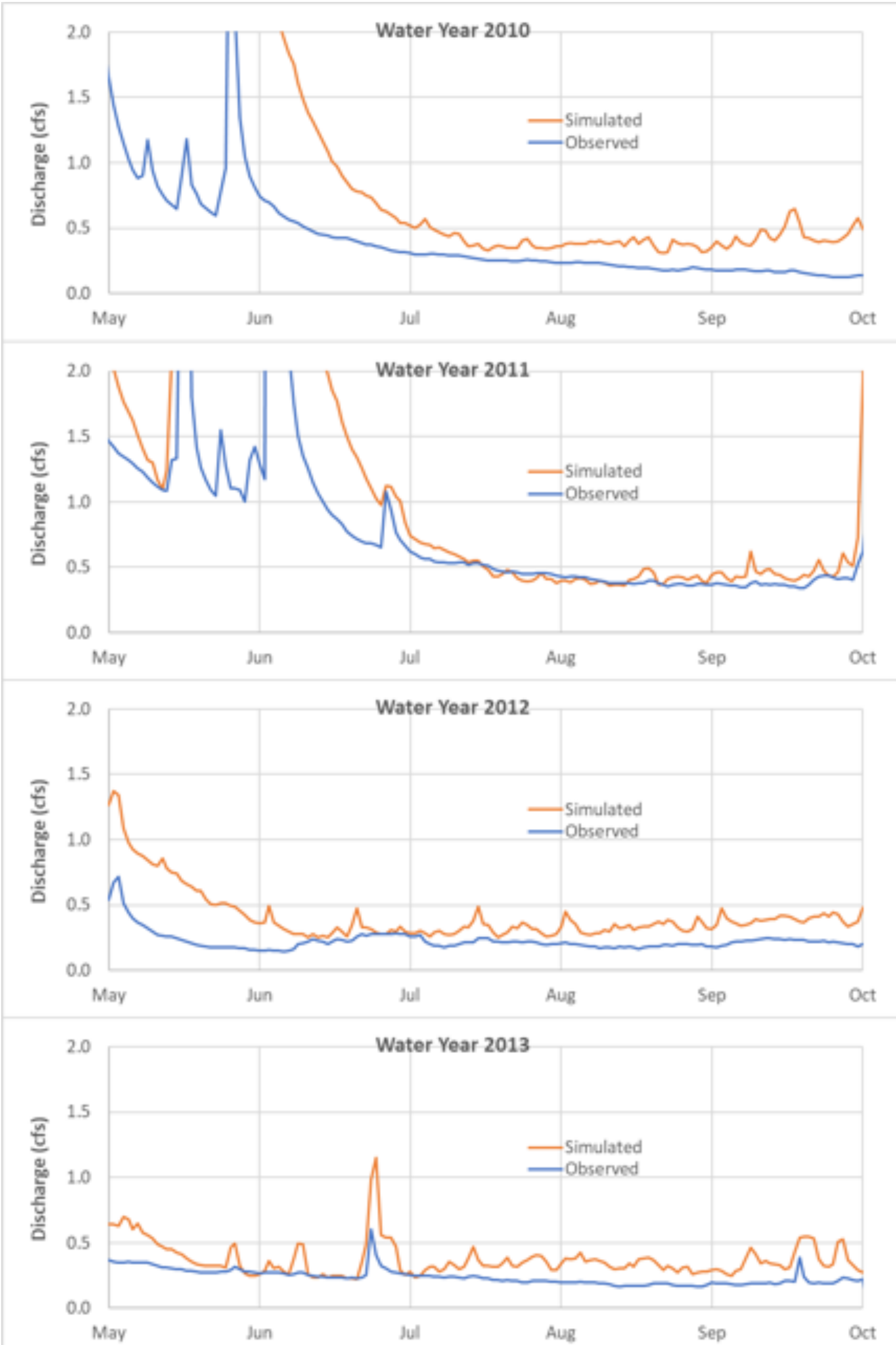


Figure 33: Comparison between model simulated and observed streamflow for the 2018 – 2019 May through September low flow period at the Monan's Rill gauge.


Water Year 2010
Discharge (cfs)
2.0
1.5
1.0
0.5
0.0
May
Jun
Jul
Aug
Sep
Oct
Simulated
Observed
Water Year 2011
Discharge (cfs)
2.0
1.5
1.0
0.5
0.0
May
Jun
Jul
Aug
Sep
Oct
Simulated
Observed
Water Year 2012
Discharge (cfs)
2.0
1.5
1.0
0.5
0.0
May
Jun
Jul
Aug
Sep
Oct
Simulated
Observed
Water Year 2013
Discharge (cfs)
2.0
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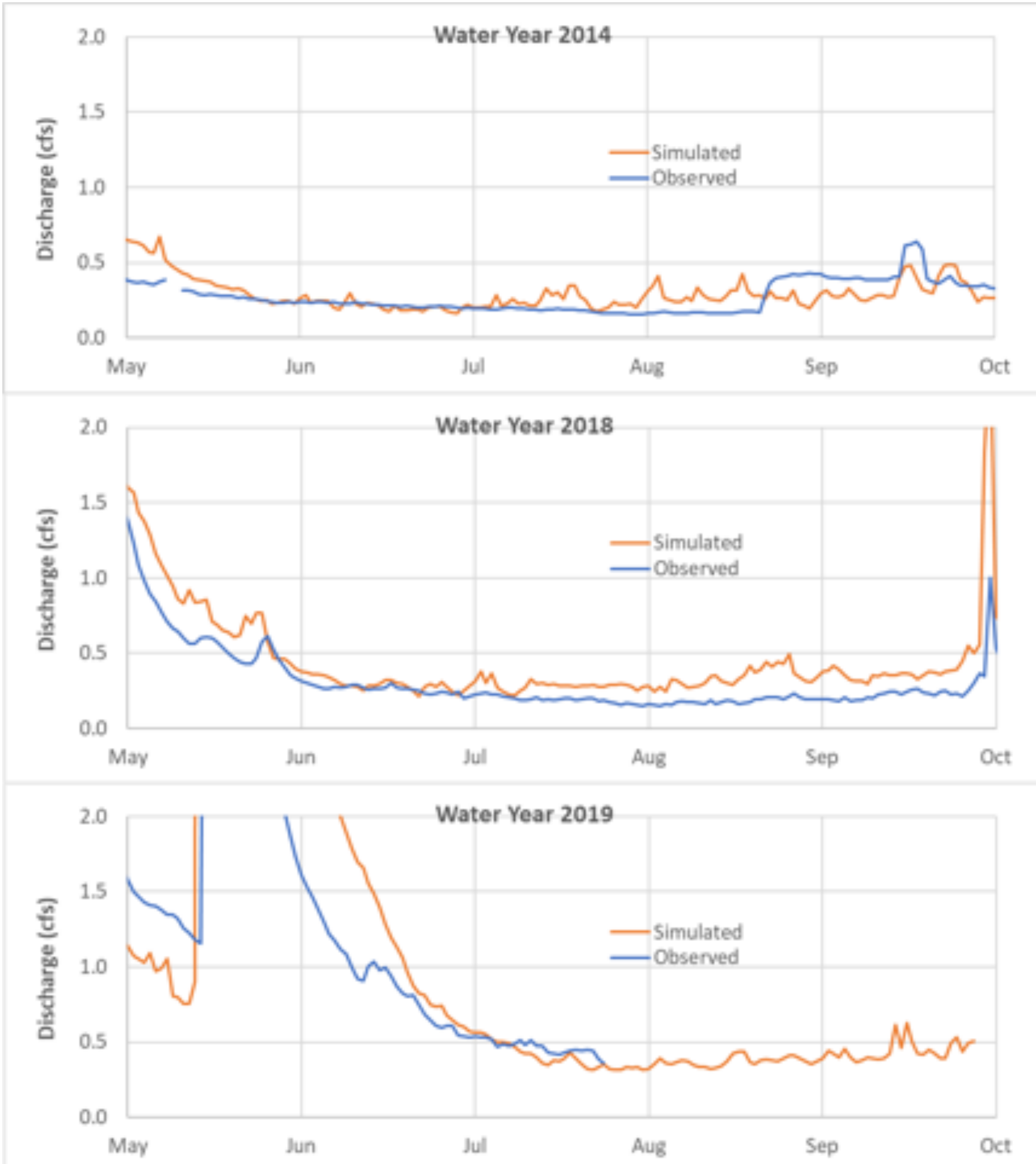


Figure 34: Comparison between model simulated and observed streamflow for the 2010 – 2014 and 2018 – 2019 May through September low flow period at the Mark West Creek at Rancho Mark West gauge.

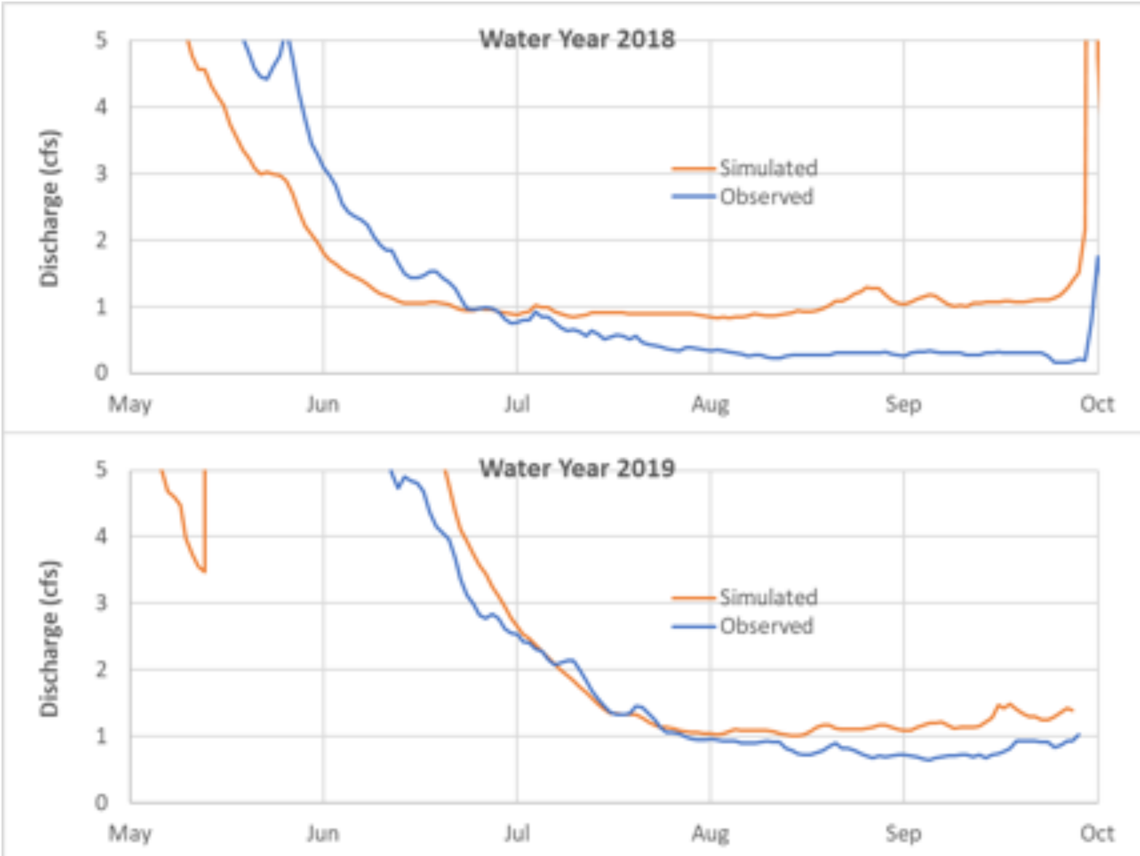


Figure 35: Comparison between model simulated and observed streamflow for the 2018 – 2019 May through September low flow period at the Mark West Creek at Michelle Way gauge.

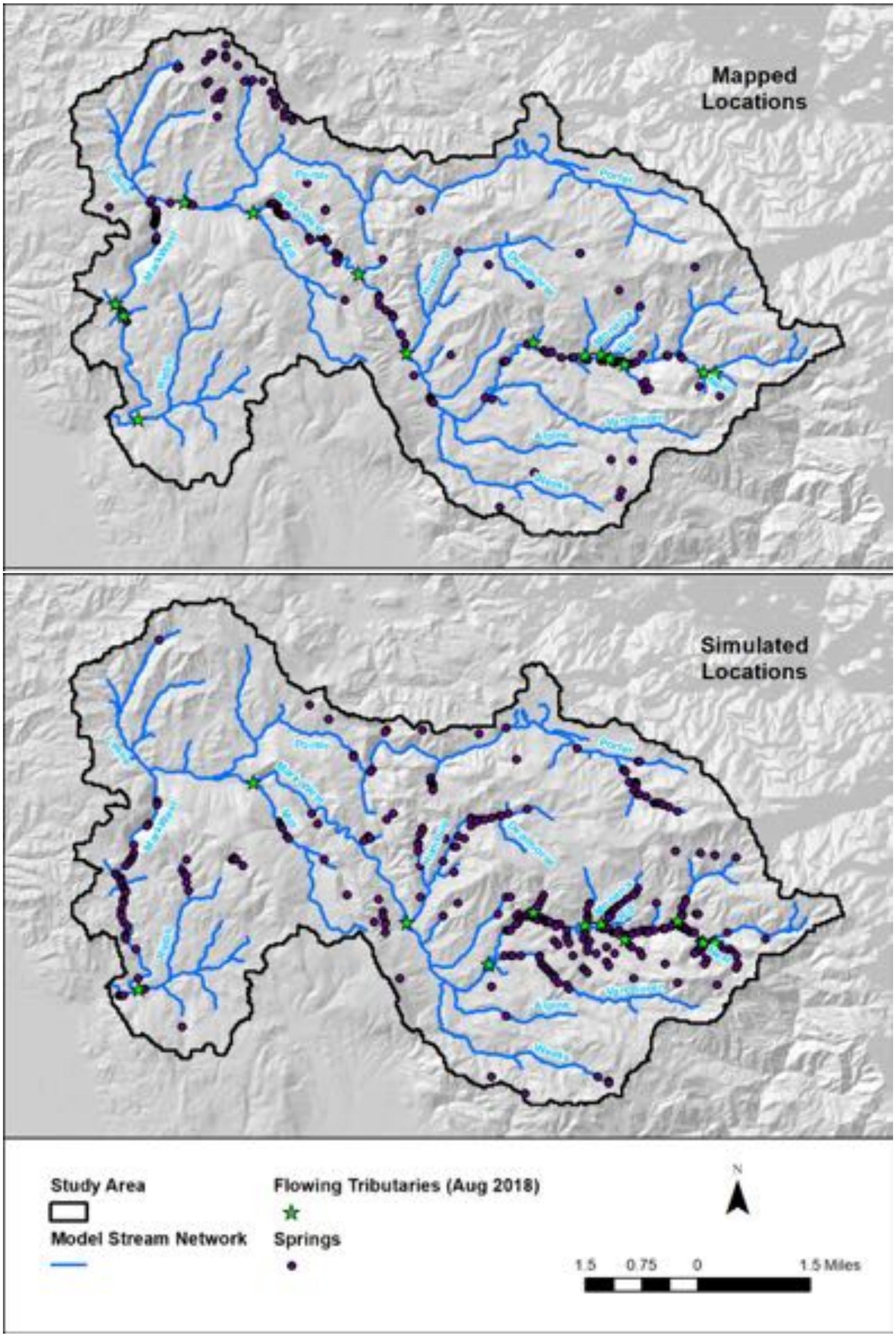


Figure 36: Comparison between known spring locations and locations of perennial springs as simulated in the MWC hydrologic model.

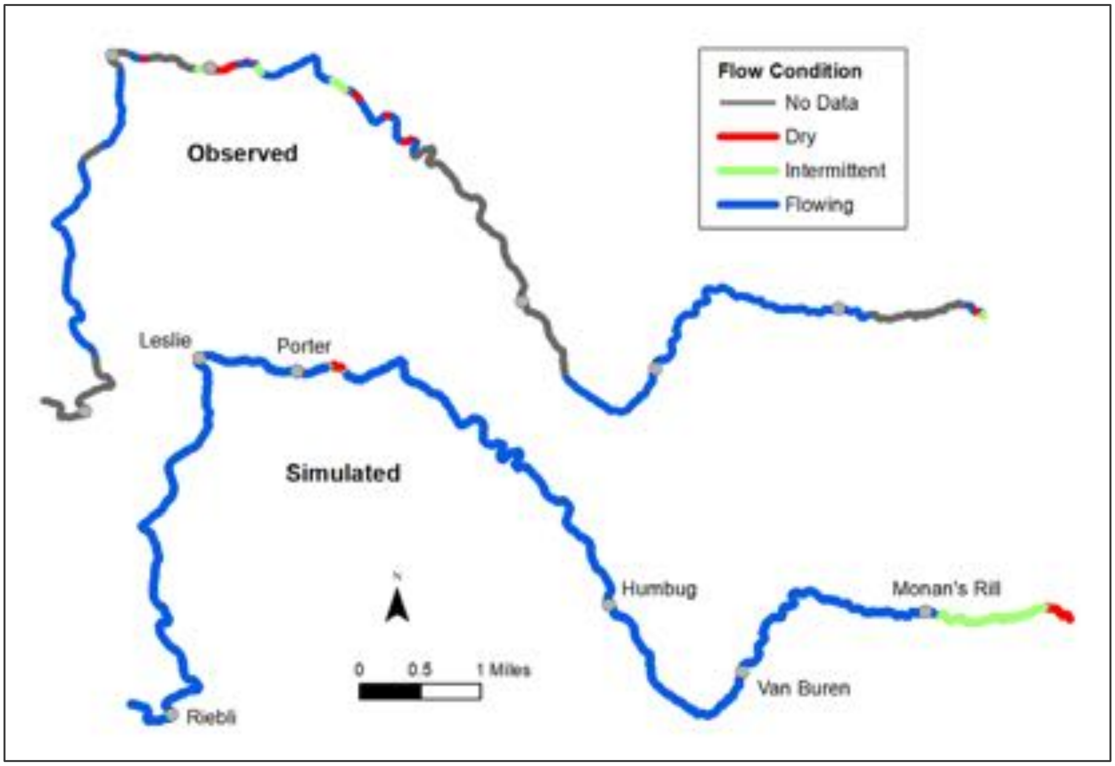


Figure 37: Comparison between observed and simulated late summer flow condition for 2015.

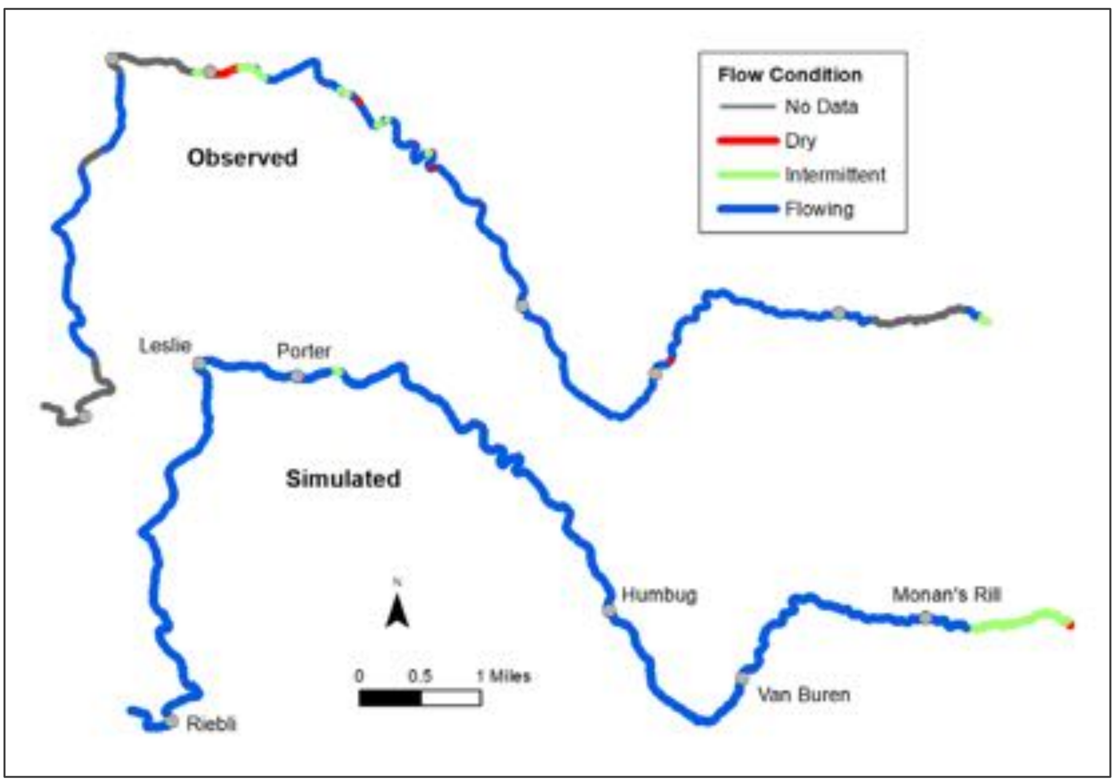


Figure 38: Comparison between observed and simulated late summer flow condition for 2016.

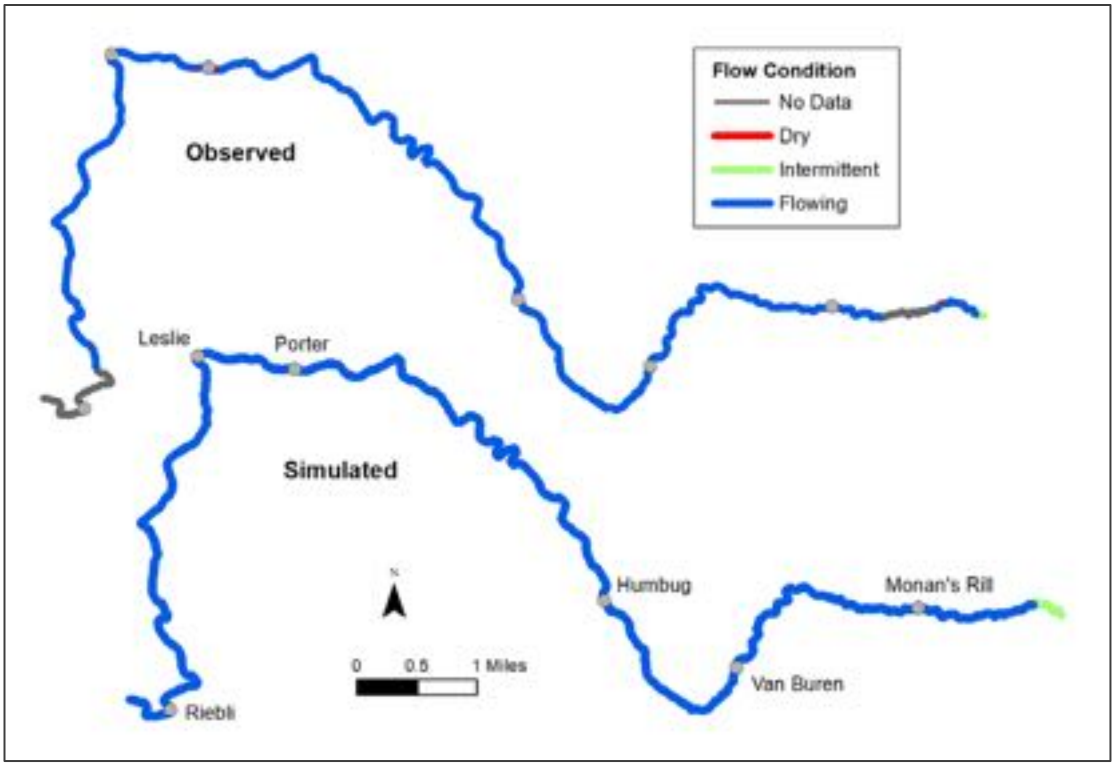


Figure 39: Comparison between observed and simulated late summer flow condition for 2017.

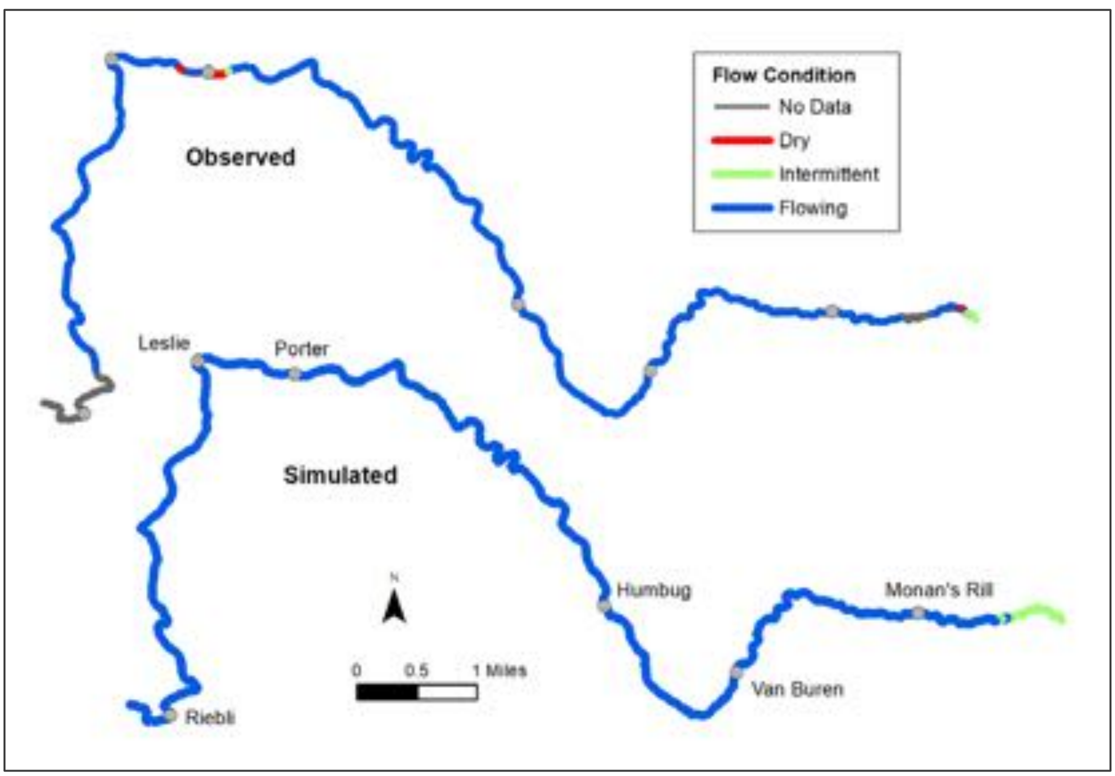


Figure 40: Comparison between observed and simulated late summer flow condition for 2018.

Groundwater Calibration

In order to evaluate the agreement between model simulated groundwater elevations and measured groundwater elevations, Mean Error (ME) and Root Mean Square Error (RMSE) were calculated for the residuals (difference between simulated and observed groundwater elevations) at each of the nine monitoring wells. Due to the limited periods of record at the available monitoring locations it was deemed appropriate to calibrate the model to all of the available data rather than divide the simulation into calibration and validation periods as is more typically done when long-term monitoring data is available. The composite comparison of simulated and measured groundwater elevations is shown in Figure 41. Figure 42 shows the comparison between model-simulated and measured groundwater elevations for each of the seven monitoring wells with available data and calibration statistics are presented in Table 11.

Overall, the observed groundwater elevations are reasonably well-predicted by the model. MEs range from –11.3 to 15.4-ft with an average error of 5.2-ft (Table 11). RMSEs range from 1.1 to 18.6-ft with an average of 9.9-ft. Small seasonal fluctuations occur in all of the wells with maximum elevations generally occurring in March or April and minimum elevations occurring in October or November presumably in response to seasonal recharge patterns. Four of the nine wells (all in the Sonoma Volcanics) show very steady elevations throughout the monitoring period (<3.5-ft annual fluctuation), four show modest fluctuations between 7 and 13-ft, and one shows significant fluctuation on the order of 35-ft (Figure 42). In most cases, the seasonal fluctuations predicted by the model are less than what was observed, with seasonal fluctuations in the model ranging from 0.2-ft to 13.2-ft. Excluding one well with anomalously high fluctuation, the mean seasonal fluctuation simulated in the model was 3.5-ft compared to 6.3-ft based on monitoring observations.

Although the model was able to reproduce observed groundwater elevations with reasonable accuracy, the available monitoring data is very limited both in spatial and temporal extent. Calibration of the groundwater component of the model was also complicated by the difficulties associated with interpreting the observed data which often represents composite head elevations from multiple screened intervals spanning as much as 250-ft. Additional groundwater monitoring from dedicated monitoring wells screened to target specific geologic layers is recommended to support further calibration/validation of the model results with respect to groundwater.

Table 11: Groundwater calibration results for the MWC hydrologic model (see Figure 29 for locations).

Well ID	# Observations	Layer #	ME	RMSE
3	8	2	0.7	3.0
4	11	1	15.0	15.5
5	12	1	-11.3	11.5
7	5	1	-5.7	5.9
8	11	1	15.4	18.6
9	10	1	11.6	12.1
10	11	1	13.9	14.0
11	10	1	7.7	7.8
12	11	1	-0.7	1.1
Mean			**5.2**	**9.9**

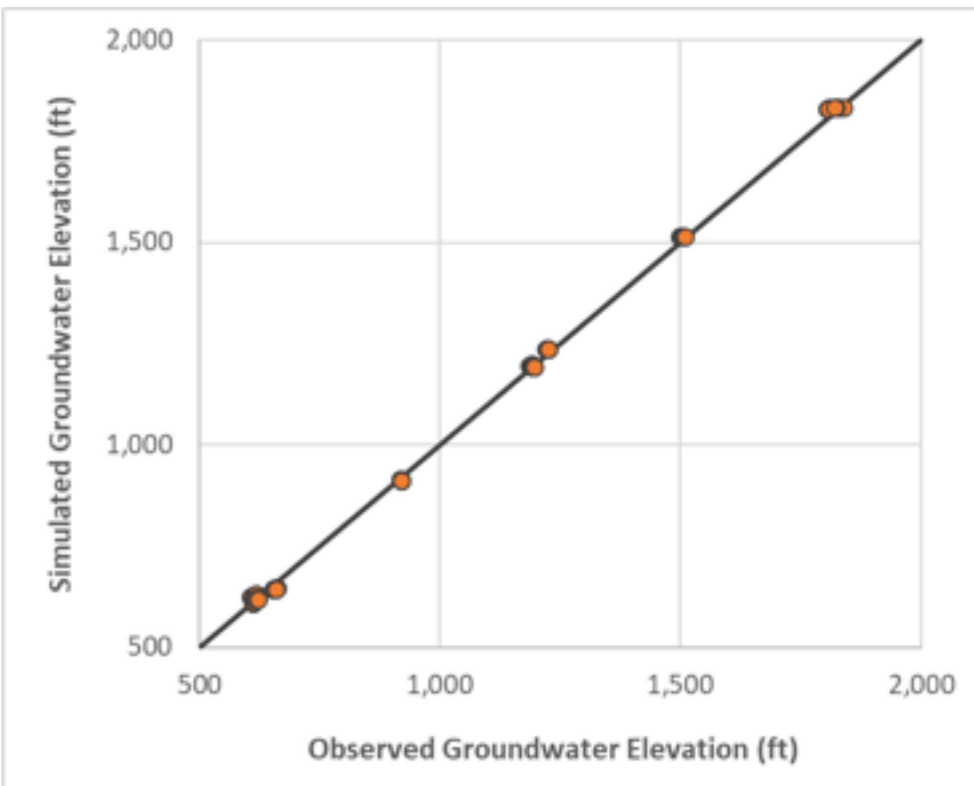
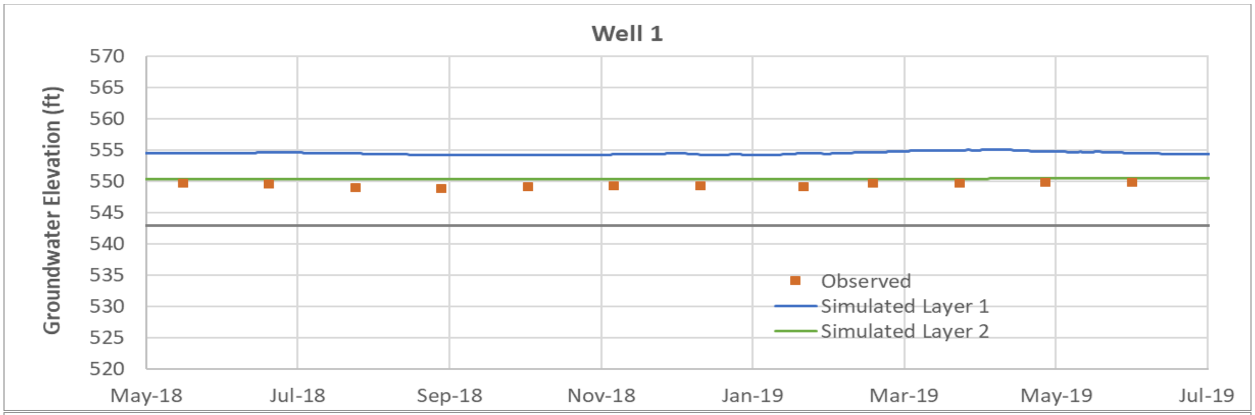
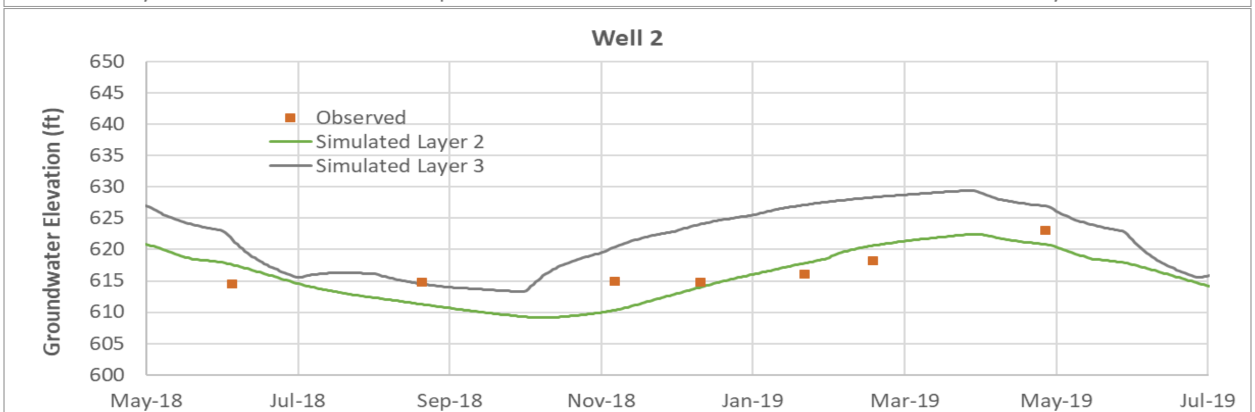
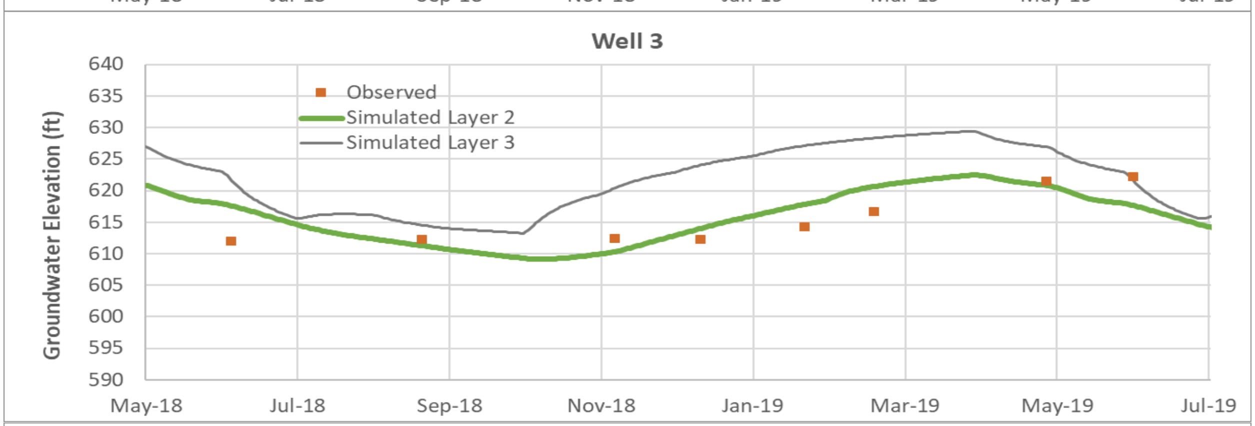
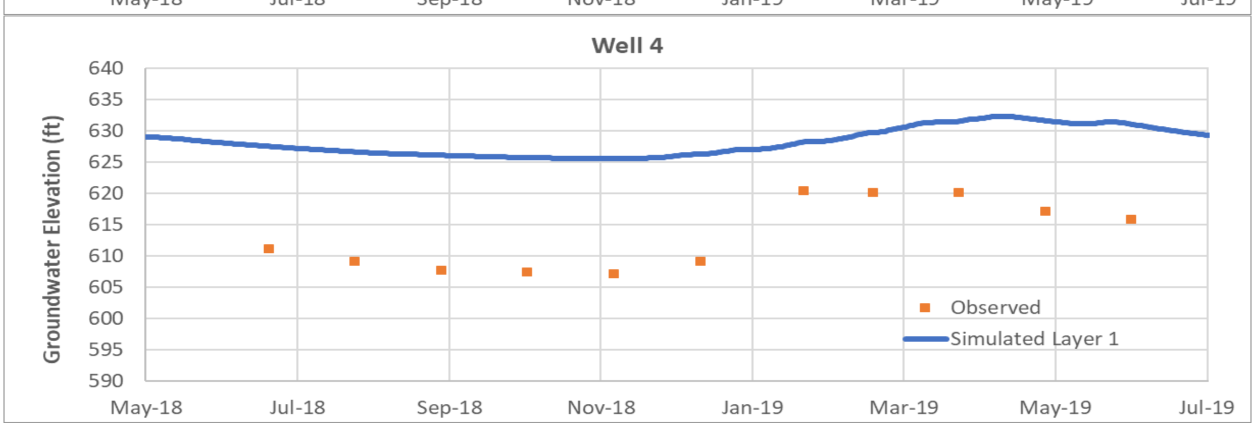


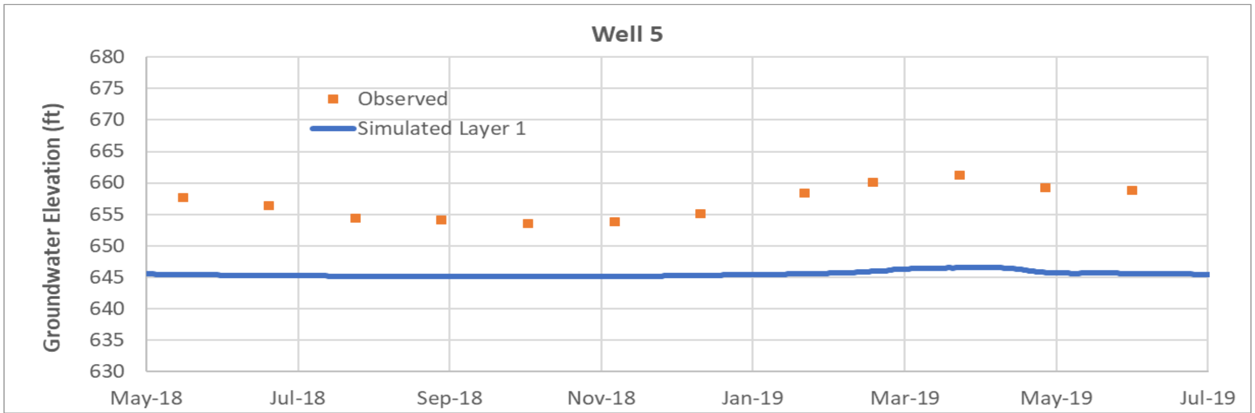
Figure 41: Composite comparison between simulated and observed groundwater elevations (black line shows a 1:1 fit).

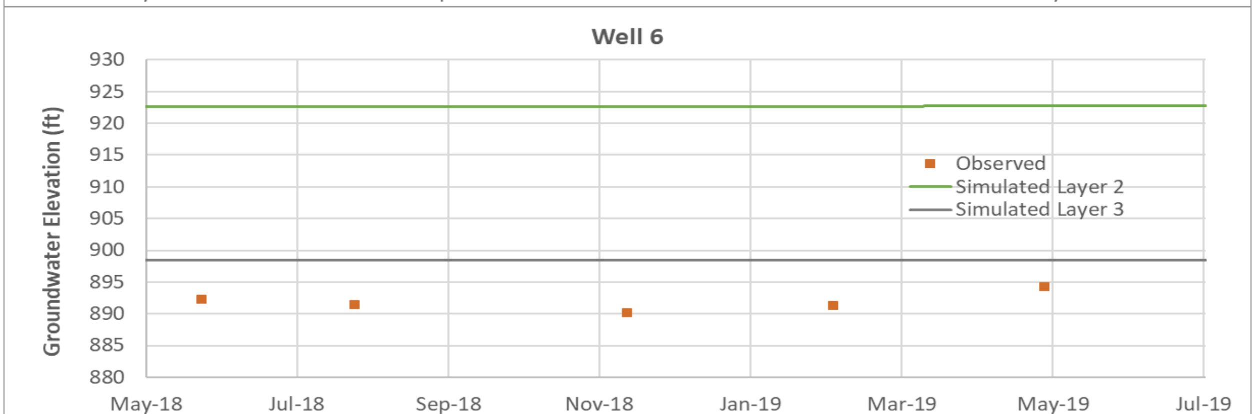

Well 1
Groundwater Elevation (ft)
570
565
560
555
550
545
540
535
530
525
520
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19
Observed
Simulated Layer 1
Simulated Layer 2

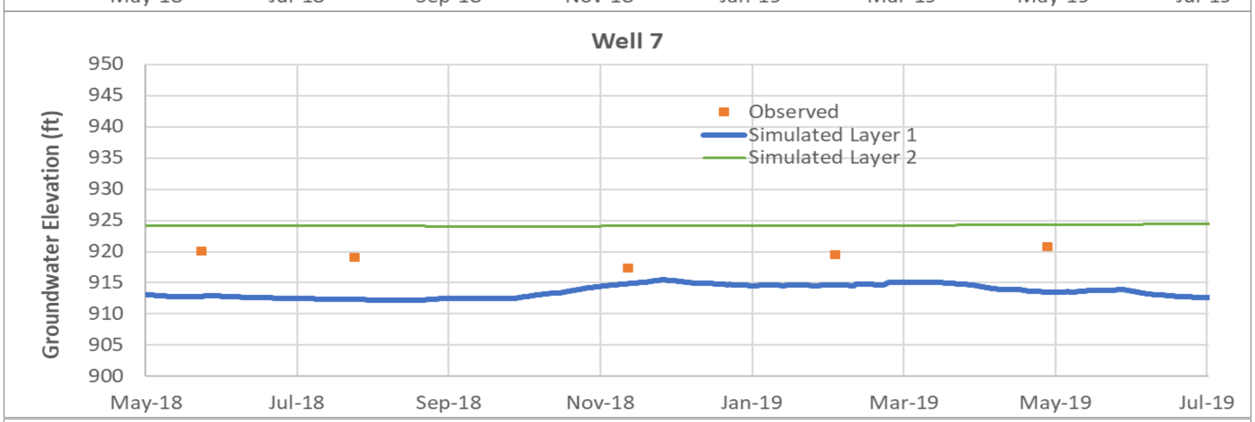

Well 2
Groundwater Elevation (ft)
650
645
640
635
630
625
620
615
610
605
600
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19
Observed
Simulated Layer 2
Simulated Layer 3

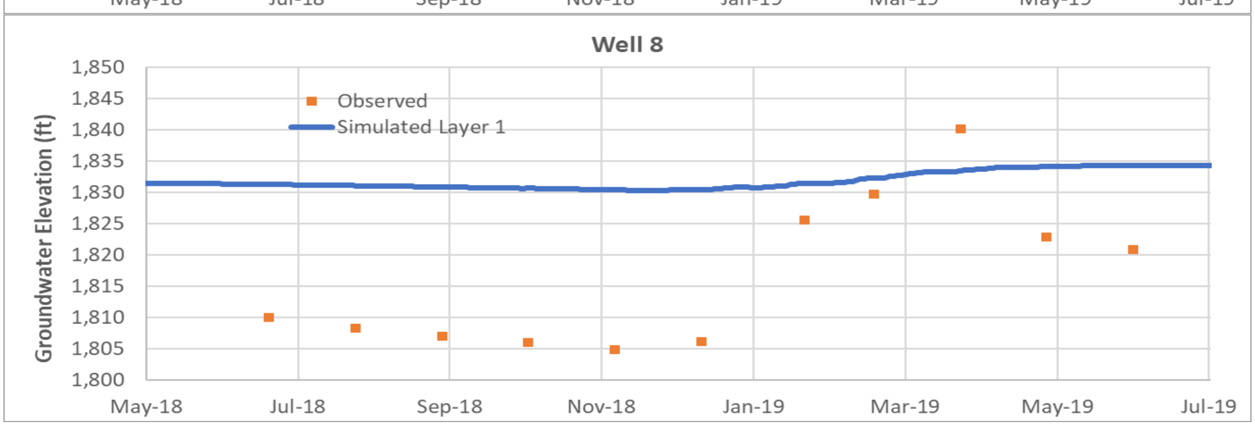

Well 3
Groundwater Elevation (ft)
640
635
630
625
620
615
610
605
600
595
590
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19
Observed
Simulated Layer 2
Simulated Layer 3


Well 4
Groundwater Elevation (ft)
640
635
630
625
620
615
610
605
600
595
590
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19
Observed
Simulated Layer 1


Well 5
Groundwater Elevation (ft)
680
675
670
665
660
655
650
645
640
635
630
Observed
Simulated Layer 1
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19


Well 6
Groundwater Elevation (ft)
930
925
920
915
910
905
900
895
890
885
880
Observed
Simulated Layer 2
Simulated Layer 3
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19


Well 7
Groundwater Elevation (ft)
950
945
940
935
930
925
920
915
910
905
900
Observed
Simulated Layer 1
Simulated Layer 2
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19


Well 8
Groundwater Elevation (ft)
1,850
1,845
1,840
1,835
1,830
1,825
1,820
1,815
1,810
1,805
1,800
Observed
Simulated Layer 1
May-18
Jul-18
Sep-18
Nov-18
Jan-19
Mar-19
May-19
Jul-19

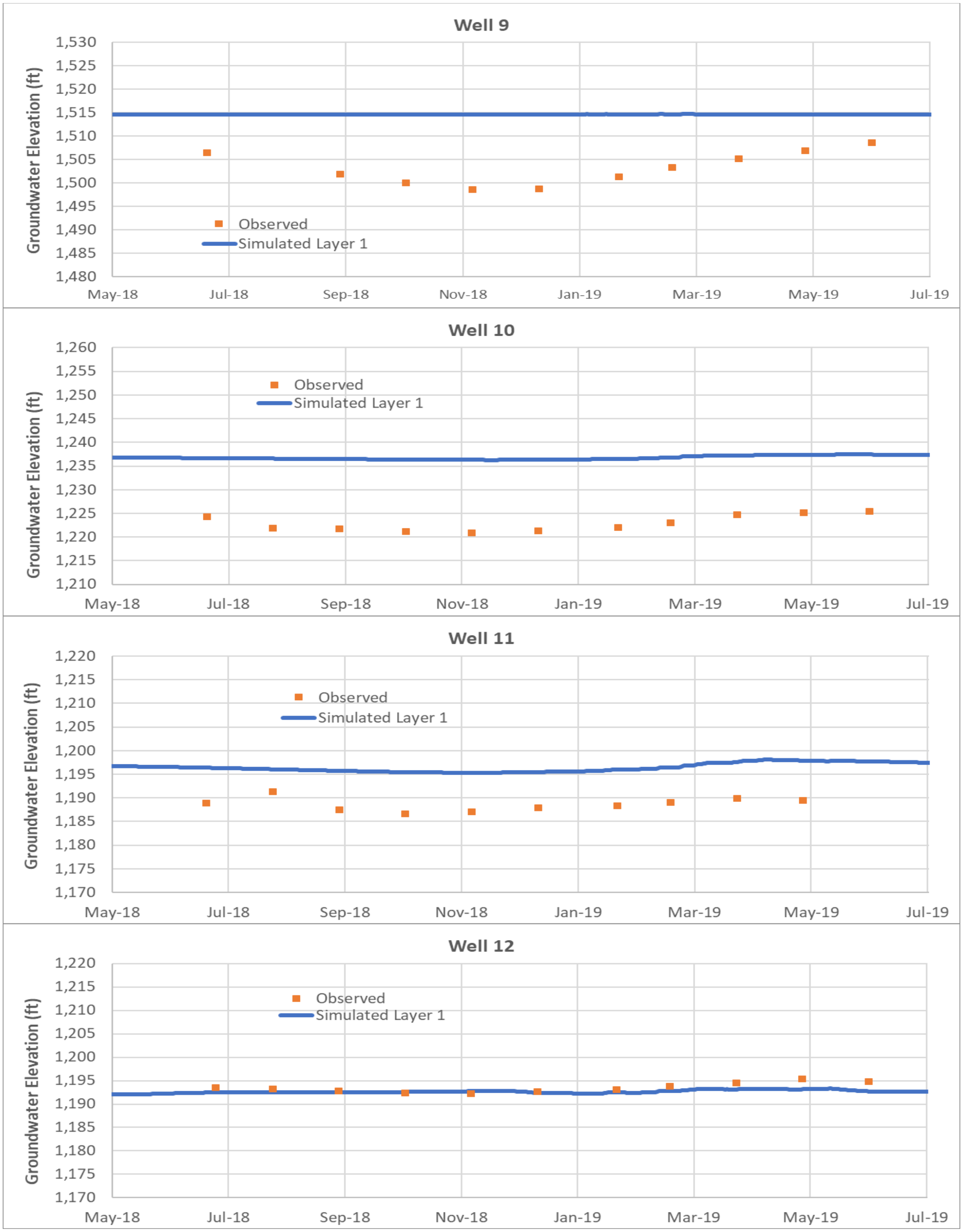


Figure 42: Comparisons between model simulated and observed groundwater elevations (thicker lines indicate simulated data used for calibration).

Chapter 6 – Model Results

Water Balance

A description of the water balance is one of the most fundamental outputs from the model. Water balance information can be extracted for the full study area or for any subarea. A water balance may be highly detailed (e.g. decompose ET into interception, evaporation, transpiration from the unsaturated zone, and transpiration from groundwater) or more general, and can be developed for the watershed as a whole or for a specific component of the hydrologic system such as the saturated zone. A general annual water balance for the whole watershed and a more detailed groundwater water balance have been developed for each of the simulated Water Years of 2010 - 2019. A monthly water budget is also presented for selected water budget terms as are maps depicting the spatial variations of key water budget components.

Watershed Water Balance

The primary inflow to the upper MWC watershed is precipitation, which ranged from 19.5 inches in the dry water year of 2014 to 61.2 inches in the wet water year of 2017 (Table 12). Irrigation is a minor additional source of inflow (0.07 in/yr) and it was uniform between water years owing to the way irrigation demands were estimated. Except for the two wettest years of the simulation (2017 & 2019) when streamflow exceeded Actual Evapotranspiration (AET), AET was the largest outflow from the watershed. Variations in AET were significantly less than variations in precipitation and ranged from 14.1 inches in 2014 to 24.1 inches in 2010 (Table 12). Stream flow was the next largest outflow from the watershed, and it varied substantially and in a similar fashion to precipitation ranging from 8.3 inches in 2014 to 32.8 inches in 2017. Groundwater pumping was approximately two orders of magnitude less than AET or stream flow (0.15 in/yr) and was relatively uniform owing to the way water demands were estimated. The watershed boundaries were represented as no-flow boundaries in all components of the model, therefore there are no external inflow or outflow terms in the water budget. Increases in storage of up to 6.9 inches occurred during the wet water year of 2017 and decreases in storage of up to 3.0 inches occurred during the dry water year of 2014 (Table 12).

Groundwater Water Balance

Infiltration recharge represented the largest source of inflow to the groundwater system in the MWC watershed and varied widely as a function of precipitation from 0.8 inches in 2014 to 10.1 inches in 2017 (Table 13). In contrast, streambed recharge was relatively constant ranging from 0.5 to 1.0 inches. In most water years, infiltration recharge is several times larger than streambed recharge. Under drought conditions such as occurred in 2014, streambed recharge becomes a more significant fraction of the total recharge accounting for about 38% of total recharge. Approximately half of the total recharge leaves the groundwater system quickly as interflow, which is the largest source of groundwater outflow varying from approximately 1.1 to 4.3 inches (Table 13). ET from groundwater was the next largest outflow term and was relatively uniform ranging from 0.8 to 1.1 inches.

Springflow and baseflow are also significant outflow terms. Both represent groundwater discharge in the model with the former representing discharge to the land surface or along unsaturated stream banks and the later representing discharge through the bed and wetted banks of the stream. Both of these discharge components were relatively uniform with springflow ranging from 0.5 to 1.0 inches and baseflow ranging from 0.5 to 0.9 inches (Table 13). Baseflow and streambed recharge are approximately equal in magnitude, thus the net gain in groundwater discharge through the bed and wetted banks of streams is near zero when averaged across the watershed; this highlights the importance of springflow as the key mechanism for sustaining summer streamflows in the watershed. Groundwater pumping was a relatively small component (~3%) of the total outflow at 0.15 inches, and there are no subsurface inflows or outflows owing to the no-flow boundary assumption used in the model. Storage decreases of up to 2.2 inches occurred in dry years such as 2014 and storage increases of up to 4.7 inches occurred in wet years such as 2017 (Table 13).

Table 12: Annual watershed water budget simulated with the MWC hydrologic model; all units are inches.

	Inflows		Outflows			
Water Year	**Precipitation**	**Irrigation**	**AET**	**Streamflow**	**Groundwater Pumping**	**Change in Storage**
2010	42.51	0.07	24.06	17.14	0.15	1.23
2011	43.97	0.07	23.13	17.92	0.15	2.84
2012	28.07	0.07	20.07	10.67	0.15	-2.76
2013	28.87	0.07	17.58	12.83	0.15	-1.62
2014	19.46	0.07	14.06	8.30	0.15	-2.97
2015	26.57	0.07	14.94	12.74	0.15	-1.19
2016	33.30	0.07	17.30	13.83	0.15	2.09
2017	61.18	0.07	21.47	32.75	0.15	6.88
2018	26.59	0.07	18.93	9.07	0.15	-1.49
2019	49.77	0.07	21.63	23.44	0.15	4.62
Average	**36.03**	**0.07**	**19.32**	**15.87**	**0.15**	**0.76**

Table 13: Annual groundwater water budget simulated with the MWC hydrologic model; all units are inches.

	Inflows		Outflows					
Water Year	**Infiltration Recharge**	**Streambed Recharge**	**Interflow**	**Baseflow**	**Springflow**	**ET from Groundwater**	**Groundwater Pumping**	**Change in Storage**
2010	6.05	0.71	4.29	0.76	0.58	0.82	0.15	0.16
2011	7.49	0.70	4.00	0.80	0.62	0.89	0.15	1.73
2012	2.22	0.57	1.72	0.63	0.84	1.08	0.15	-1.63
2013	2.39	0.58	2.19	0.60	0.68	0.98	0.15	-1.62
2014	0.84	0.52	1.09	0.50	0.76	1.06	0.15	-2.19
2015	2.10	0.66	1.53	0.59	0.67	1.02	0.15	-1.20
2016	4.44	0.60	2.55	0.67	0.48	0.75	0.15	0.44
2017	10.12	1.03	3.39	0.86	0.97	1.07	0.15	4.72
2018	2.87	0.53	1.91	0.62	0.72	1.06	0.15	-1.05
2019	8.17	1.03	3.48	0.83	0.99	0.99	0.15	2.76
Average	**4.67**	**0.69**	**2.61**	**0.69**	**0.73**	**0.97**	**0.15**	**0.21**

Spatial and Temporal Variations of Water Budget Components

The monthly water balance results illustrate the strong seasonality of precipitation and streamflow typical of Mediterranean climates (Figure 43). As a result of the seasonal fluctuations in Potential Evapotranspiration and soil moisture availability, AET was generally lowest during the late fall and early winter and highest during the spring, progressively decreasing throughout the summer months as available soil moisture diminished (Figure 43). During average and wet water years, infiltration recharge occurred in most months between November and April, whereas in the drought conditions of 2014, recharge only occurred during the month of February (Figure 43). The number of days with significant (>0.1-in) recharge varied widely between 4 days in 2014 and 34 days in 2017.

Significant variations in infiltration recharge occur across the watershed with much of the watershed generating less than 2 in/yr and portions of the upper watershed generating more than 20 in/yr (Figure 44). Numerous factors affect the recharge rates, however the spatial variations in recharge appear to be primarily controlled by soil properties, topographic position, and the west to east precipitation gradient. Recharge is concentrated in the upper Mark West Creek watershed upstream of and including the Van Buren Creek watershed, as well as in the upper Humbug Creek watershed (Figure 44). Higher recharge rates also occur locally in portions of the central Porter Creek watershed, and the upper Leslie Creek and upper Reibli Creek watersheds, although recharge rates in these watersheds are generally low. Small negative recharge rates (indicative of net groundwater discharge) occur along valley-bottom areas particularly in the lower watershed (Figure 44). As discussed earlier, recharge only occurred during four days during a single month in the drought of 2014, and much of the watershed experienced negative or near-zero recharge (Figure 45).

As discussed earlier, groundwater discharge occurs in the model both as springflow (subaerial discharge) and as baseflow (subaqueous discharge). Across the entire watershed, springflow is responsible for generating most of the summer streamflow given that net groundwater discharge in the spring and summer months is near zero (e.g. streambed recharge ≈ baseflow discharge). Locations of perennial springflow were discussed previously as part of the calibration discussion in Chapter 5 (see Figure 36). The spatial patterns of surface water/groundwater interaction indicate that gaining conditions predominate throughout the spring and summer months in much the upper watershed upstream of Van Buren Creek, as well as in upper Humbug Creek, portions of upper and central Porter Creek, and lower Mark West Creek below Leslie Creek (Figure 46 & Figure 47). During spring, losing conditions occur in Mark West Creek upstream of Porter Creek, and in the lowest portions of many of the tributary watersheds, notably Porter Creek and Weeks Creek (Figure 46). By late summer, most of the losing reaches in the tributary streams become inactive as streamflows drop to zero (Figure 47). The area overlying the deepest alluvial body in the watershed near and upstream of the confluence of Mark West and Porter Creeks is the most active area in terms of surface water/groundwater interaction. Losing conditions persist throughout the summer months in this area, however the effect on streamflow is localized given that most of the flow loss returns to the stream as baseflow where the alluvium pinches out downstream (Figure 47).

AET varies substantially throughout the watershed, and in most locations rates range from about 10 to 30 in/yr. AET as high as 50 in/yr occurs locally along certain stream channels where transpiration of riparian vegetation is not limited by soil moisture availability due to accessibility of shallow groundwater (Figure 48). Spatial variability of AET is primarily a function of variability in available soil moisture and vegetation water requirements, with the two factors being inextricably linked. Climatic water deficit (CWD) is defined as the difference between PET and AET and is a useful metric for describing the seasonal moisture stress. In the 10-yr average condition the annual CWD ranged from 15 to 40 in/yr across most of the watershed, except locally where rates were near zero due to accessibility of shallow groundwater and associated insensitivity to soil moisture availability (Figure 49). Topographic aspect appears to be a primary control on the spatial variability of CWD with north-facing slopes characterized by lower PET having significantly lower CWD values relative to south-facing slopes. During the drought of 2014, CWD values increased substantially to between 30 and 50 in/yr across most of the watershed (Figure 50). The 10-yr mean CWD across the watershed was 26.0 in/yr compared to 32.7 in/yr in 2014.

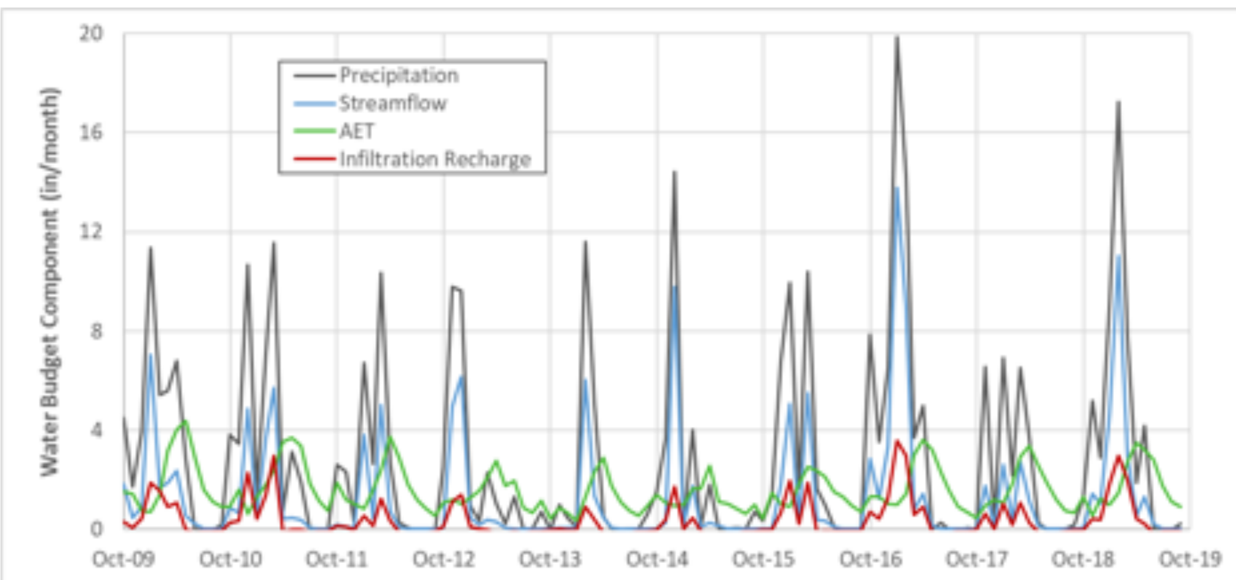


Figure 43: Monthly variation in select water budget components simulated with the MWC hydrologic model.

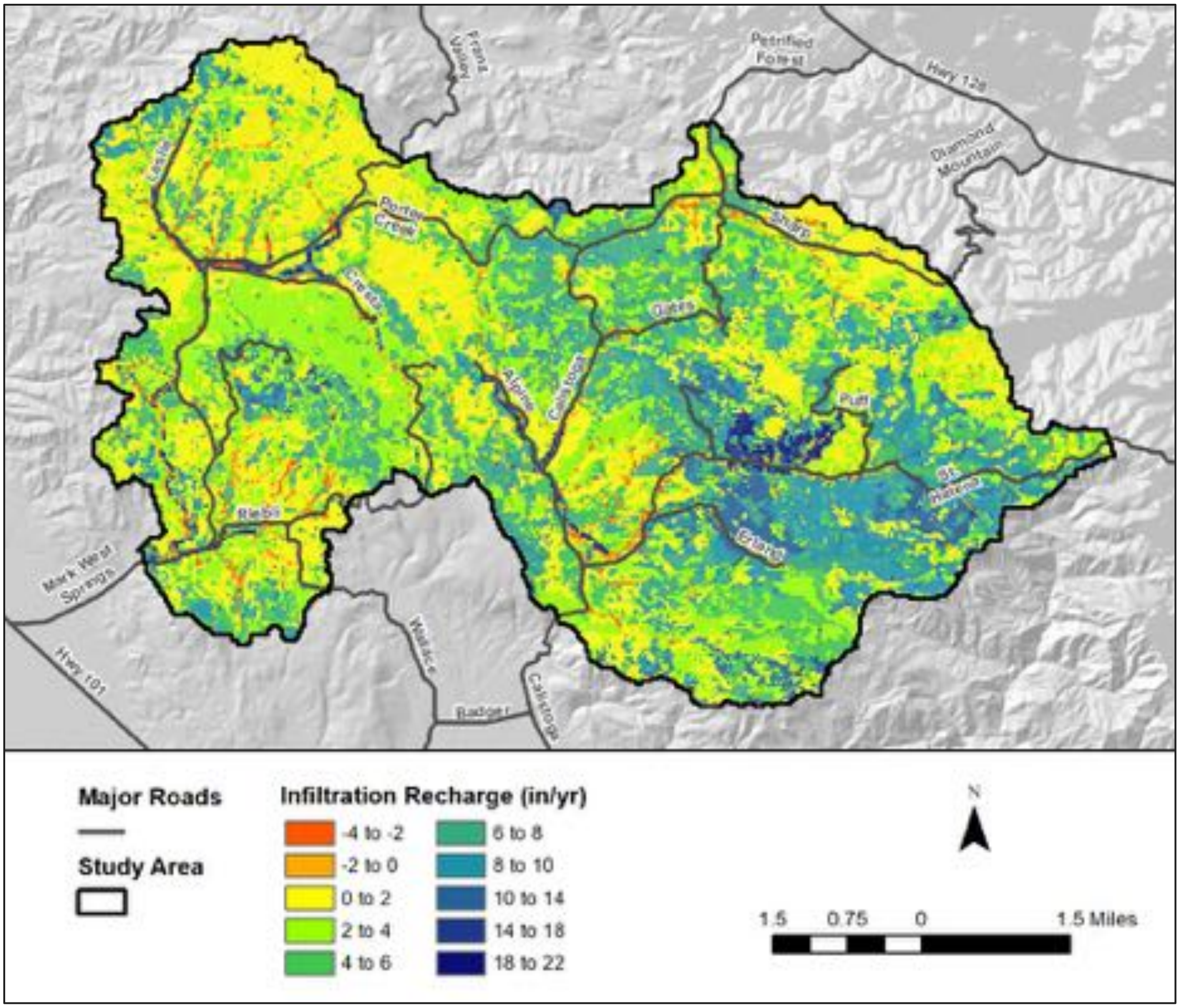


Figure 44: Mean annual infiltration recharge for water years 2010-2019 simulated with the MWC hydrologic model.

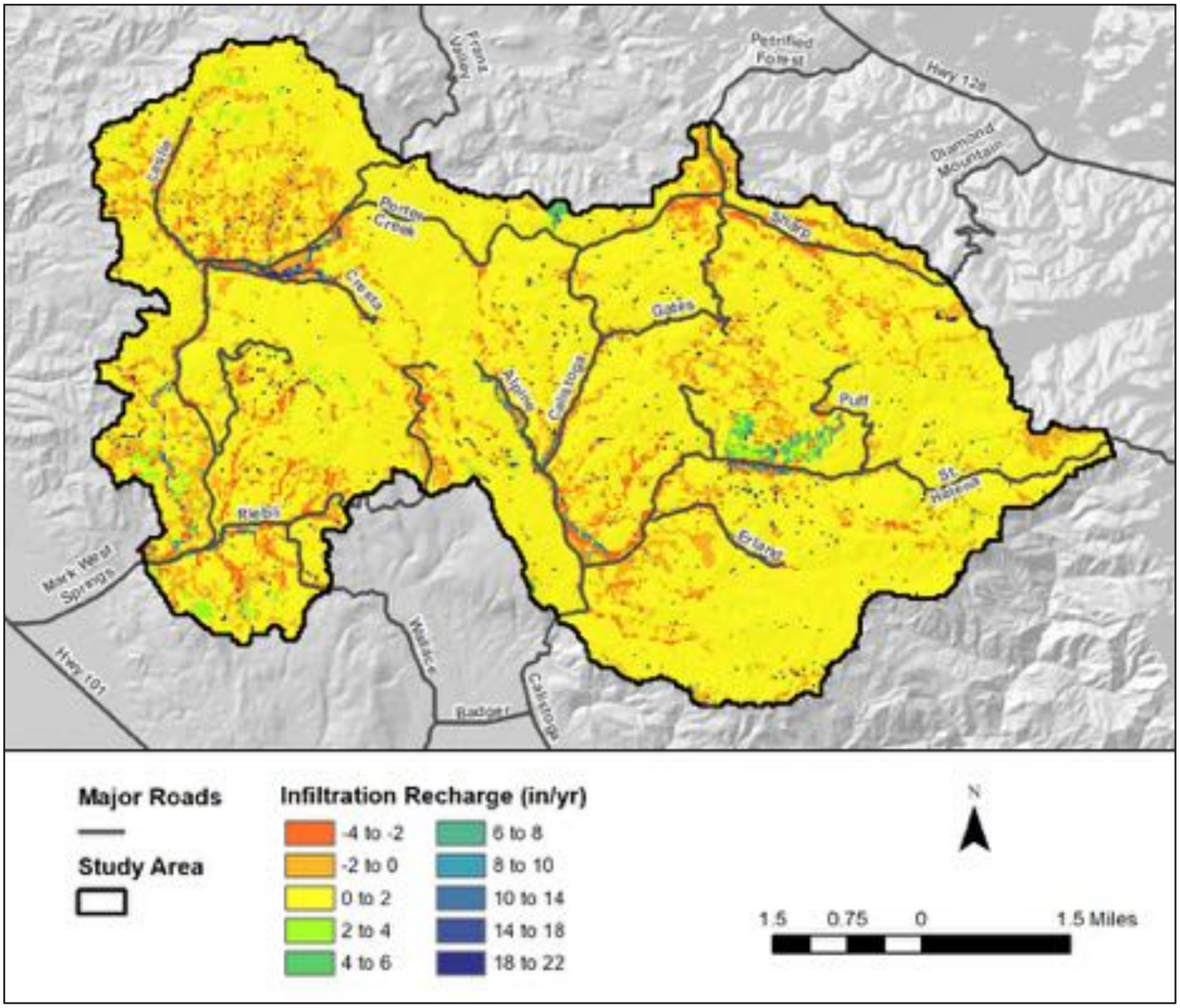


Figure 45: Infiltration recharge for water year 2014 simulated with the MWC hydrologic model.

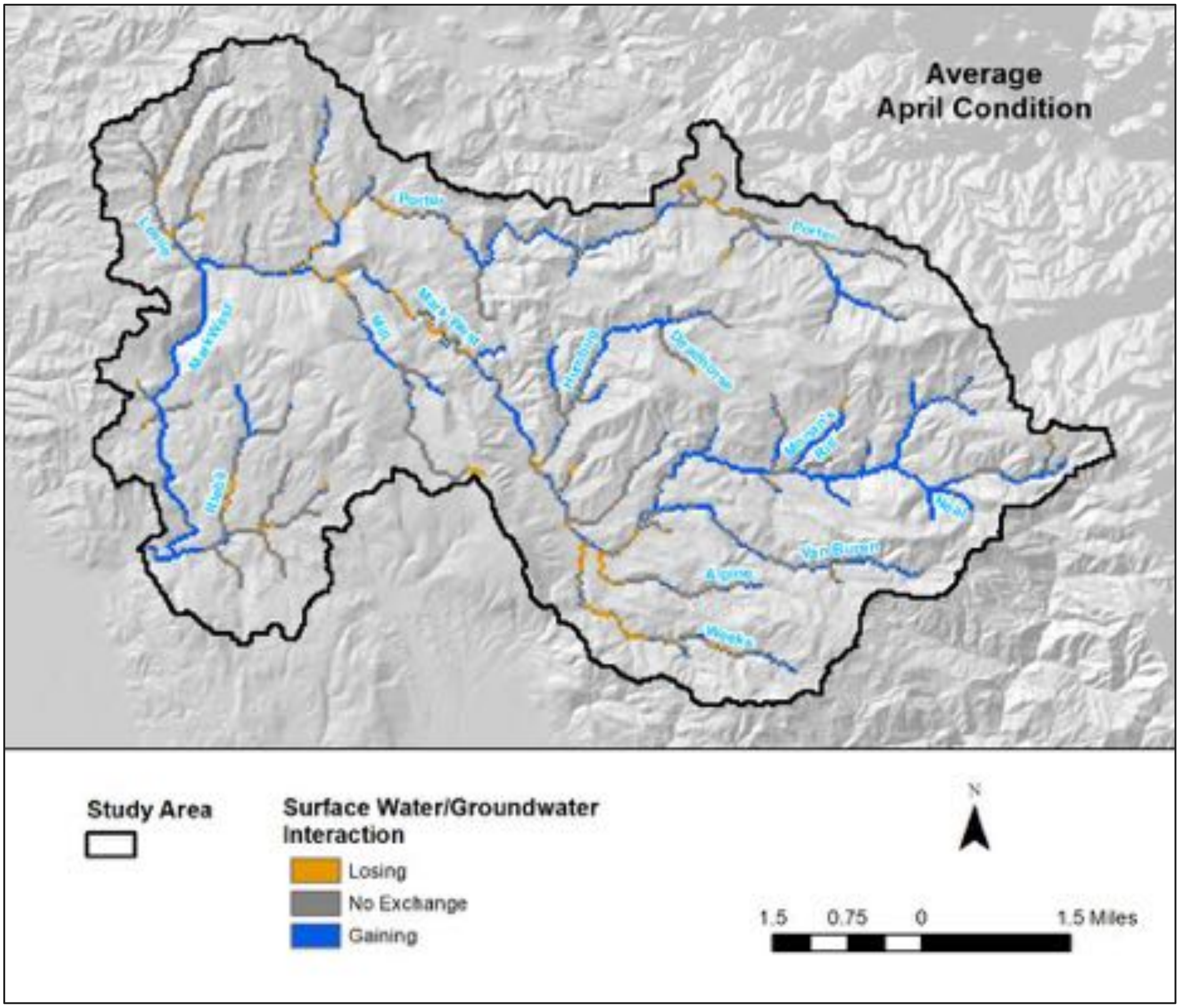


Figure 46: Extent of gaining and losing reaches for the month of April (2010-2019 mean value) as simulated with the MWC hydrologic model.

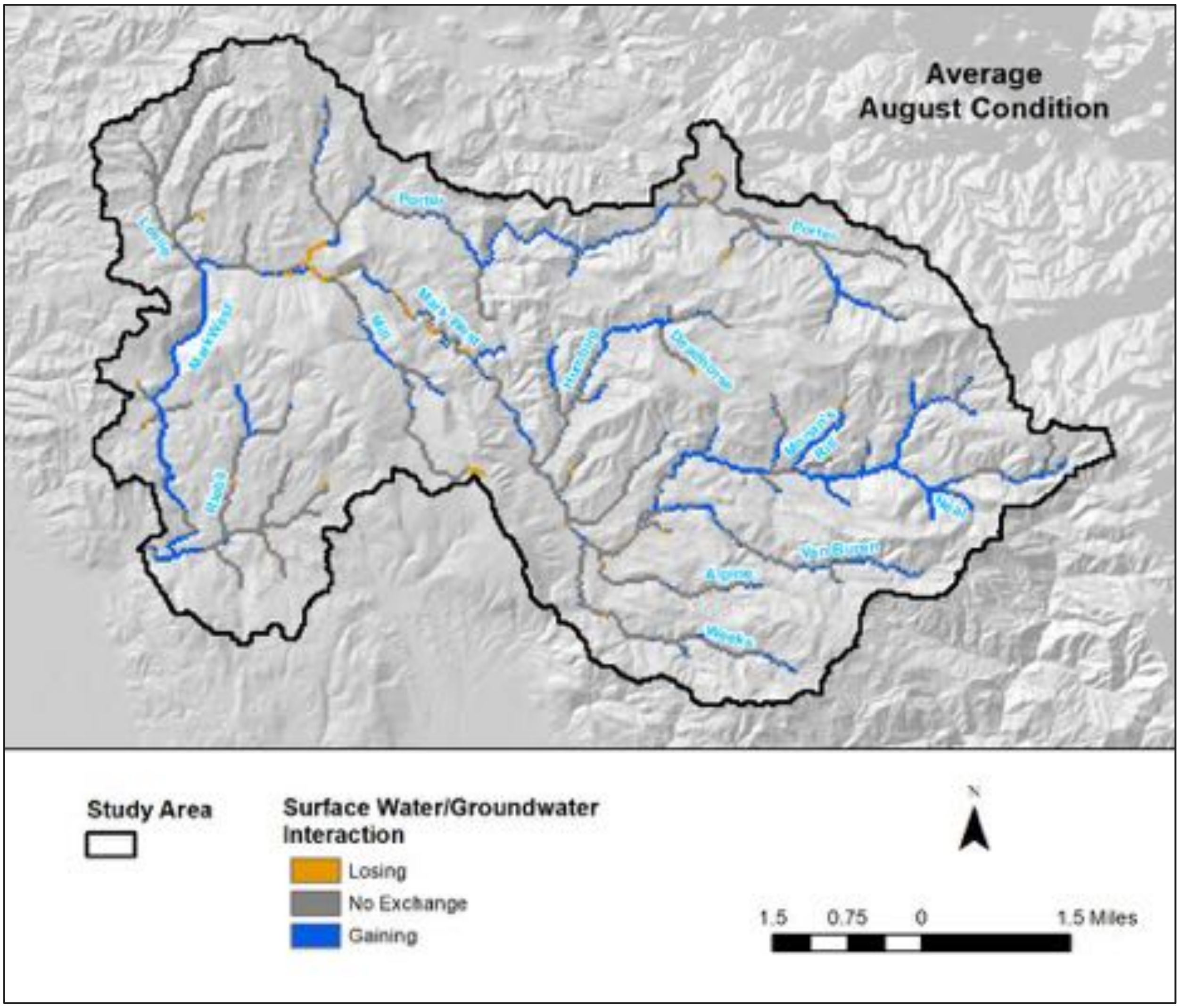


Figure 47: Extent of gaining and losing reaches for the month of August (2010-2019 mean value) as simulated with the MWC hydrologic model.

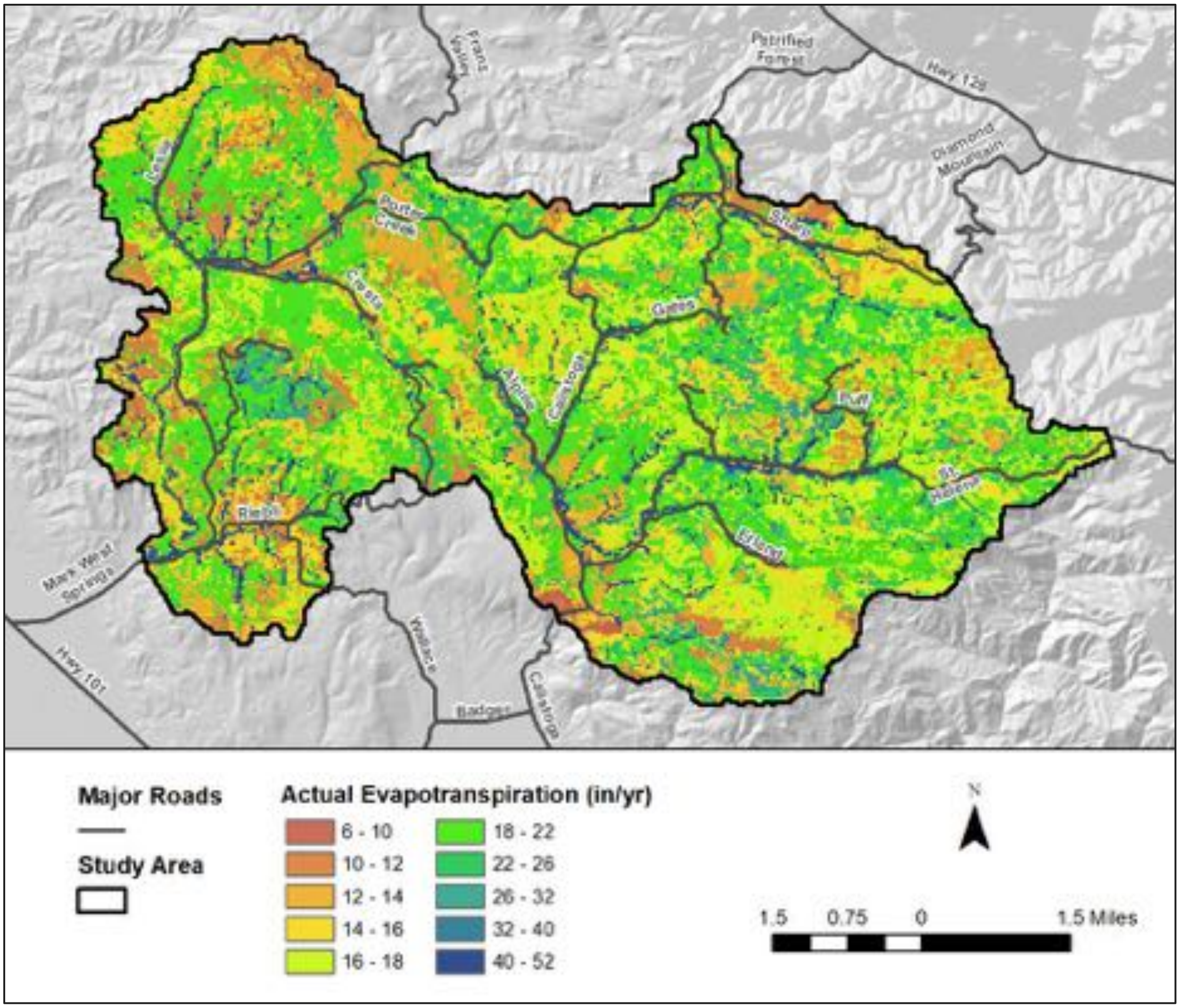


Figure 48: Mean annual Actual Evapotranspiration (AET) for water years 2010-2019 simulated with the MWC hydrologic model.

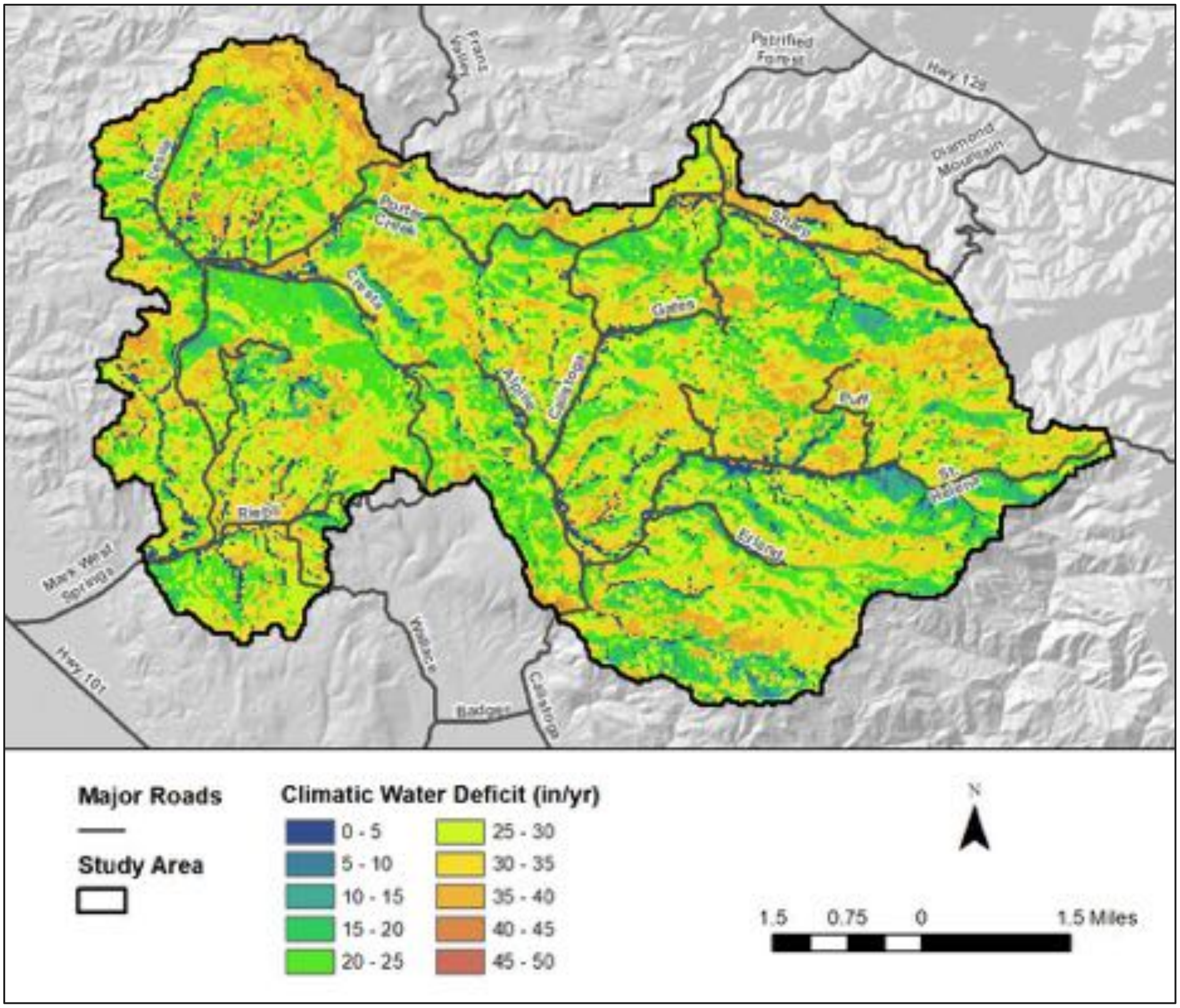


Figure 49: Mean annual Climatic Water Deficit (CWD) for water years 2010-2019 simulated with the MWC hydrologic model.

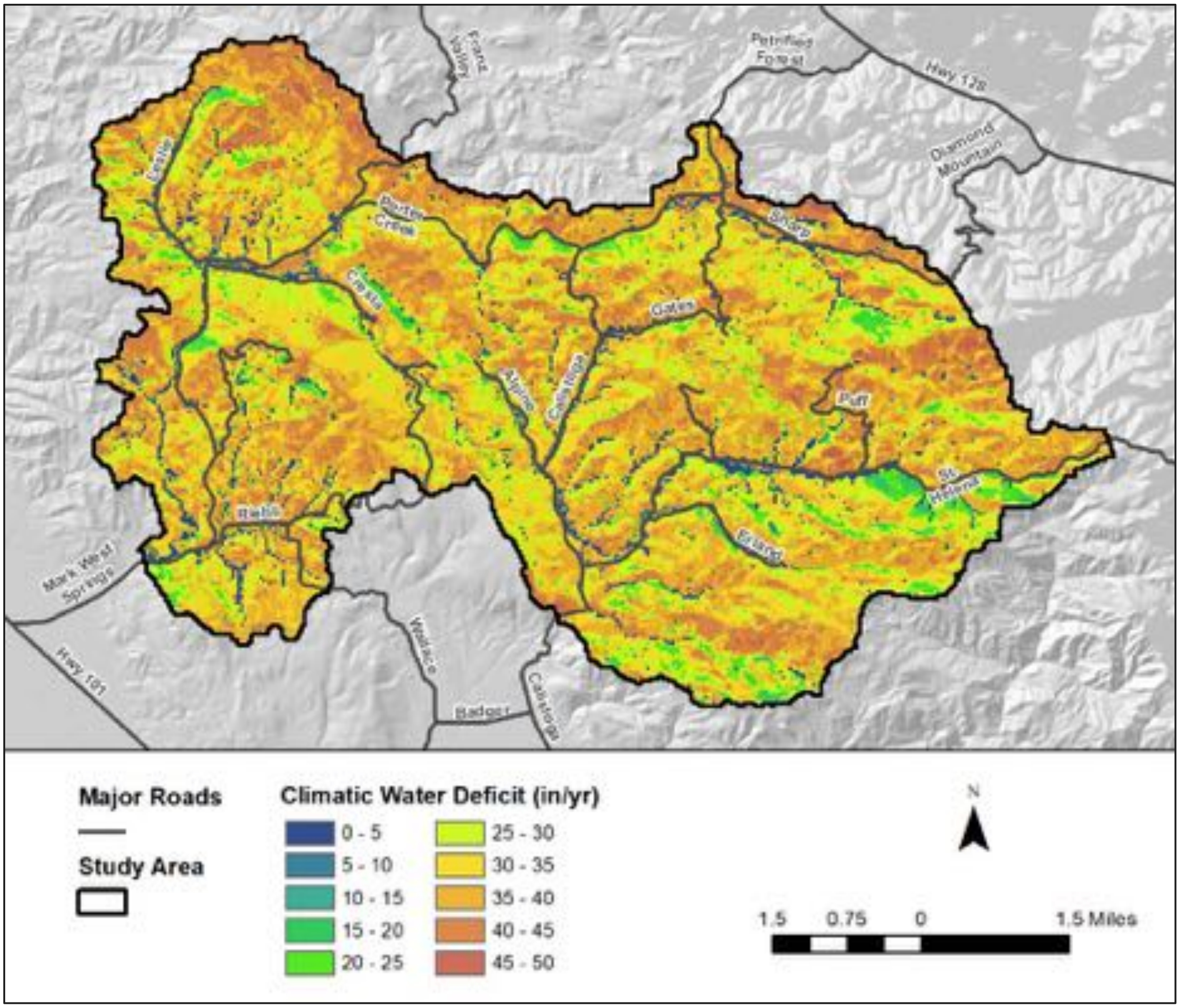


Figure 50: CWD for water year 2014 simulated with the MWC hydrologic model.

Groundwater Flow

Two hydrogeologic cross sections were prepared, one in the upper watershed downstream of Monan's Rill and one in the central watershed downstream of Humbug Creek (Figure 51). These sections show the vertical and horizontal variations in Hydraulic Conductivity, as well as the simulated equipotential lines, and approximate flow directions (perpendicular to equipotential lines) and locations of groundwater discharge predicted by the model. It is important to note that in both cross sections there is a significant downstream (out of the page) component to the flow directions not visible in this one-dimensional cross section view. Equipotentials are based on simulation results for 10/1/2010 but are representative of the regional patterns of groundwater flow throughout the simulation period which do not show significant variation at the regional scale of the cross sections.

The northern portion of the upper cross section (A-A') passes through the area with the thickest sequence of primarily tuffaceous volcanic materials that was identified from available Well Completion Reports. A transition to more andesitic-dominated materials occurs throughout the cross section with increasing depth, which is typical of our characterization of the volcanics in the upper watershed (Figure 52). Franciscan Complex, which was represented by simple vertical contacts owing to lack of data with which to describe contact orientation, occurs in the southern portion of the cross section. A thin deposit of Quaternary Alluvium is present within a relatively narrow band along the stream channel. Flow is primarily vertical downward within the higher elevation portions of the cross section (Figure 52). Mid-way along the hillslopes above Mark West Creek, the flow directions transition toward horizontal and a vertical groundwater divide occurs beneath the creek with vertical upward flow in the upper ~300-ft (model Layers 1-3) and vertical downward flow in the lower ~500-ft (model Layers 4-6). Springs occur where upward vertical groundwater flow intersects the land surface. This primarily occurs along the lower hillslopes and stream banks in the upper watershed and appears to be associated with horizontal transitions from more tuffaceous to less tuffaceous materials as well as with steep dissected topography (Figure 52).

The cross section below Humbug Creek (B-B') passes through the relatively thin Humbug Creek Deposits on the northeast side of Mark West Creek which are underlain by primarily andesitic rocks of the Sonoma Volcanics. (Figure 53). A contact between the volcanics and the Franciscan Complex associated with the Maacama Fault Zone occurs near the creek in this reach, and a second contact occurs ~2,000-ft southwest of the creek with a mixture of tuffaceous and andesitic materials occurring in the southwest portion of the cross section. A thin deposit of Quaternary Alluvium is present within a narrow band along the stream channel. Flow is primarily vertical downward within the higher elevation portions of the cross section (Figure 53). A shallow flow path with more horizontal flow occurs mid-way along the hillslope northeast of Mark West Creek, and a somewhat deeper horizontal flow path also occurs at a similar topographic position on the other side of the creek within the Franciscan Complex.

A vertical groundwater divide occurs beneath the creek and adjacent hillslopes with vertical upward flow in the upper ~300-ft and vertical downward flow in the lower ~500-ft. A cone of depression associated with pumping from the well located in the Franciscan Complex is readily apparent and influences the flow directions along the adjacent hillslope (Figure 53). Large persistent cones of depression like this one are relatively uncommon in the model and appear to coincide with wells exhibiting both high production rates and low aquifer Hydraulic Conductivity. Although there is some intersection of equipotentials with the land surface, rates of groundwater movement through these materials are very low and the model does not predict significant springflow in the vicinity of this cross section.

Streamflow & Riffle Depths

The model simulates streamflows and the depth of surface flow across riffles on the stream bed (i.e. riffle depths) throughout the various tributaries in the watershed; however, this discussion focuses on the main-stem of Mark West Creek where nearly all of the available suitable salmonid habitat is contained. The reach shown on subsequent maps extends upstream to the limits of anadromy associated with a natural waterfall as identified in the CDFW Fish Passage Barrier Database.

April through June (hereafter referred to as Spring) mean streamflows varied substantially between water years with the driest conditions occurring in water year 2014 when flows ranged from less than 2 cfs above Van Buren Creek to 6-10 cfs below Porter Creek. The wettest conditions occurred in water year 2010 with flows above Van Buren Creek on the order of 4-8 cfs and flows below Porter Creek in excess of 30 cfs (Figure 54). July through September (hereafter referred to as Summer) mean streamflows were significantly lower than during Spring and also varied much less between water years. The driest conditions occurred in 2015 when flows ranged from less than 0.3 cfs above Van Buren Creek to 0.6-0.8 cfs below Porter Creek. The wettest summer conditions occurred in 2011 when flows ranged from less than 0.7 cfs above Van Buren Creek to more than 1.5 cfs below Porter Creek (Figure 55).

To assist in relating flow conditions to salmonid habitat requirements, we also compiled simulated water depths (hereafter referred to as riffle depths) which were found to be loosely equivalent to riffle crest thalweg depth conditions as discussed in greater detail in Chapter 7. The results were post-processed from model output data by extracting the minimum simulated depth per 1,000-ft of channel length (10 cross sections) to better represent riffle crest conditions observed in the field. Average Spring riffle depths during the drought of 2014 ranged from less than 0.2-ft upstream of Van Buren Creek to 0.2-0.4 ft below Porter Creek. In the wet water year 2017, riffle depths in the upper reaches were above 0.2-ft all the way to upstream about one river mile beyond Monan's Rill (Figure 56). Summer mean riffle depths are significantly lower than Spring depths and are relatively consistent between water years. In typical conditions, depths remain above 0.1-ft in most locations downstream of Monan's Rill, and below Porter Creek depths reach 0.2-0.3 ft in many locations (Figure 57). The simulated spatial distributions of riffle depth reflect both reaches where riffle depths are limited by reduced streamflows, most notably the reach upstream of Porter Creek which loses flow to the alluvium, as well as where depths are limited by geomorphic controls such as the reaches about 1-mile upstream of Riebli Creek (Figures 56 & 57).

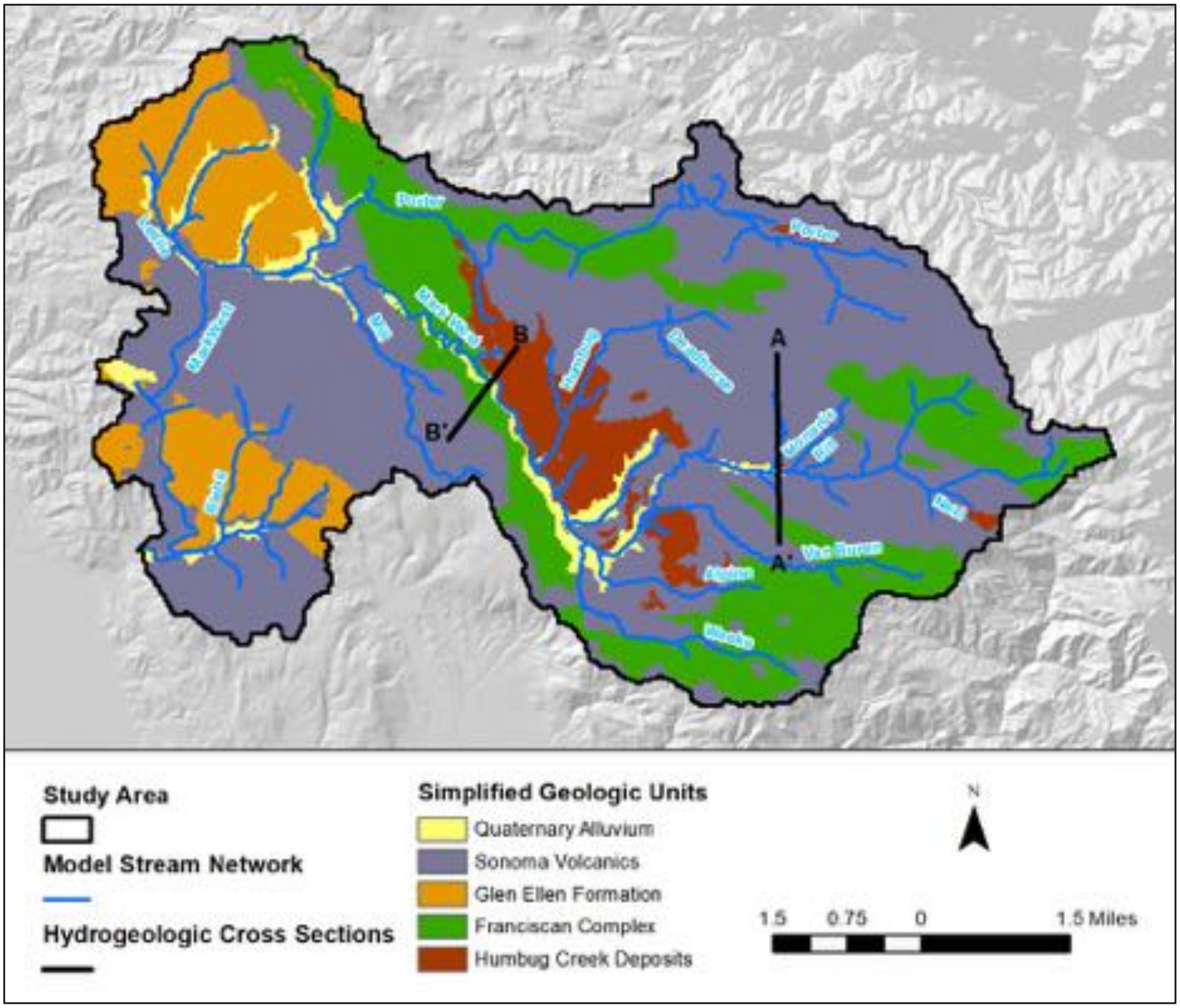


Figure 51: Simplified geologic map and locations of hydrogeologic cross sections A-A' and B-B'.

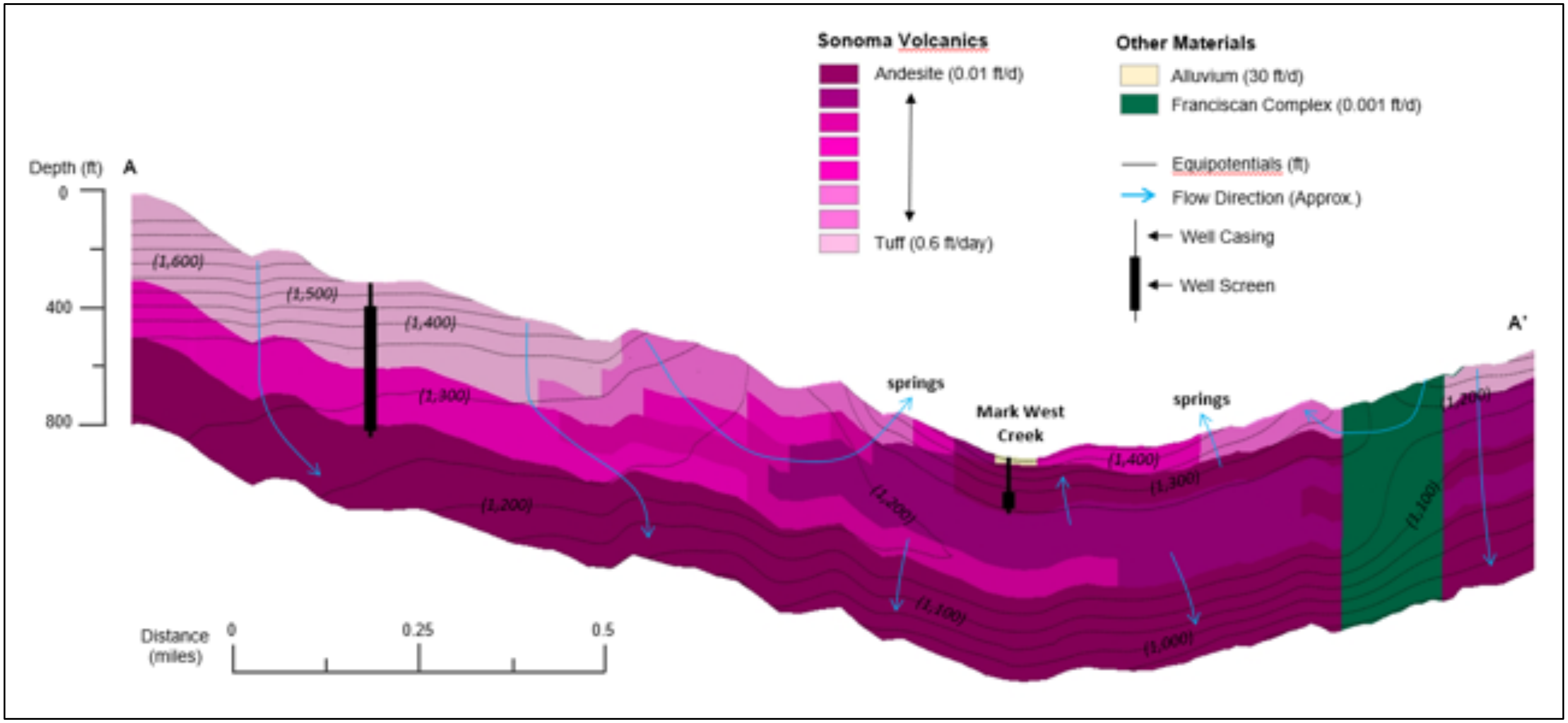


Figure 52: Hydrogeologic cross section A-A' showing hydraulic conductivities, equipotentials, and approximate flow directions as simulated with the MWC hydrologic model (see Figure 51 for location).

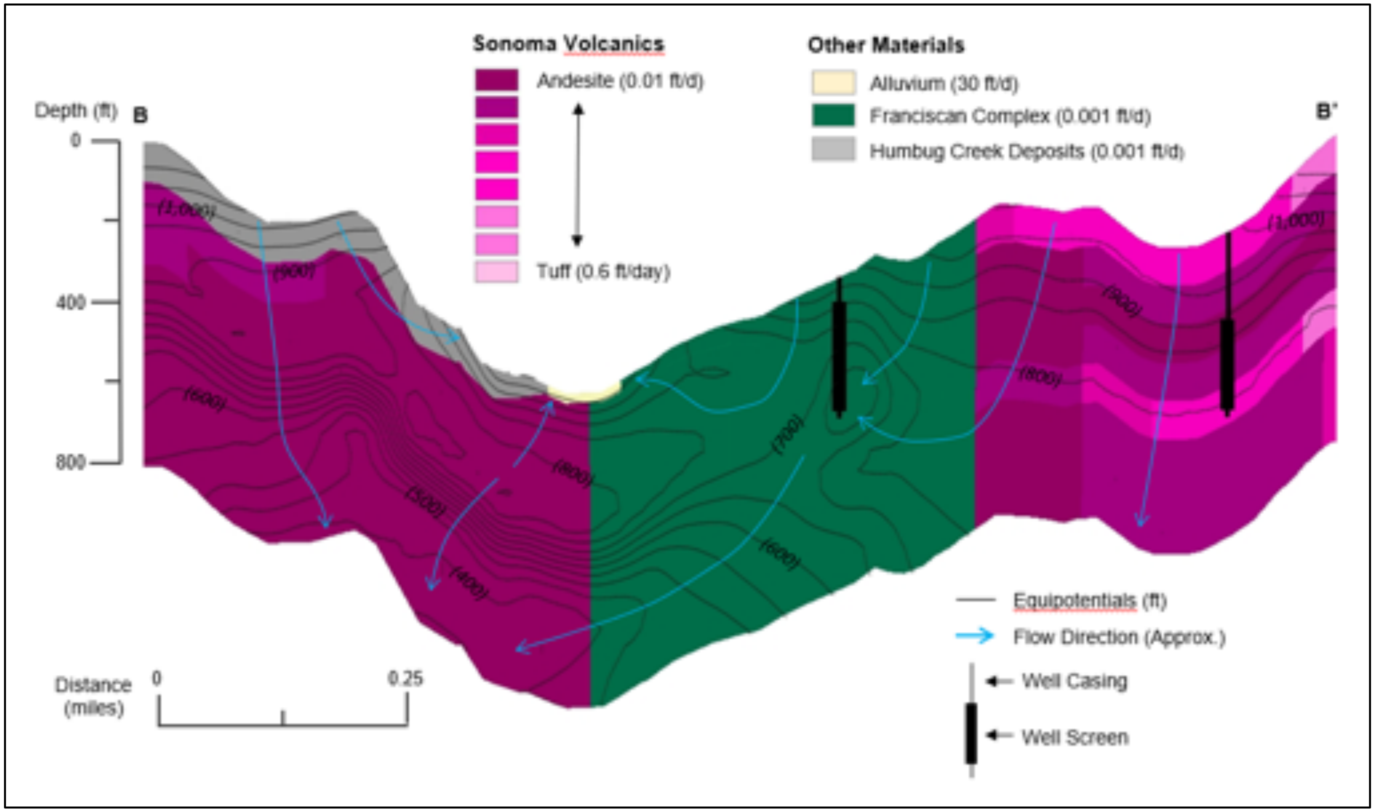


Figure 53: Hydrogeologic cross section B-B' showing hydraulic conductivities, equipotentials, and approximate flow directions as simulated with the MWC hydrologic model (see Figure 51 for location).

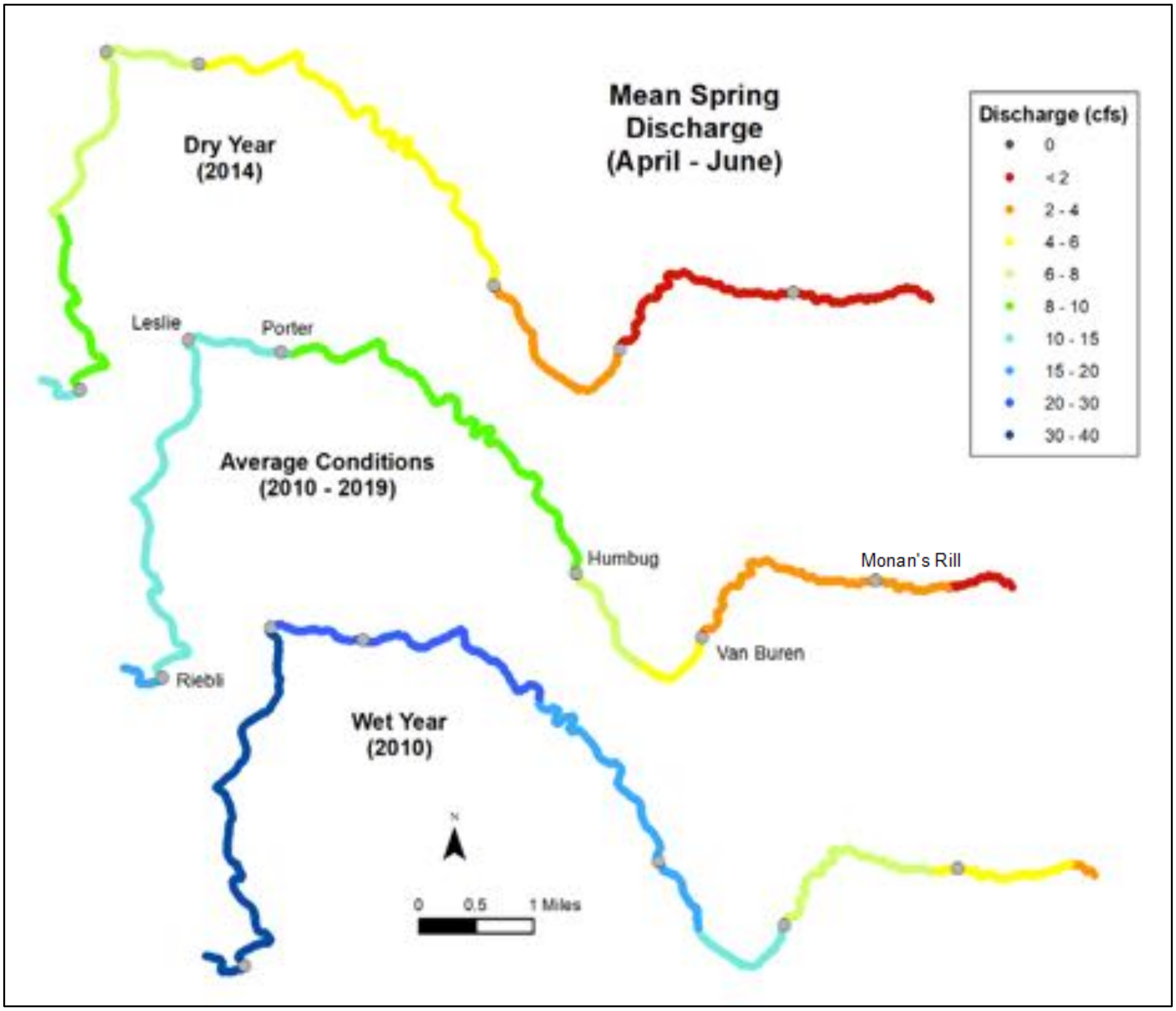


Figure 54: Mean simulated Spring (April – June) streamflows for dry, average, and wet water year conditions.

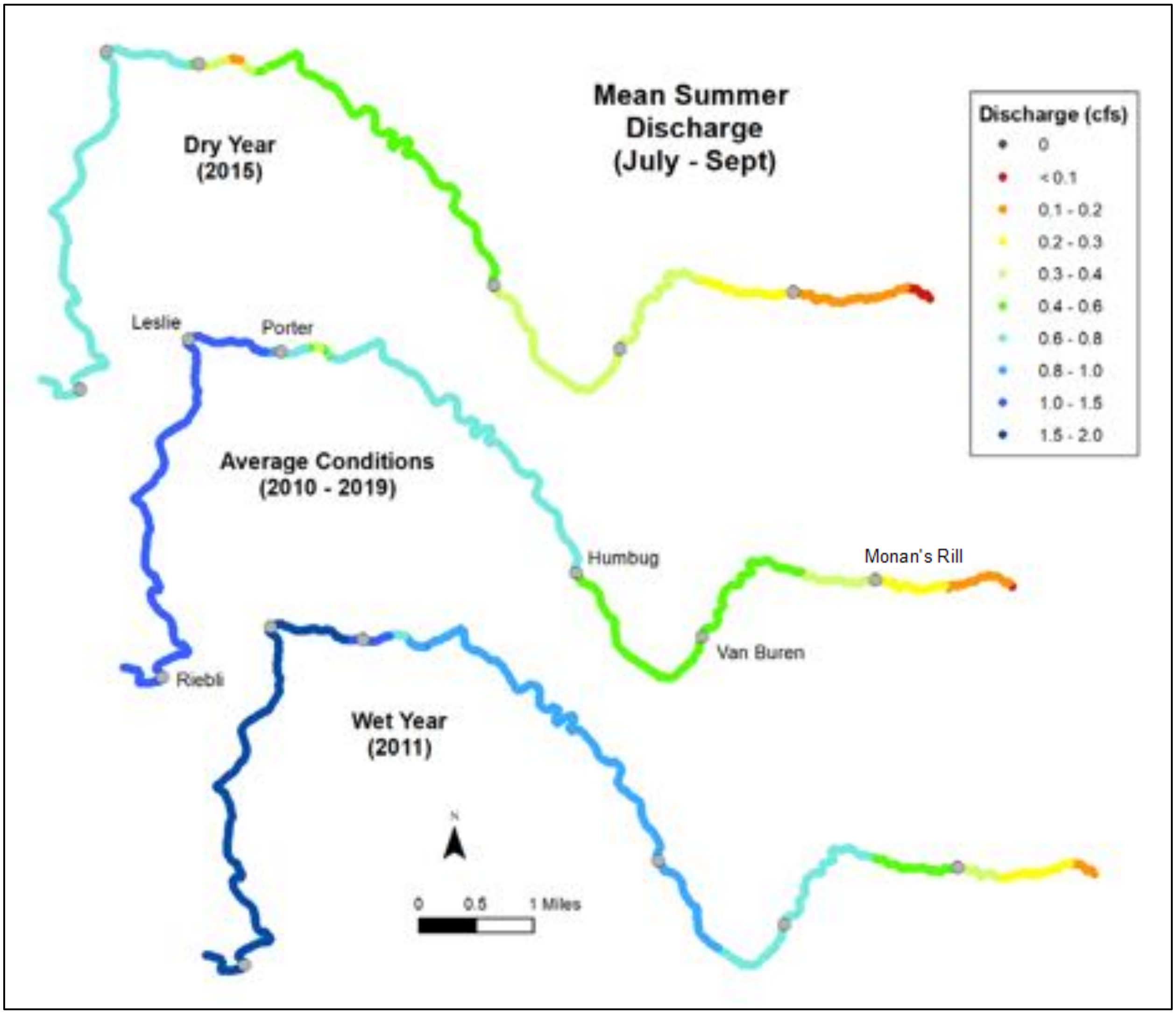


Figure 55: Mean simulated Summer (July - Sept) streamflows for dry, average, and wet water year conditions.

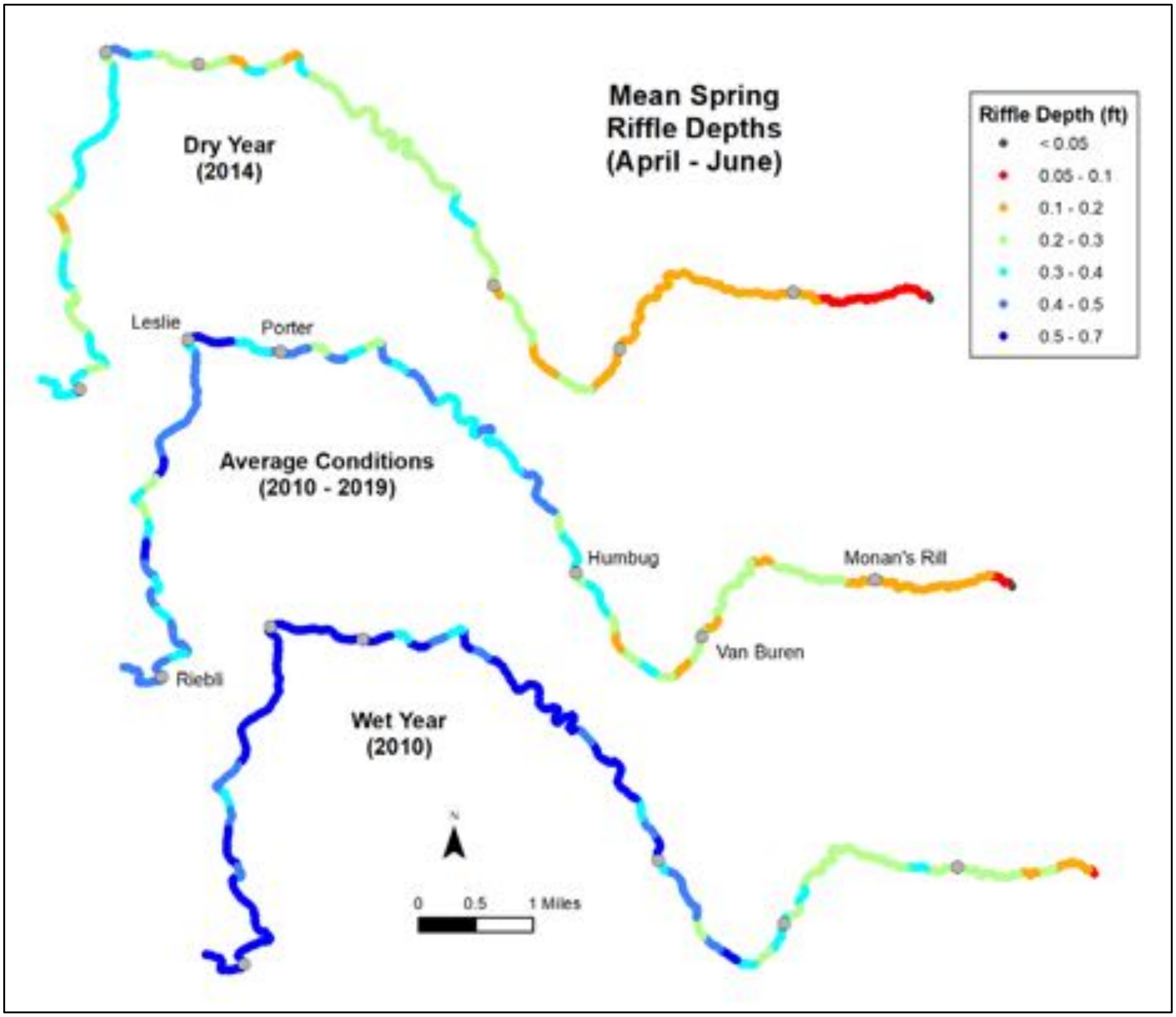


Figure 56: Mean simulated Spring (April – June) riffle depths for dry, average, and wet water year conditions.

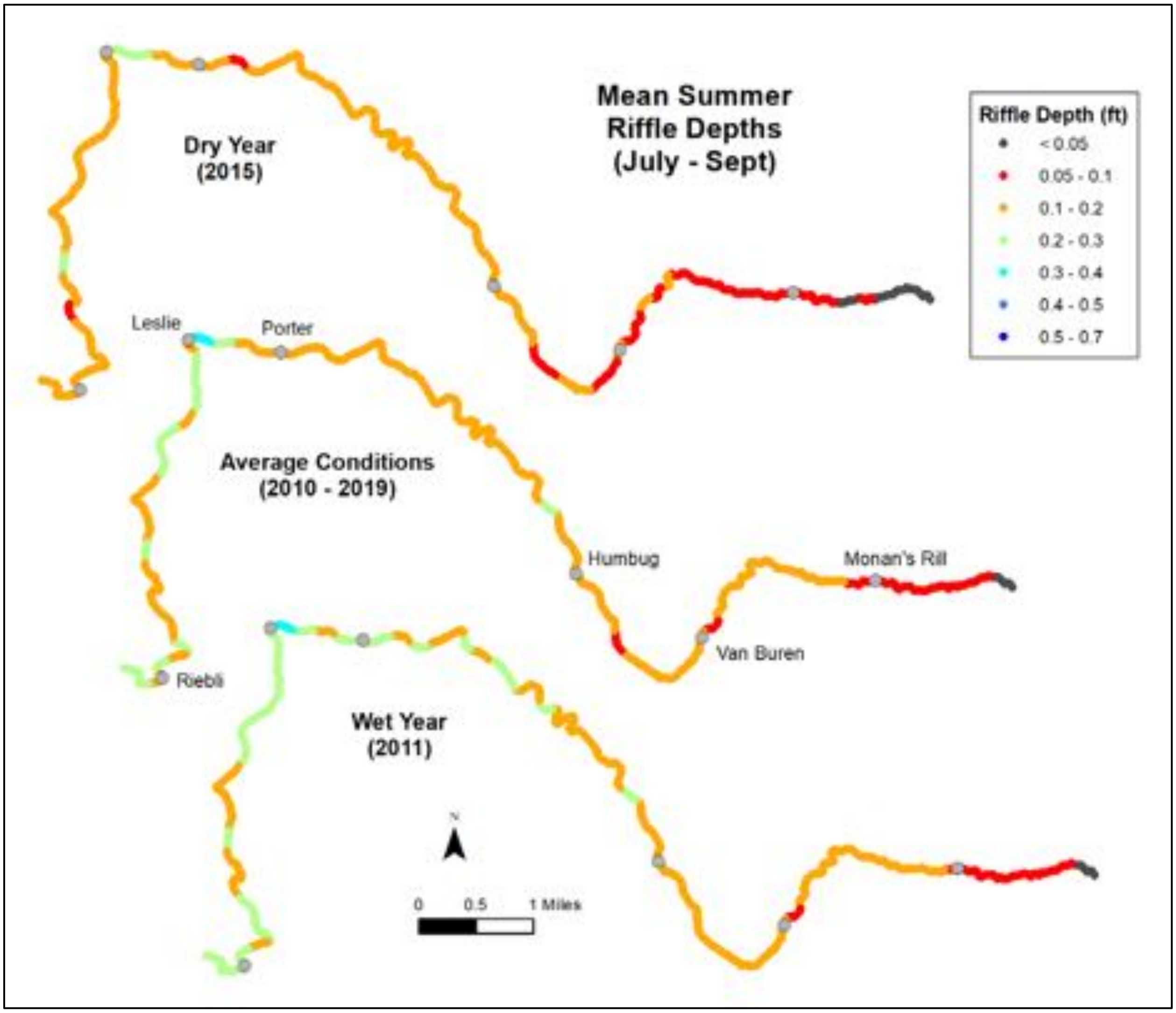


Figure 57: Mean simulated Summer (July - Sept) riffle depths for dry, average, and wet water year conditions.

Chapter 7 – Habitat Characterization and Prioritization

Background

Inadequate stream flow to support juvenile rearing habitat during the summer months has been identified as a primary limiting factor for coho survival in Russian River tributaries (CDFG, 2004; NFMS, 2012). Flows during the spring outmigration period may also be limiting in some cases. Numerous methods have been developed to relate stream flow conditions to habitat quality and define minimum flow requirements for a specific species and life stage of interest. These methods include applying regional regression equations that have been developed from multiple habitat suitability curve studies (e.g. Hatfield & Bruce, 2000), wetted perimeter and critical riffle depth methods (e.g. Swift, 1979, R2 Resource Consultants, 2008), and direct habitat mapping approaches (e.g. McBain & Trush, 2010).

Regional regression equations produce discharge estimates for Mark West Creek and other Russian River tributaries that are an order of magnitude higher than typical conditions during the summer months. Given that coho persist in these tributaries despite these very low flow conditions, application of these regional equations may be of limited value for delineating the extent and quality of existing habitat with respect to streamflow. Direct habitat mapping approaches require extensive fieldwork and site-scale characterization which is beyond the scope of this reginal planning study; a concurrent CDFW Instream Flow Study utilizing such methods is being conducted in upper Mark West Creek.

A simple approach to utilizing hydrologic model results to delineate habitat availability (and the selected approach for this study) is to relate water depths simulated in the model to riffle crest thalweg depths (RCTDs) which have been investigated as important indicators of salmonid habitat suitability. This approach assumes that the simulated water depths are representative of conditions at riffle crests. This assumption is consistent with the limitations of the LiDAR topographic data which does not penetrate water and therefore would be expected to capture riffles and pool water surfaces but not pool geometries. To validate this assumption, we measured riffle crest thalweg depths (RCTDs) at nine riffle crests identified in three reaches of Mark West Creek across a range of typical low to moderate flow conditions and compared the resulting discharge/RCTD relationships to relationships extracted from the model for equivalent locations (Figure 58).

There was generally good agreement between the measured and simulated discharge/RCTD relationships, and the agreement was improved by sampling the cross section within a given 1,000-ft reach with the lowest simulated depths (i.e. finding the cross section most representative of conditions at nearby riffle crests). At most riffle crests observed in the field, maximum depths occur across a relatively narrow width commonly associated with gaps between small clusters of individual cobbles. This level of topographic detail is not captured in the model topography, therefore a small residual depth (0.05-ft) was added to the simulated values to account for the effects of this microtopography. The simulated discharges associated with a RCTD of 0.2-ft ranged from 0.21 to 0.46 cfs based on interpolation between field measurements, and from 0.18 to 0.53 cfs as simulated in the model (Figure 58).

Previous research has demonstrated relationships between RCTDs and various indicators of salmonid habitat suitability including fish passage, water quality, and abundance of benthic macroinvertebrates. Maintaining suitable riffle depths to allow for fish passage is critically important during smolt outmigration (typically mid-February to mid-June) and is also important for facilitating pool selection prior to summer rearing. A minimum passage depth of 0.3 feet has been estimated for juvenile coho (R2 Resource Consultants, 2008; CDFW, 2017). This depth criterion and methodology is somewhat conservative by design and fish passage is thought to occur in Russian River tributaries at shallower depths, therefore it is useful to define a lower criterion below which passage is presumably not possible. For the purposes of this study, that depth was defined as 0.2 feet expressed as a RCTD. It is important to note that we are applying this depth threshold to RCTDs rather than based on CDFW critical riffle methodology. We calculated the flows required to achieve a 0.2-ft depth from our field data following CDFW protocols for performing Critical Riffle Analysis (CDFW, 2017). This resulted in estimates of required flows ranging from 2.0 to 3.2 cfs, which are about 5 to 10 times higher than the typical summer flows experienced in the watershed.

Another key factor in summer survival is the suitability of water quality conditions in the pools that provide rearing habitat for salmonids. Maintaining sufficient flow between riffles is key to maintaining oxygenation in pool habitats, and monitoring in Green Valley Creek has shown that coho survival begins to decline when pools become disconnected with mortality increasing as a function of length of disconnection (Obedzinski et al., 2018). Through extensive field monitoring in Green Valley, Dutch Bill, and Mill Creeks, CA Sea Grant found a statistically significant relationship between RCTDs and Dissolved Oxygen (DO) concentrations in intervening pools, with ~80% of the pools with RCTDs greater than 0.2-ft maintaining suitable DO concentrations above 6 mg/L (CA Sea Grant, 2019). As discussed below in greater detail, water temperature conditions are higher in Mark West Creek relative to the monitored streams nearer the Pacific Ocean in Sonoma County, therefore while we still consider RCTDs to be an important indicator of water quality in Mark West Creek, temperature considerations must be accounted for in more detail.

In addition to suitable water quality, another factor critical summer rearing habitat for salmonids is the availability of a reliable food supply in the form of benthic macroinvertebrates (BMI) which are concentrated in riffle habitats with sufficient flow velocity. Velocities at riffles between about 1.0 and 2.5 ft/s have been shown to be optimal for BMI (Giger 1973, Gore et al., 2001). As part of our riffle crest analysis in Mark West Creek we measured velocities and interpolated relationships between RCTDs and thalweg velocities (Figure 59). At lower flows, depths were too low to measure velocity at more than a few locations across the riffle, however in most cases velocities approaching those at the thalweg only occurred across a relatively small portion of the riffle profile. To ensure that the threshold velocity represents a condition that provides suitable habitat for BMI across larger swaths of the riffle we applied a minimum velocity threshold of 1.5 ft/s and do not consider the upper velocity limit important over the range of summer flows experienced in Mark West Creek. This exercise revealed that 0.2-ft was also a useful threshold for describing the approximate minimum RCTD that corresponded to adequate velocity at riffle crests for BMI (Figure 59).

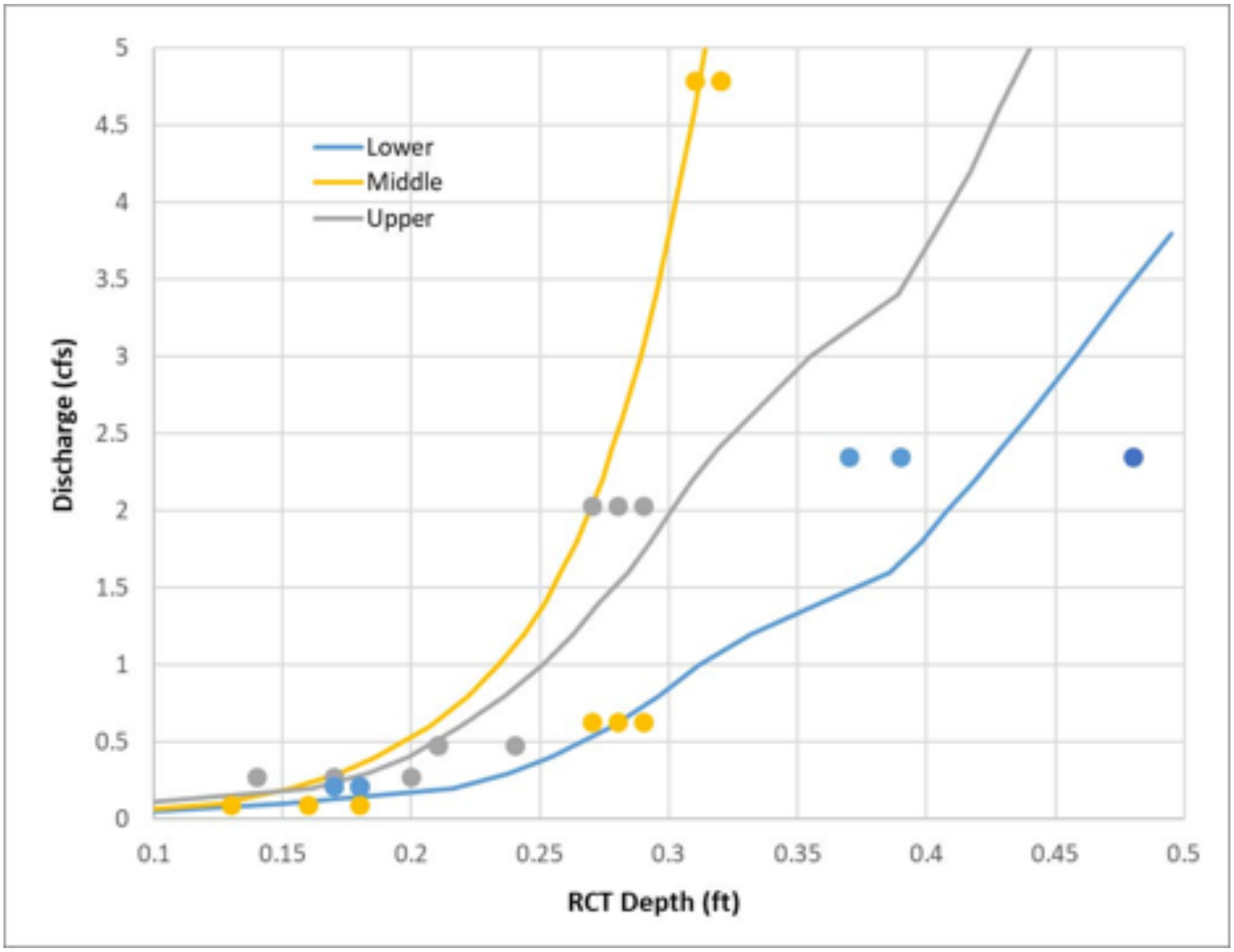


Figure 58: Comparisons between RCTD/discharge relationships measured in the field (points) and simulated with the MWC hydrologic model (lines).

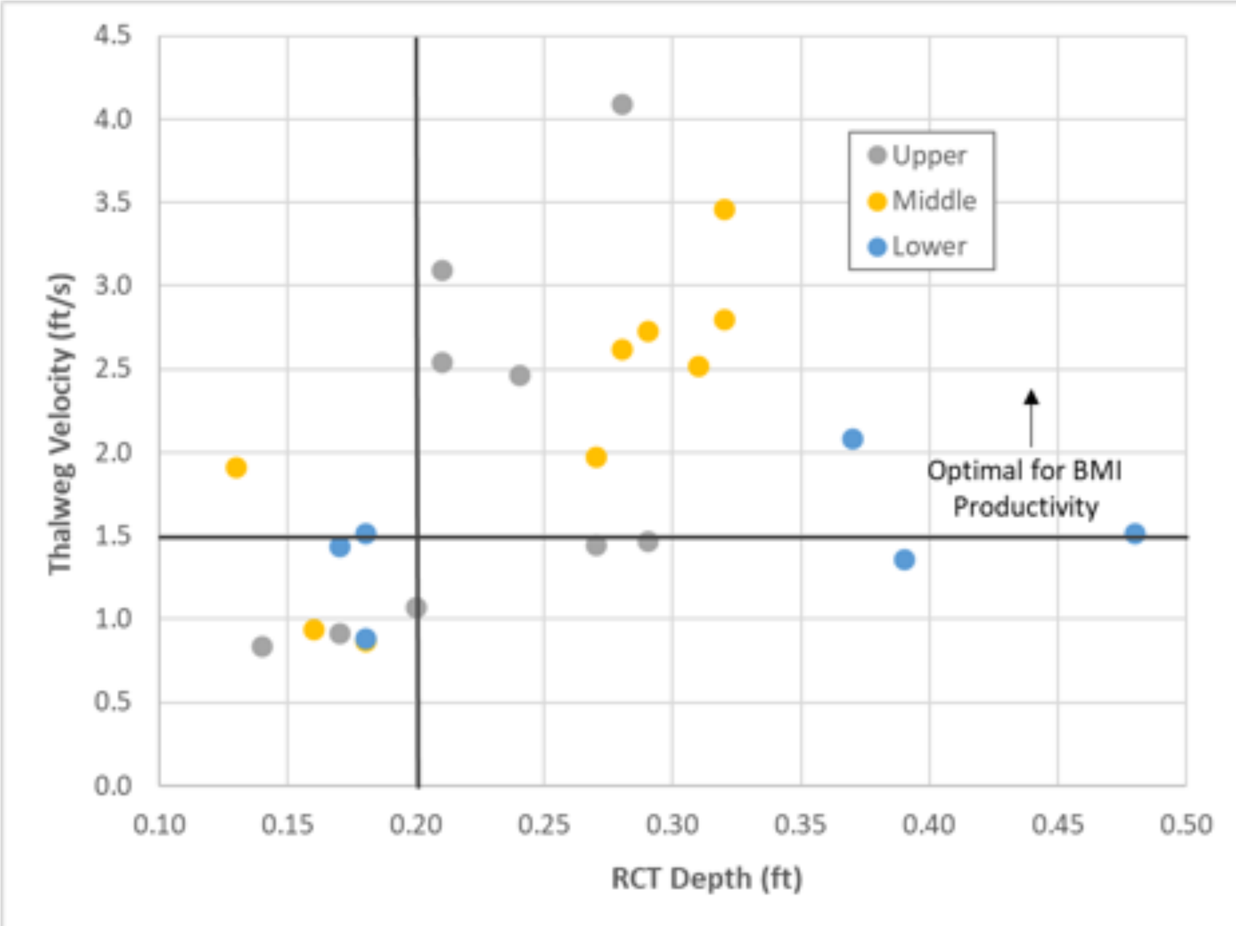


Figure 59: Relationship between RCTD and velocity based on measurements at nine riffles crests in Mark West Creek.

Approach

We developed two streamflow classifications with respect to salmonid habitat condition, one for smolt outmigration and one for juvenile rearing. Both classifications focus on the 0.2-ft RCTD threshold which is intended to represent the minimum flow conditions required to provide suitable (not optimal) habitat for salmonids. It is important to note that the primary goals in defining a minimum flow threshold for this study were to 1) assist in distinguishing between reaches with varying levels of habitat suitability under existing and plausible future flow conditions in the watershed to aid in prioritizing reaches for restoration projects, and 2) to distinguish between conditions that are likely suitable versus not suitable rather than attempting to distinguish between optimal and suboptimal conditions. Optimal summer rearing habitat conditions for salmonids, particularly coho salmon, are rarely found or non-existent in most lower Russian River tributaries.

We obtained smolt outmigrant trap data collected by Sonoma Water in Mark West Creek for 2012-2018. These traps were only deployed during April and May to capture the primary pulse of outmigration. CA Sea Grant has collected data from outmigrant traps in other Russian River tributaries over the full outmigration season from late February to late June. We compared the CA Sea Grant data in Mill Creek for 2014-2019 with the Mark West data and found very similar outmigration timing with peak outmigration occurring between the first week of April and the third week of May in both creeks. CA Sea Grant's analysis of the Mill Creek data (which we believe is representative of Mark West Creek) indicated 80% of the outmigrants had moved by the week of May 21st in a late outmigration year and 99% had moved by the week of June 18th (Nossaman Pierce, personal communication). We developed habitat suitability criteria based on these dates and a RCTD threshold of 0.2-ft as follows:

- Maintain RCTD threshold through week of May 21st in the 10-yr average condition
- Maintain RCTD threshold through week of June 18th in the 10-yr average condition
- Maintain RCTD threshold through week of May 21stin drought years
- Maintain RCTD threshold through week of June 18th in drought years

We followed a similar approach for the juvenile rearing habitat classification focused on July-September conditions. In our previous flow-based habitat classification work in Green Valley/Atascadero & Dutch Bill Creeks, we focused on differentiating between reaches where pools remain connected, become disconnected for short periods of time, and become disconnected for longer periods of time (OEI, 2016). Disconnected pools are relatively rare in Mark West Creek (with the exception of a short reach above Porter Creek), therefore this was not a useful metric for distinguishing between various levels of habitat suitability in this watershed. We developed an alternative and likely more stringent set of habitat suitability criteria for summer rearing habitat conditions as follows:

- Maintain RCTDs threshold for portions of the summer in the 10-yr average condition (always > 0.1-ft)
- Maintain RCTD threshold continuously in the 10-yr average condition
- Maintain RCTD threshold for portions of the summer in drought years (always > 0.1-ft)
- Maintain RCTD threshold continuously in drought years

We then assigned each 1,000-ft stream reach in the model with a score of zero through four based on the number of these criteria that were met to develop flow-based habitat classification maps for smolt outmigration and juvenile rearing.

Although water temperature analysis was not part of our project scope, preliminary review of available temperature data revealed that elevated water temperatures may be an even more important limiting factor for juvenile rearing habitat than flow in this watershed, therefore we compiled available temperature data from Sonoma RCD, CA Sea Grant, Trout Unlimited, and CDFW to facilitate incorporating temperature into the habitat classification. We calculated the Maximum Weekly Maximum Temperature (MWMT) from continuous temperature datasets at 15 locations in Mark West Creek. Each location had between one and five years of data between 2010-2019, however many locations had only one year of data and most years had only a few locations, complicating the interpretation of spatial and temporal patterns. Nevertheless, the data was sufficient to perform a preliminary water temperature classification based on the

MWMT and various levels of temperature impairment. Based on previous work, a threshold of 18.0 °C was used to represent impaired conditions, 21.1 °C to represent severe impairment, and 23.1 °C to represent conditions that may be lethal for salmonids given prolonged exposure (NCRWQCB, 2008). Each reach was assigned a score from zero to three based on the number of the following criteria that were met:

- Maintain MWMT < 23.1 °C
- Maintain MWMT < 21.1 °C
- Maintain MWMT < 18.0 °C

In addition to sufficient flow to enable passage, maintain water quality, and support benthic macroinvertebates, there are many other important factors for maintaining suitable salmonid habitat. These include presence of pools with sufficient depth and cover, suitable spawning gravels, and availability of refugia from high velocity winter flows, among others. To account for some of these factors in our classification, we compiled Stream Inventory Report data collected by CDFW in 1996 and ranked each of the five reaches described in the report based on the relative quality of pool habitat and spawning habitat. Although we did not collect detailed pool or substrate data, we incorporated our general observations of these conditions in our interpretations of the resulting rankings. Our observations suggest that even though the inventory data described conditions more than 20 years ago, the relative quality of habitat conditions between reaches described by the data appears to be fairly consistent with current conditions. Finally, we compiled summer snorkel survey data collected by CA Sea Grant to understand which reaches have been utilized by salmonids in recent years.

We then produced a generalized multi-factor habitat classification map by combining the flow- and temperature-based classifications and making adjustments and interpretations based on the pool and spawning habitat rankings as well as our general observations about other factors such as off-channel habitat availability and potential for redd scour, and recent patterns of salmonid utilization. The resulting maps are intended to delineate the reaches providing the best overall habitat value for salmonids in the watershed as well as the reaches where conditions are likely unsuitable due to one or more critical limiting factors.

Results

The flow-based habitat classification results indicate that most reaches are impaired with respect to flow both in terms of smolt outmigration and summer rearing (Figure 60). Both the juvenile rearing and smolt outmigration classifications show similar patterns overall. Upstream of Van Buren Creek either one or zero of the four flow criteria are met, most reaches between Humbug Creek and Porter Creek meet two or three of the criteria, and most reaches below Porter Creek meet three or four criteria (Figure 60). Notable exceptions to this include short reaches upstream of Porter Creek and between Leslie and Riebli Creeks which are more flow-limited than adjacent upstream and downstream reaches (Figure 60).

Two of the three temperature criteria are met upstream of Van Buren Creek, one of the criteria are met between Van Buren and about 2-miles upstream of Porter Creek, and none of the criteria are met (MWMT > 23.1 °C) in the reach upstream of Porter Creek (Figure 61). No continuous temperature data was available farther downstream. The available water temperature data shows an overall pattern of increasing temperature in the downstream direction with all reaches being temperature-impaired at times to varying degrees (Figure 62). In the upper watershed, maximum water temperatures generally occur in mid-July, whereas the reach above Porter Creek follows a similar trend in general but superimposed on this is a period of elevated temperatures resulting in maximum temperatures about a six weeks earlier in early June; this behavior may reflect a contrast in the timing of response to solar radiation inputs (Figure 63).

We examined the temporal variations in temperatures relative to streamflows observed at the stream gauges in the watershed and found no obvious correlations between flow and temperature at the most temperature-impaired locations. In fact, the highest temperatures in these reaches generally occur during June and begin to improve by August and September, whereas flows are generally declining throughout this period. In the reach above Porter Creek, June/July water temperatures ranged from 14.4 to 23.1 °C when flows were very low (< 0.2 cfs) and exhibited a similar range of variability (14.5 to 24.3 °C) when flows were relatively high (> 1 cfs) (Figure 64). This suggests that flow is not the primary control on temperature and that even significant streamflow enhancement is unlikely to mitigate elevated temperatures.

We also examined the relationship between pool depth and temperature in six pools monitored by CDFW upstream and downstream of Humbug Creek in 2017. Pools with depths greater than 3.5-ft maintained significantly lower temperatures than shallower pools less than 2.5-ft deep (Figure 65). Although based on a limited sample size from a single year, this suggests that deep pools likely provide critical refugia for salmonids in Mark West Creek when extreme temperatures occur in shallower pool habitats (Figure 65).

The CDFW inventory data indicates that the best pool habitat occurs in the reach above and below Humbug Creek (CDFW Reach 5) and above and below Riebli Creek (CDFW Reach 2) (Figure 66). It is important to remember that this is a relative ranking and pool conditions in these reaches are likely still impaired. The CDFW data indicates that these reaches have relatively low shelter ratings (mean of 40), shallow pools (2.5-ft mean maximum depth), and very little Large Woody Debris (1% occurrence) (Table 14). The best spawning habitat as indicated by the CDFW data occurs in the middle and lowest reaches (CDFW Reaches 2 and 4) (Figure 66). Upstream of Van Buren Creek, spawning suitability is limited by high embeddedness and the predominance of bedrock and cobble-sized substrate conditions (Table 14). Not captured in the CDFW data are considerations of potential for redd scour which is likely to increase significantly below Porter Creek due to increased stream power and sediment mobility. Therefore, the most suitable spawning habitat is likely to occur in the reach of Mark West Creek between Van Buren Creek and Porter Creek. It is important to remember that the inventory data is more than 20 years old and as such may not be reflective of current conditions other than in generally describing reach-to-reach variability.

Summer snorkel survey data is available from 2016-2019. Very few (<10) coho were observed in Mark West Creek during 2016 and 2018 and interpreting the data from 2017 is complicated by a spring release of juvenile coho in the upper watershed. Therefore, the 2019 data is the most useful for examining which reaches have been utilized by coho in recent years. Nearly all (98%) of the 734 observed coho were found in pools between Humbug Creek and Porter Creek. Within this reach, coho were highly concentrated in a relatively small number of pools, with 72% of the coho located in just 11 pools and the remaining 28% distributed between 33 additional pools (Figure 67).

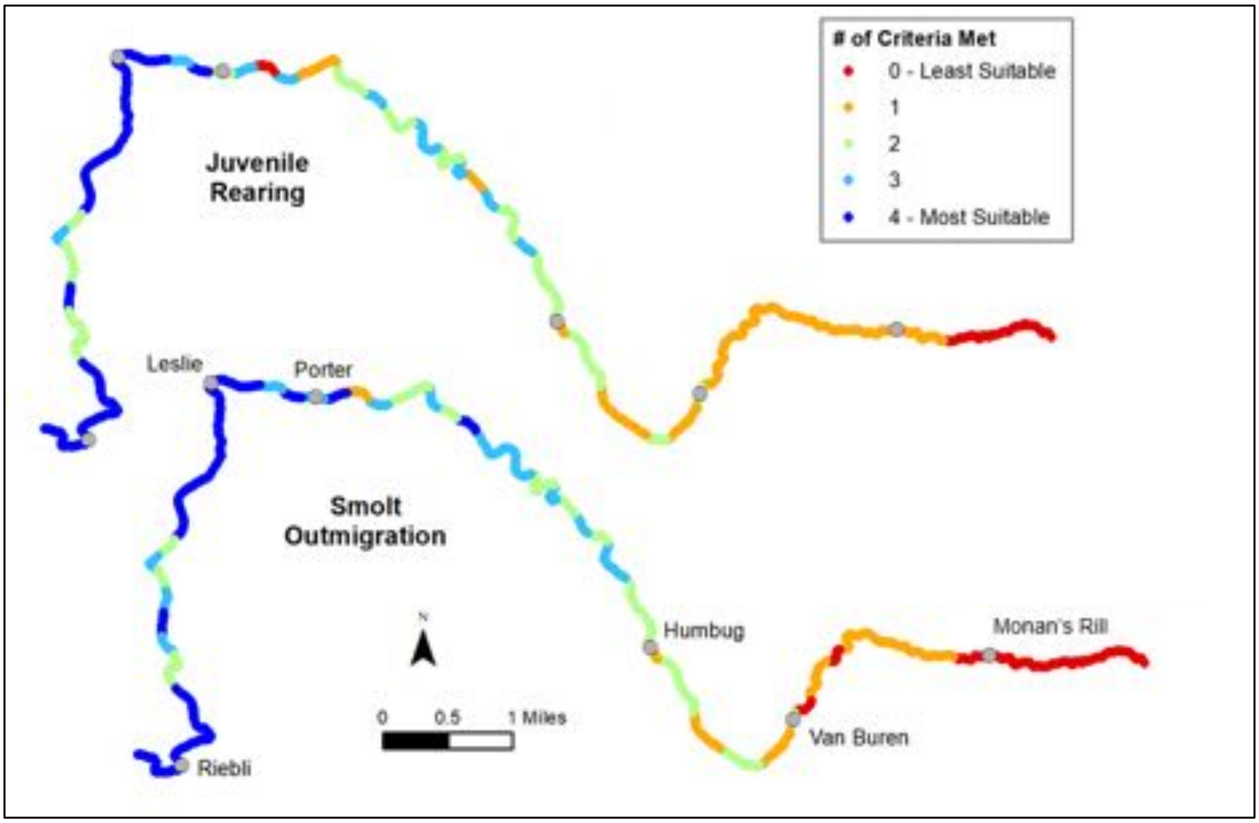


Figure 60: Flow-based habitat suitability classifications for juvenile rearing and smolt outmigration.

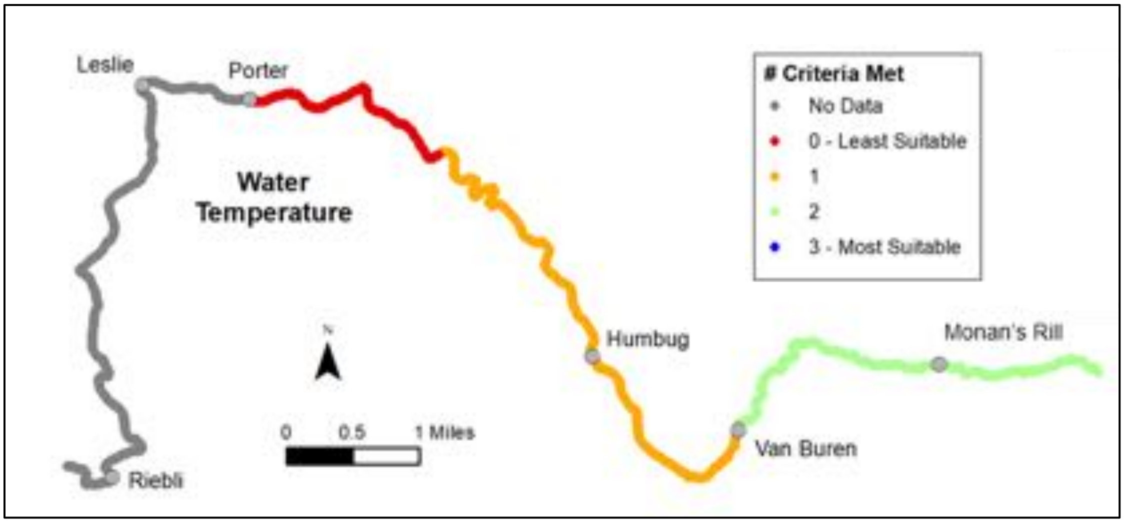


Figure 61: Water temperature-based habitat suitability classification.

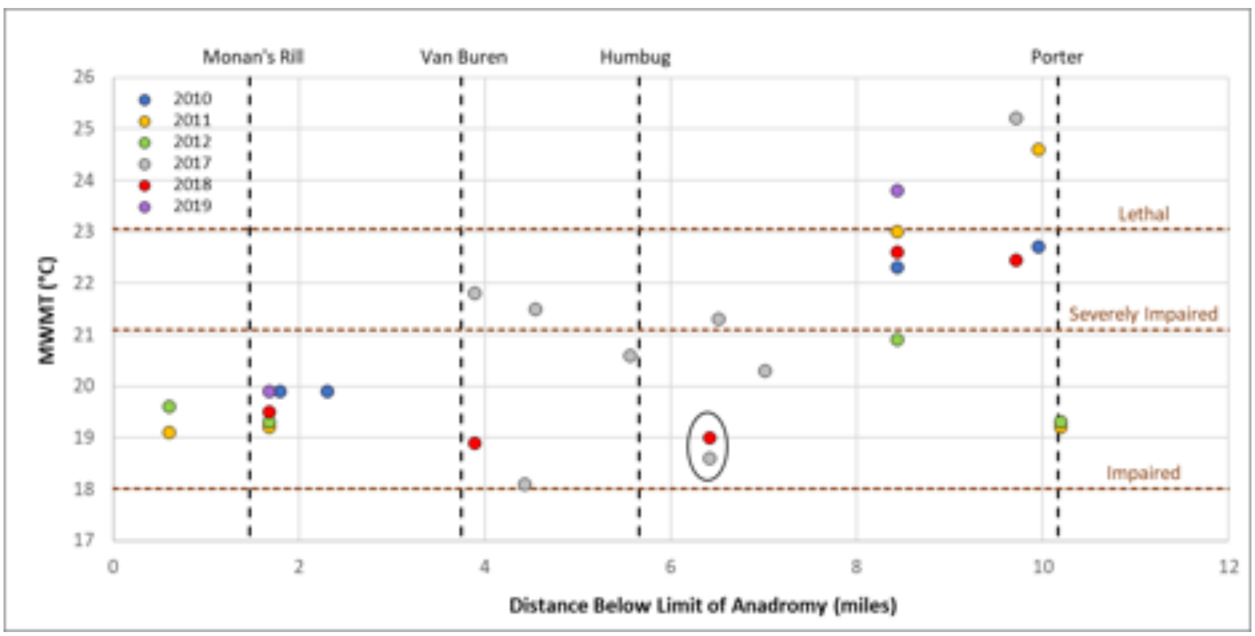


Figure 62: Longitudinal and temporal variations in Mean Weekly Maximum Water Temperature (MWMT) derived from continuous temperature data at 15 stations between 2010 and 2019, black oval indicates location of deep pool cold water refugia; temperature data from CDFW, Sonoma RCD, CA Sea Grant, and TU.

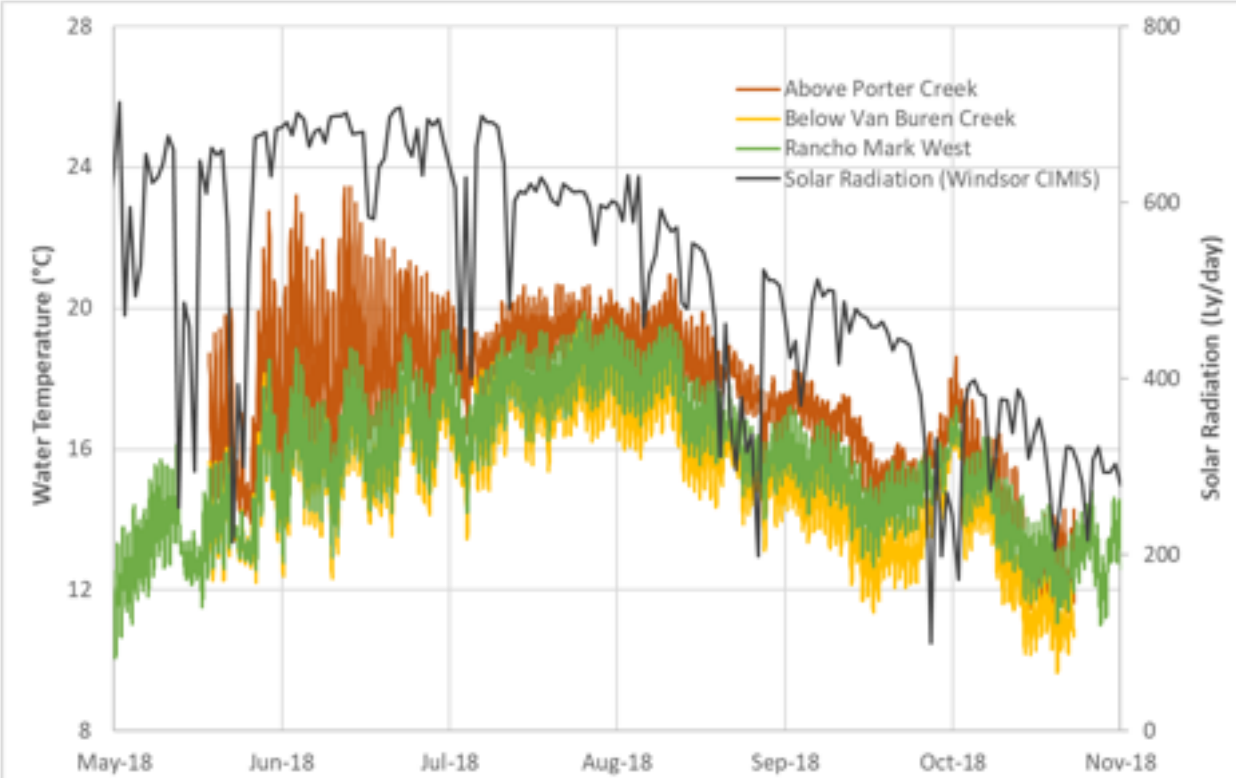


Figure 63: 15-minute interval water temperature data at three locations in Mark West Creek for 2018 and solar radiation data from the Windsor CIMIS station.

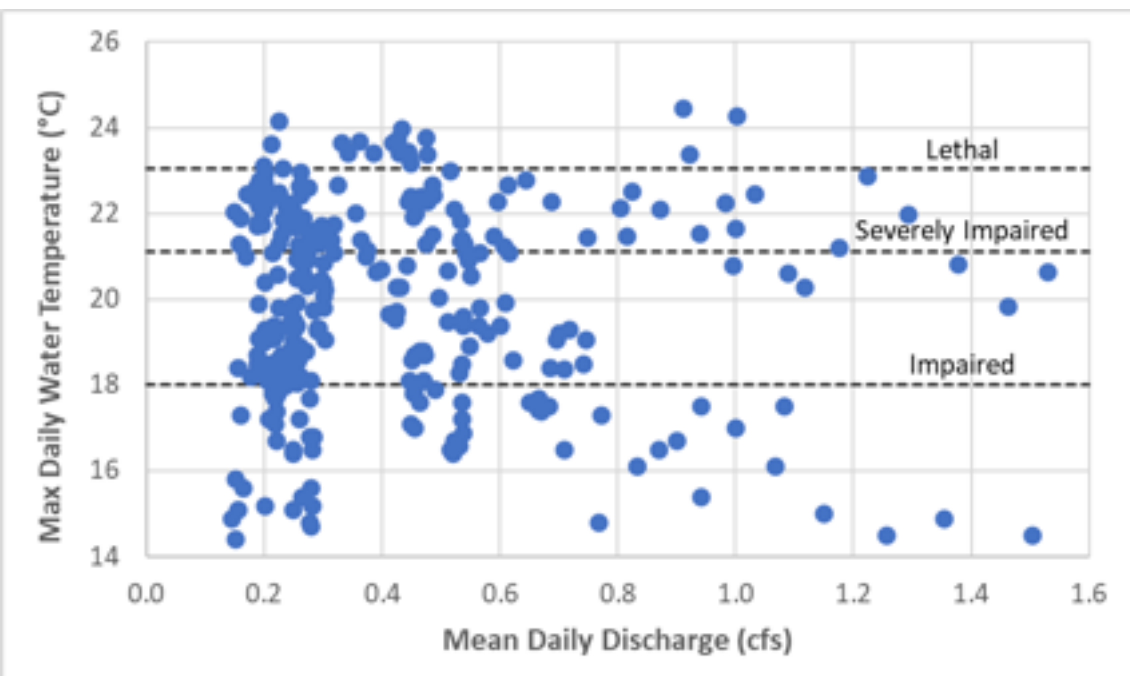


Figure 64: Comparison between Maximum Daily Water Temperature above Porter Creek during June and July of 2010-2012 & 2018-2019 and corresponding discharges as measured at the Rancho Mark West gauge.

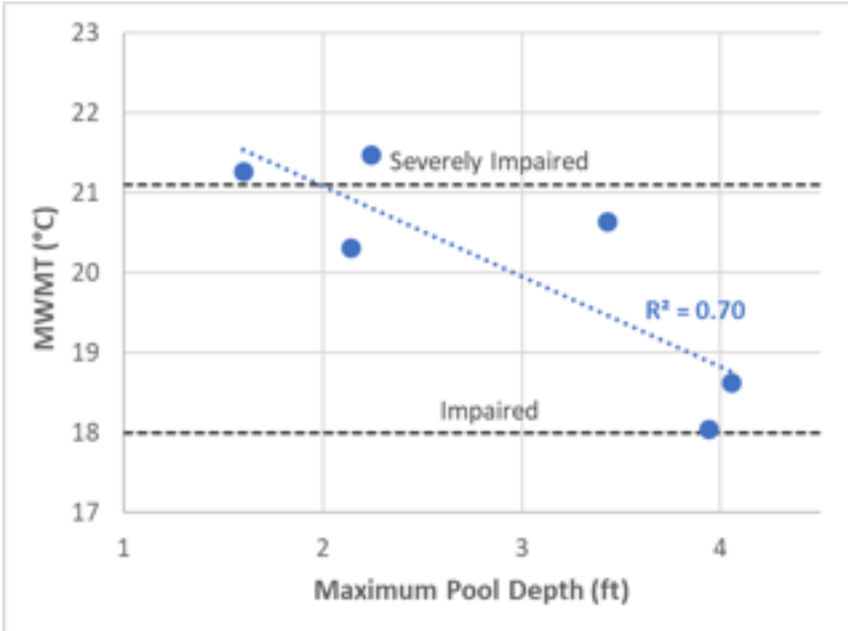


Figure 65: Relationship between maximum residual pool depth and 2017 MWMT for six pools above and below Humbug Creek, data from CDFW.

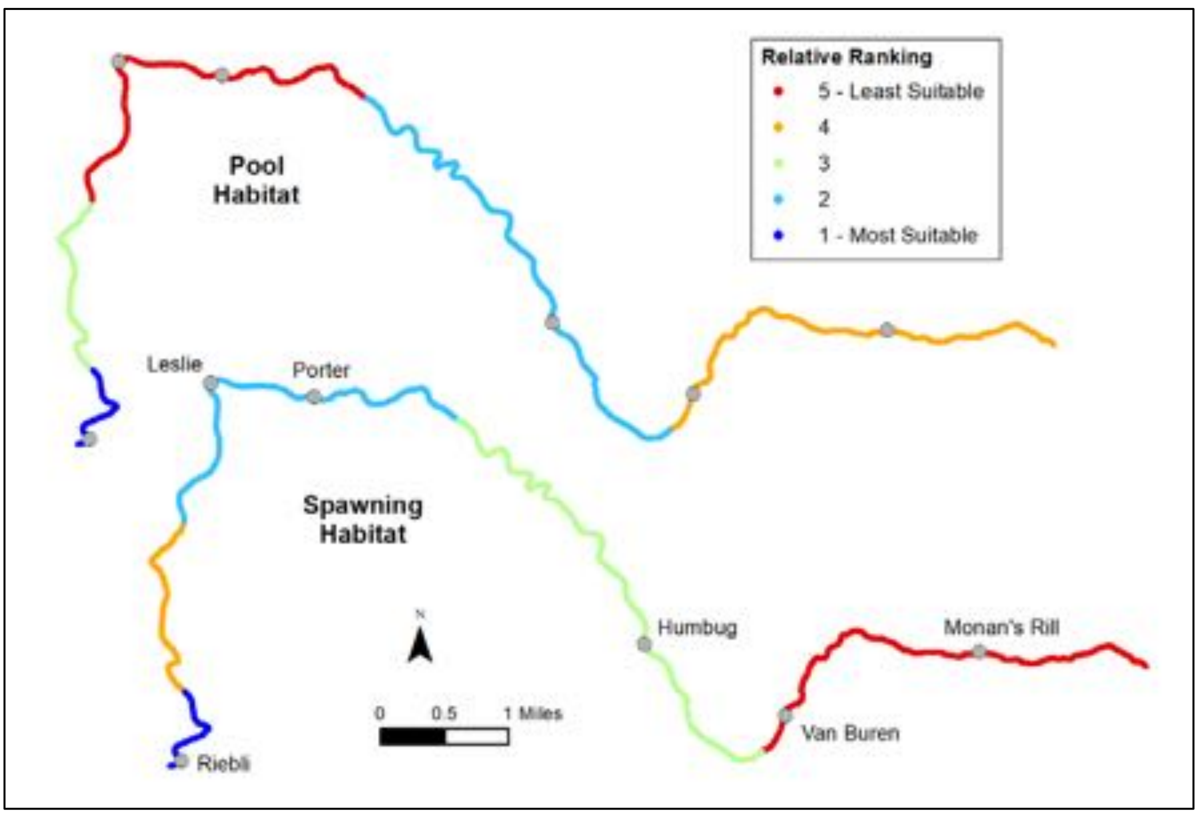


Figure 66: Pool and spawning habitat quality ranking based on the 1996 CDFW Stream Inventory Report.

Table 14: Summary of various pool and spawning habitat indicator metrics compiled from the 1996 CDFW Stream Inventory Report and used to develop the rankings presented in Figure 66.

	Pool Habitat Indicators								Spawning Suitability Indicators		
CDFW reach #	Pools as % of total length	Pools >3-ft as % of total length	Mean maximum residual depth (ft)	Residual maximum depth (ft)	Mean residual pool volume (ft^3)	Mean Shelter Rating	% occurrence of LWD	Pool Ranking	% gravel dominant	% embedded-ness 1 or 2	Spawning Ranking
6	39%	7%	2.0	5.0	379	47	3.1	**4**	14	1	**5**
5	37%	11%	2.5	8.1	751	42	1.0	**2**	12	33	**3**
4	32%	8%	2.2	3.9	784	28	2.7	**5**	32	33	**2**
3	34%	12%	2.7	5.7	1,412	33	0.2	**3**	19	19	**4**
2	49%	11%	2.6	8.9	2,562	38	1.0	**1**	33	64	**1**

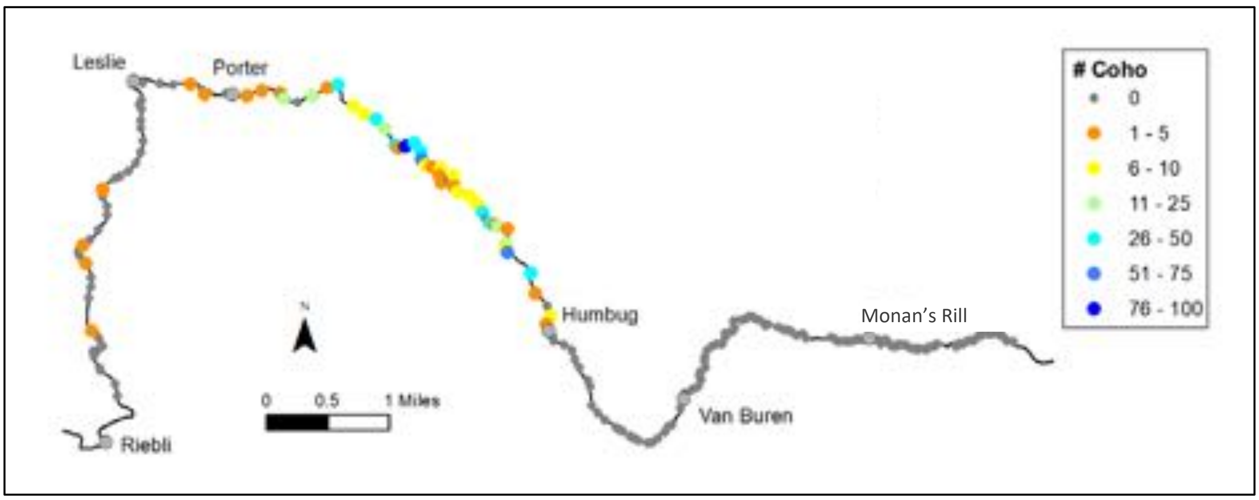


Figure 67: Snorkel survey data showing the distribution of juvenile coho observed in Mark West Creek during June/July of 2019, data from CA Sea Grant and Sonoma Water.

Restoration Prioritization & Recommendations

The overall salmonid habitat classification identifies a ~four mile reach of Mark West Creek between about 0.2 river miles upstream of Alpine Creek (~0.5 miles downstream of Van Buren Creek) and about two river miles upstream of Porter Creek as providing the best overall habitat for salmonids in the watershed (Figure 68). This reach (hereafter referred to as the high priority reach) is considered most suitable because it represents the best combination of flow and water temperature conditions and is also consistent with available data and observations about other indicators of habitat quality such as pool and spawning conditions. Upstream of this reach, no more than one of the four established flow criteria are met, spawning conditions are suboptimal, and natural bedrock controls limit deep pool development and pose migration challenges. The two-mile reach upstream of Porter Creek experiences very high temperatures (>23.1 C) which may be lethal for salmonids and portions of this reach also experience very low RCTDs and periodic pool disconnection making overall conditions problematic for juvenile salmonids. We are aware of anecdotal reports of steelhead trout using the reach upstream of Van Buren Creek, despite the evidence of poor habitat. Less is known regarding temperature conditions farther downstream below Porter Creek, however it is unlikely that conditions improve dramatically and high stream power in this reach is expected to be problematic for spawning success owing to risk of redd scour.

Although the high priority reach we identified (see Figure 68) has the highest overall habitat quality in the watershed, it is still impaired with respect to both flow and temperature, and pool habitat is also likely limited by insufficient cover and large wood. Most of the coho observed in the watershed in recent monitoring were in this reach, further supporting the importance of this reach. Although not the focus of this study, field observations suggest there are multiple opportunities for enhancing off-channel habitat (SRCD has completed a design for an off-channel habitat design project in the reach) and improving pool habitat with LWD projects within this critical reach. We recommend that restoration projects aimed at enhancing both pool and off-channel habitat be implemented in this high priority reach where they are likely to provide the greatest benefits to salmonids.

Additional data and analyses are required to better understand the controls on stream temperatures; nevertheless, our preliminary assessment of available data suggests that daily and seasonal fluctuations in temperatures are driven primarily by fluctuations in incoming solar radiation rather than by quantity of streamflow. Preliminary evidence suggests that deeper pools maintain significantly lower water temperatures than surrounding habitats. The degree of temperature-impairment in the identified high priority reach is severe enough that salmonid survival may only be possible in a relatively small number of deeper pools capable of providing cold-water refugia. Given the importance of water temperature for salmonid survival in Mark West Creek, actions to increase shading through riparian vegetation projects and actions to maintain and enhance deep pools with good cover are likely to provide the greatest benefits for salmonids in Mark West Creek. Additional water temperature investigation is also warranted to better understand the controls on water temperatures and identify the most critical pool habitats within the identified ~4-mile high priority reach.

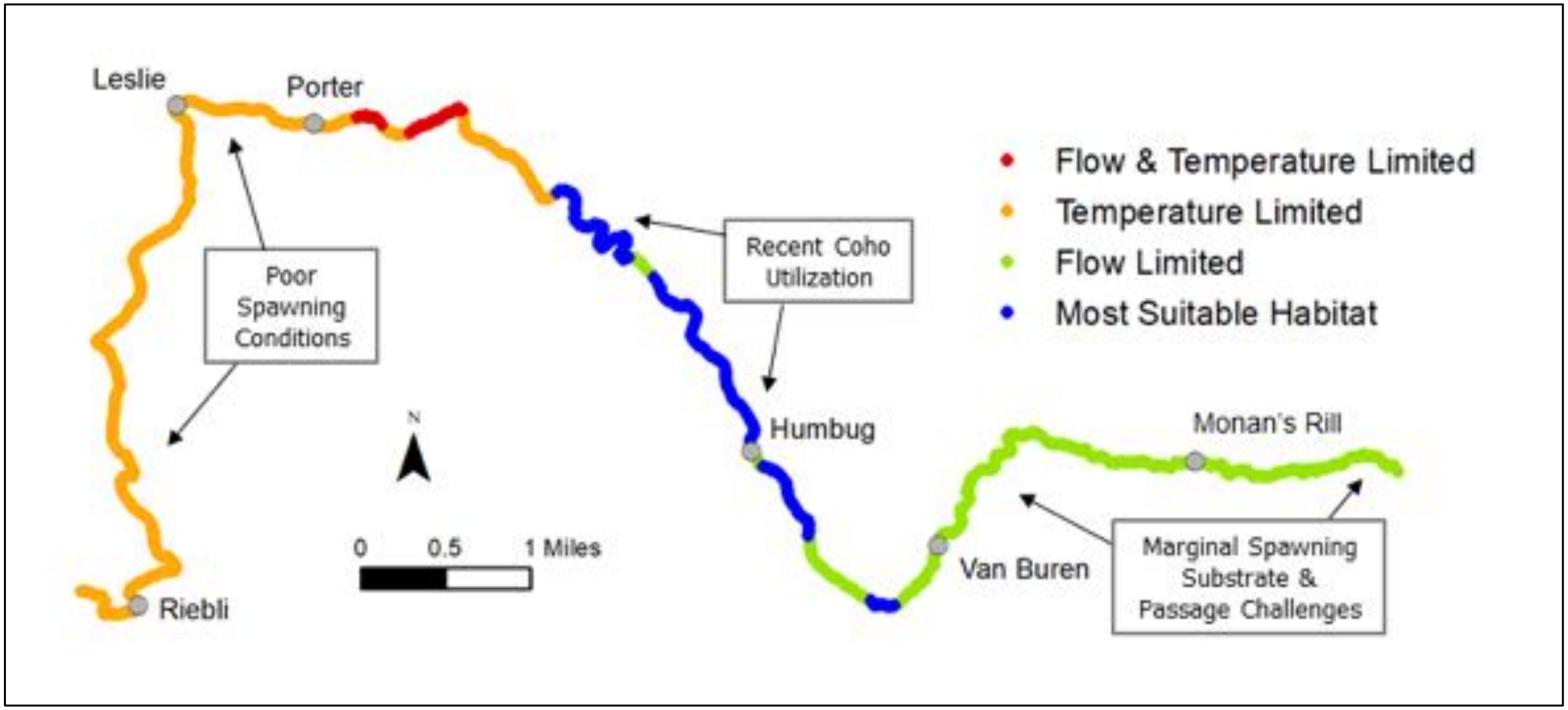


Figure 68: Final overall habitat suitability classification for Mark West Creek identifying the high priority reaches with the most suitable overall habitat conditions in blue.

Chapter 8 – Scenario Analysis

Overview

Efforts to sustain and enhance streamflow conditions have become a recent focus of restoration practitioners working in tributaries of the lower Russian River. Some actions have already been implemented such as pond and flow release projects in Green Valley, Dutch Bill, and Porter Creek (not the Porter Creek in Mark West watershed), and rainwater and diversion storage projects aimed at reducing dry season water use in Mark West Creek watershed and other tributaries. On the other hand, the watershed is subject to increasing water use pressure as new vineyard, winery, cannabis, and residential development projects are proposed, and local and state regulatory agencies are grappling with how best to regulate new groundwater use to avoid detrimental effects on streamflows and associated instream habitat. These challenges are further complicated by ongoing global climate change and the uncertainties associated with future hydrologic conditions. There is a clear need to be able to quantitatively evaluate the relative benefits of various flow enhancement strategies as well as the cumulative effects of land development and water-use on the landscape, and to do so within the context of future climate predictions so that more informed and effective management outcomes can be achieved.

To assist in meeting this need, we developed a series of model scenarios designed to provide an understanding of the hydrologic sensitivity of various hypothetical management and restoration actions as well as the effects of global climate change. There are a total of 19 scenarios grouped in four primary categories: Water Use, Land/Water Management, Climate Change, and Mitigated as described in detail below (Table 15). Each scenario was implemented by changing one or more model inputs and comparing model results to existing hydrologic conditions as simulated with the calibrated model described in previous chapters.

Approach

Water Use Scenarios

Three water use scenarios were developed to estimate the cumulative effects of diversions and groundwater pumping in the watershed: 1-No Diversions, 2-No Groundwater Pumping, and 3-No Water Use. Implementation of these scenarios was a simple matter of turning off well and diversion inputs in the model. Irrigation associated with wells and diversions was also turned off. To examine the factors that influence the degree to which a given well results in streamflow depletion, we developed four additional scenarios where we turned off between 125 and 150 wells (~17% of all wells) based on various criteria (Figure 69). These scenarios included: 2B-wells located within 500-ft of a stream and screened entirely within the upper 200-ft of aquifer material, 2C-wells located within 500-ft of a perennial spring (as simulated in the existing conditions model) regardless of screen depth, 2D-wells screened in tuffaceous materials in the upper 300-ft of aquifer material, and 2E-wells located more than 1,200-ft from a stream or spring, not completed in tuffaceous materials, and not screened in the upper 200-ft of aquifer material. Minor adjustments were made to the selected well distributions to allow for an approximately equal volume of pumping between the four scenarios (Figure 69).

Table 15: Overview of the scenarios evaluated with the MWC hydrologic model.

Scenario Category	Scenario #	Scenario Name	Brief Description
Water Use	1	No Diversions	All surface water diversions turned off
	2	No Groundwater Pumping	All groundwater pumping turned off
	2B	No Pumping Near Streams	Wells within 500-ft of streams and screened in upper 200-ft turned off
	2C	No Pumping Near Springs	Wells within 500-ft of springs turned off
	2D	No Pumping From Tuff	Wells screened in surficial tuffaceous materials turned off
	2E	No Distal Pumping	Wells distal to streams/springs/tuff and not screened in upper 200-ft turned off
	3	No Water Use	All surface diversions and groundwater pumping turned off
Land/Water Management	4	Forest Management	Forest treatment on 7,054 acres of oak and Douglas Fir forests
	5	Grassland Management	Application of organic matter on 2,874 acres of grasslands
	6	Runoff Management	Manage runoff from 310 acres of developed lands to maximize infiltration
	7	Summer Pond Releases	Release water from three ponds with a total release of 0.19 cfs from June 15th to Sept 15th
	7B	Spring Pond Releases	Release water from three ponds with a total release of 0.82 cfs from May 7th to May 28th
	8	Combined Management	Combination of Scenarios 4 through 7
Climate Change	9	CNRM Climate Change	2070-2099 timeframe future climate as predicted by the CNRM model under the rcp8.5 emmisions pathway
	10	CCSM4 Climate Change	2070-2099 timeframe future climate as predicted by the CCSM4 model under the rcp8.5 emmisions pathway
	11	GFDL Climate Change	2070-2099 timeframe future climate as predicted by the GFDL model under the SRES B1 emmisions pathway
	12	MIROC esm Climate Change	2070-2099 timeframe future climate as predicted by the MIROC esm model under the rcp8.5 emmisions pathway
Mitigated	13	GFDL & Pond Releases	Combination of Scenarios 11 & 7 or 7B
	14	GFDL & Combined Management	Combination of Scenarios 11 & 7 or 7B

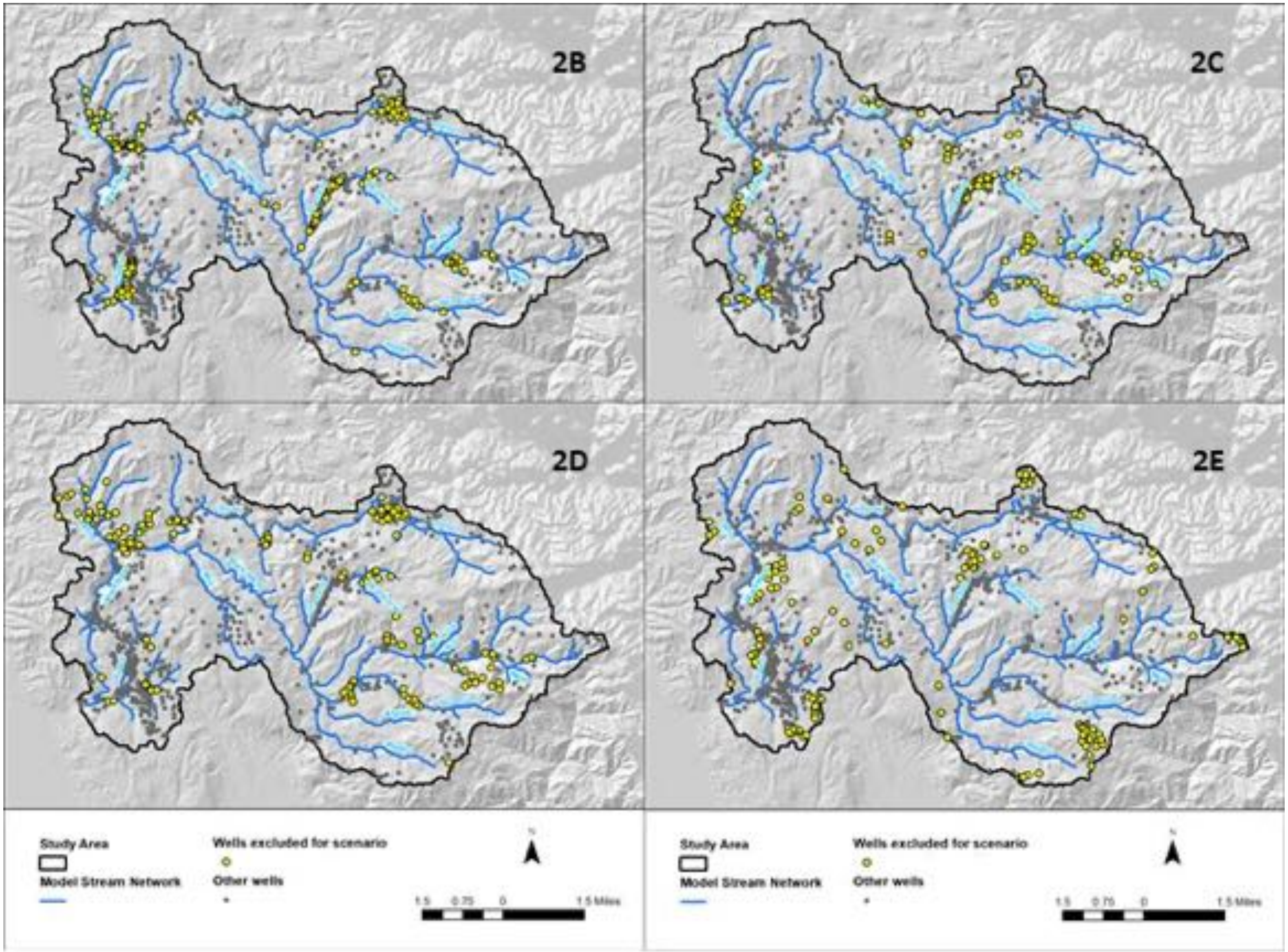


Figure 69: Distributions of wells excluded in Scenarios 2B-2E.

Land/Water Management Scenarios

Six scenarios were developed to evaluate the potential streamflow enhancement resulting from large-scale application of landscape management actions including: 4-Forest Management, 5-Grassland Management, 6-Runoff Management, 7-Summer Pond Releases, 7B-Spring Pond Releases, and 8-Combined Management (Table 15).

Forest Management

In the aftermath of the 2017 Tubbs Fire which burned through a large swath of the watershed and the 2019 Kincade Fire which burned along the north edges of the watershed, there is a very high level of awareness and interest in managing forests for reduced fuel loads. Many of the oak woodlands in the watershed are experiencing encroachment by Douglas Fir, and many Douglas Fir forests are characterized by high tree densities and abundant ladder fuels. This scenario is designed to represent wide-scale application of forest treatment strategies such as thinning and controlled burning (both of which are already occurring in portions of the watershed) and the effects of forest treatment on hydrologic conditions and streamflows.

In consultation with long-time watershed resident and forest manager Rick Kavinoky, we performed a forest condition mapping exercise on the Monan's Rill community property in the upper watershed. We mapped boundaries for nine 0.3-0.7 acre forest stands selected to represent a range of species compositions and treatment needs (determined based on qualitative assessment of tree densities and health, ladder fuel conditions, and presence of encroaching species). We sampled the Leaf Area Index data discussed in Chapter 4 to determine the mean LAI for each of the nine plots. There was a clear relationship between the stand type/treatment need categories and the mean LAI (Table 16). We used these differences to identify forested areas needing treatment throughout the watershed and to adjust the LAI values in the model to reflect implementation of treatment work.

The forest mapping indicated that stands of Black Oak and Oregon Oak not requiring treatment had a mean scaled LAI value of 3.1 and that those stands requiring minor or major treatments had mean values of 4.8 and 9.2 respectively. Douglas Fir stands not requiring treatment had a mean scaled LAI value of 7.3 and those requiring minor or major treatment had mean values of 9.5 and 14.8 respectively. The existing conditions model uses these three forest condition categories for oaks and Douglas fir forests along with these threshold LAI values (see Chapter 4), and the scenario was implemented by simply changing all minor and major treatment areas to no treatment values. Current forest conditions in areas burned by the Tubbs Fire are not captured in the LiDAR-derived LAI data and treatment needs within the burn area are unknown but may be expected to be reduced. We excluded the area of higher severity burn used to represent the Tubbs Fire in the calibration model (see Figure 12) from the identified areas needing treatment.

We used the proportional changes in LAI determined for Black/Oregon Oak and Douglas Fir to delineate treatment categories and estimate LAI for other species of oaks and for mixed Douglas Fir/Tanoak forest which were not included in the mapping at Monan's Rill. We also reduced rooting depths by 10% in the treated areas to better represent changes in transpiration not

Table 16: Forest plots mapped at Monan's Rill and associated treatment needs and Leaf Area Index (LAI) values.

Plot #	Stand Type	Treatment Needed?	Scaled LAI
1	Douglas Fir	No	7.3
7	Douglas Fir	Minor	9.5
3	Douglas Fir	Major	12.9
6	Douglas Fir w/ Tanoak	Major	16.5
5	Black Oak	No	3.0
8	Oregon Oak	No	3.2
4	Black Oak w/ Encroaching Douglas Fir	Minor	4.6
9	Oregon Oak w/ Encroaching Douglas Fir	Minor	4.9
2	Oregon Oak w/ Encroaching Douglas Fir	Major	9.2

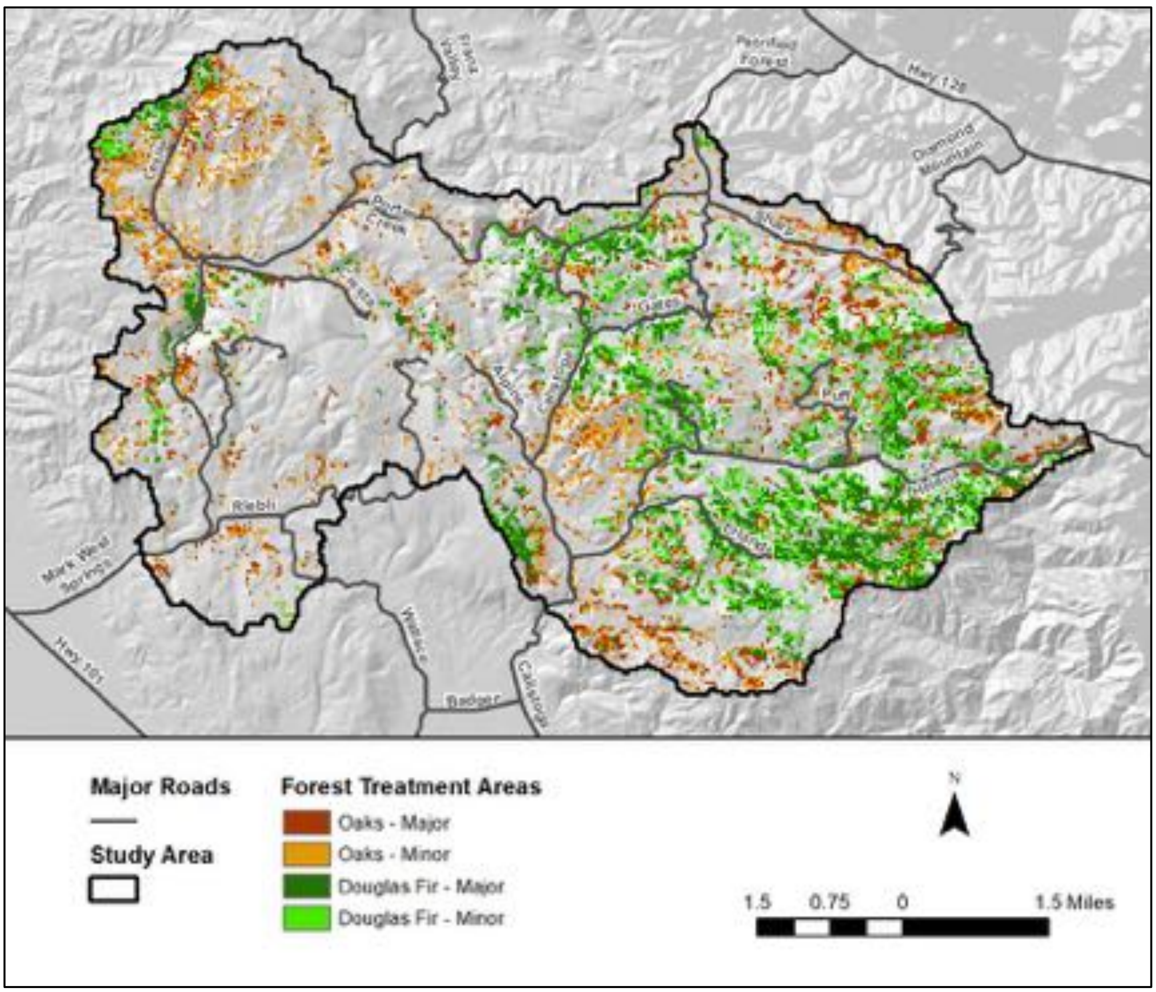


Figure 70: Areas of oak and Douglas Fir forest included as treated in the forest management scenario (Scenario 4).

captured by the LAI changes. The effects of forest treatment on other parameters such as overland roughness coefficients and detention storage are more uncertain and were assumed not to be affected by treatment for the purposes of this analysis. There are a total of 7,054 acres of treated forest represented in the model scenario which was divided approximately equally between various species of oaks (3,428 acres) and Douglas Fir (3,626 acres) (Figure 70).

Grassland Treatment

Increasing Soil Organic Carbon (SOC) on grasslands through compost application or strategic grazing practices has been identified as an important strategy for sequestering carbon (e.g. Ryals & Silver, 2013; Zomer et al., 2017). In addition to carbon sequestration benefits, increasing SOC may result in hydrologic benefits through increases in soil water availability and associated effects on seasonal soil water deficits and groundwater recharge. This scenario is designed to examine the potential hydrologic effects of large-scale adoption of grassland management practices designed to increase SOC. We assumed a 3% increase in SOC would be achievable (Flint et al., 2018) and related that change in SOC to a change in soil moisture contents at saturation, field capacity, and the wilting point based on data from 12 studies compiled by Minasny & McBratney (2018).

We implemented the grassland treatments in all grasslands in the model with more than a 2-acre contiguous area as identified in the fine-scale vegetation mapping (SCVMLP, 2017) covering a total of 2,874 acres (Figure 71). These grasslands were located in 14 different soil types as represented in the model (see Figure 15), and we classified each as fine, medium, or coarse and applied the associated mean estimates of the change in moisture contents from a 1% increase in SOC from Minasny & McBratney (2018). We scaled the estimates up to reflect a 3% increase in SOC which resulted in increases in soil moisture content at saturation, field capacity, and the wilting point of 0.10-0.14, 0.04-0.07, and 0.02-0.03 respectively, and increases in available water capacity (AWC) of 0.044-0.068. These estimates are generally consistent with the changes in AWC estimated for a 3% increase in SOC for soils of similar textures by Flint et al., (2018) which were based on the work of Saxton & Rawls (2006).

Runoff Management

Managing runoff from rooftops and impervious areas around residential and other developed areas to encourage infiltration has been recognized as an important best management practice for new development and is commonly referred to as Low Impact Development (LID). Most developed areas in Mark West Creek watershed were constructed prior to adoption of LID techniques. Traditional runoff management, on the other hand, is more likely to encourage runoff to flow quickly away from infrastructure and towards receiving water bodies via downspouts, drains, and ditches. This scenario is designed to examine the potential hydrologic benefits of large-scale adoption of LID practices on existing developed lands in the watershed.

We identified areas of contiguous impervious surface in the watershed from the developed category in our model land cover data. This spatial data is based on non-roadway impervious areas identified in the fine-scale vegetation map and resampled onto the 0.5-acre model grid.

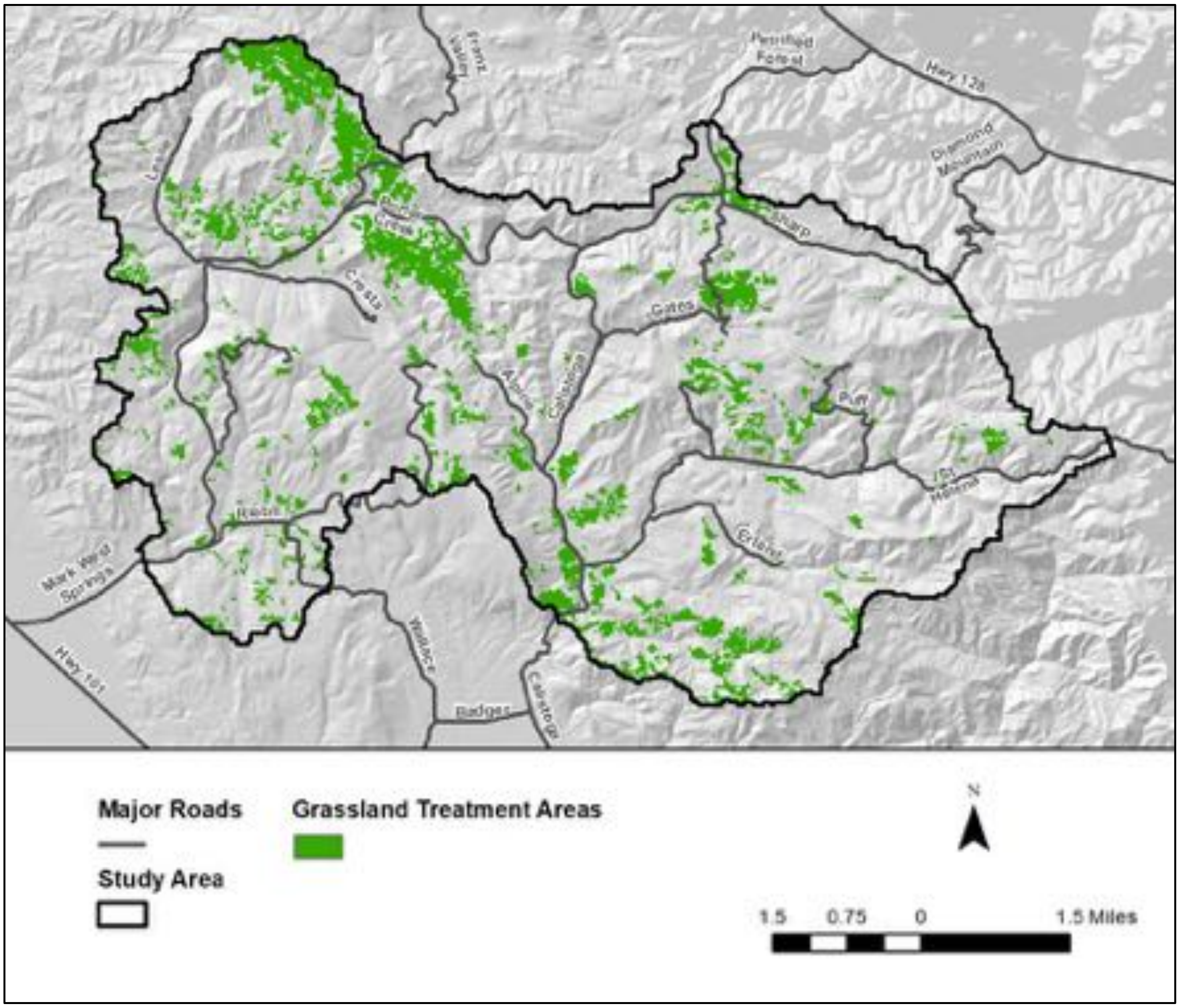


Figure 71: Treated grasslands included in the grassland management scenario (Scenario 5).

The resampling results in the exclusion of smaller impervious areas and the identification of the larger contiguous impervious areas most suitable for runoff management projects with potentially significant benefits. Roads are not represented in the scenario, although large-scale management of road runoff could have significant additional hydrologic benefits beyond what was simulated here. Development is most highly concentrated within the Riebli Creek watershed which is not considered to have high habitat value and contributes flow to Mark West Creek well downstream of the high priority reach. For these reasons, and to avoid dramatically increasing the scale of the scenario for potentially minimal benefit, we excluded Riebli Creek watershed from the analysis.

The developed areas represented in the scenario total 310 acres (Figure 72) which is about 76% of the total non-roadway impervious area in the watershed outside of the Riebli Creek drainage. There are multiple strategies possible for encouraging infiltration of runoff from these lands including use of level spreaders, bioswales, or infiltration basins. The most appropriate strategy

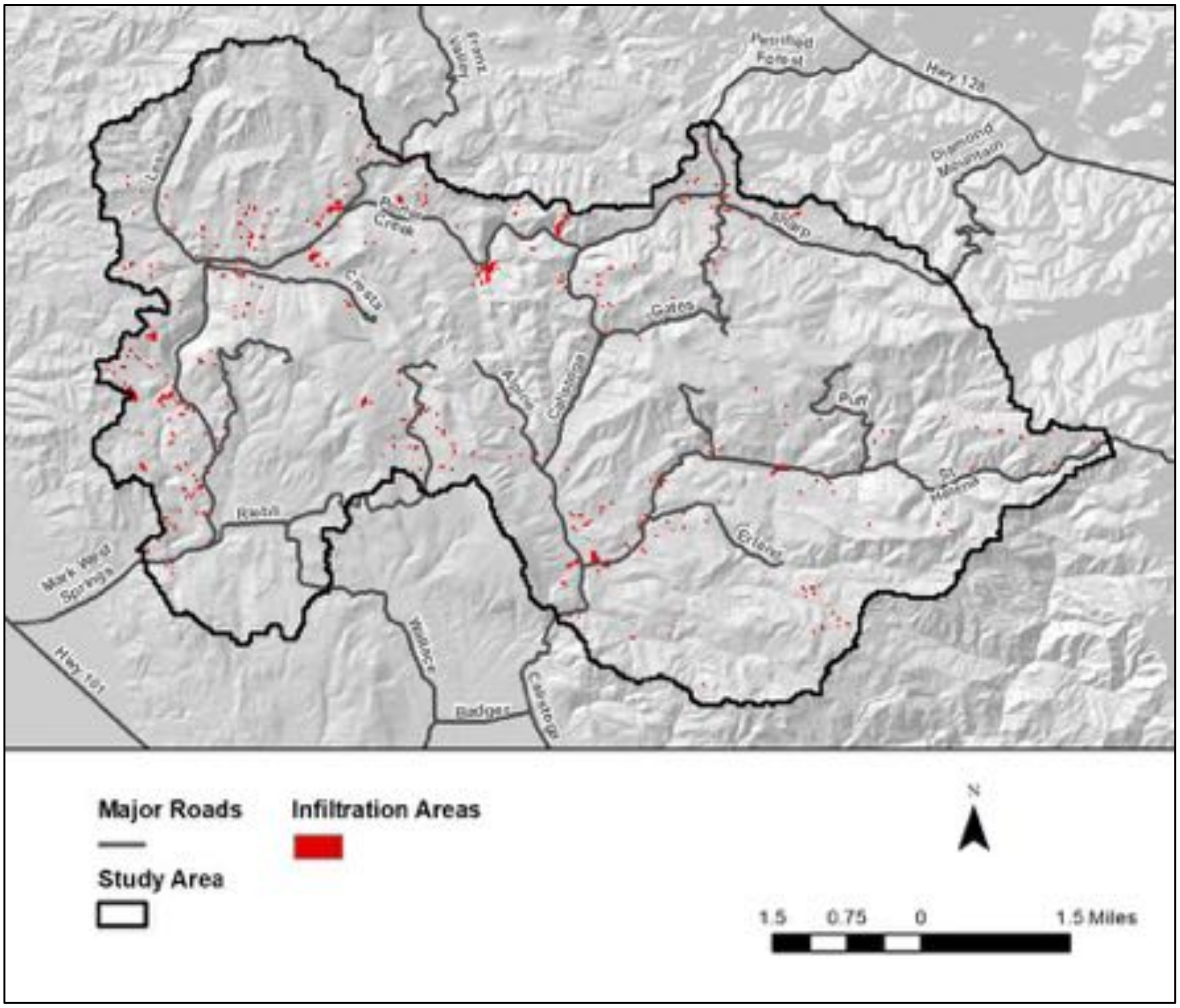


Figure 72: Developed areas included in the runoff management scenario (Scenario 6).

and design for a given location is highly site-specific and implementing the details of these stormwater management features is not practical at the 0.5-acre grid scale used in the model. Thus, for the purposes of this regional planning-level study we simply assumed that practices could be implemented to prevent all runoff generated directly from the identified developed lands from leaving the site. The scenario was implemented in the model by preventing runoff from entering or leaving each area through the use of the separated overland flow area option, and allowing water to pond, infiltrate, and evapotranspire according to the precipitation patterns and soil and evapotranspiration properties present at a given site.

The largest storm event in the 10-yr simulation was approximately a 10-yr event based on comparison to NOAA Atlas 14 precipitation frequency estimates. Thus, for projects to be equivalent to the model scenario they would need to be able to handle the peak flows and runoff volumes from a 10-yr storm. The model results indicate that in the upper watershed the 48-hr volume from this event over a 0.38 acre average per parcel developed area would be about 0.19

to 0.24 ac-ft. This would require a native soil basin on the order of 2,300 ft^2 or a gravel-filled basin of about 6,700 ft^2. These basins are large but likely feasible in many cases given the five acre average parcel size. Runoff management projects of a smaller scale are also possible; however, the goal of this scenario is consistent with the other scenarios in its focus on estimating the maximum potential benefits of runoff management projects.

Pond Releases

Releasing water from existing ponds has been recognized as a potentially important strategy for enhancing streamflows in the lower Russian River and several flow release projects have been implemented in recent years in Green Valley and Dutch Bill creeks among other locations. Most of the ponds in the MWC watershed are too small to allow for a viable release project, but we identified at least four ponds that appear large enough for such projects, and simulated releases for three of them. Out of respect for the privacy of landowners we are identifying these ponds only by their approximate locations. Available storage volumes for releases are approximate and were estimated using the LiDAR-captured water surface elevations as the late-summer residual (after water use and infiltration/evaporation losses) storage levels and a simple relationship between dam height approximated from the LiDAR and pond storage (USACE, 2018).

The three ponds include one in upper Mark West Creek with approximately 31.9 ac-ft of residual storage, one in upper Humbug Creek with approximately 5.2 ac-ft of residual storage, and one in upper Mill Creek with approximately 30.9 ac-ft of residual storage (Table 17). None of these ponds have significant consumptive water uses associated with them, therefore releasing water to augment streamflow is not expected to require new replacement water sources. Landowners we spoke with expressed concerns about fully depleting ponds because of the desire to maintain recreational and aesthetic value and maintain an emergency water source in the event of wildfire. To address these concerns, we have assumed that only half of the available residual storage could be released and the other half would be retained in storage for other uses. We also examined the simulated runoff volumes contributing to each pond and found that there is ample winter runoff to replenish the relatively small released volumes even during drought conditions and under future climate change scenarios.

We developed two flow release scenarios, one focused on enhancing summer juvenile rearing habitat (Scenario 7) and one focused on enhancing spring smolt outmigration (Scenario 7b). The summer release covers a 92-day period each year between June 15th and September 15th and release rates ranged from 0.014 – 0.088 cfs for a total release rate of ~0.19 cfs. The spring release covers a 21-day period each year between May 7th and May 28th and release rates ranged from 0.063 to 0.383 cfs for a total release rate of ~0.82 cfs (Table 17). These periods were selected based on review of historical conditions and targeted to increase minimum flow conditions during summer and the later portion of the primary outmigration period. We did not attempt to optimize the timing and release rates for this regional planning-level study, however it is likely that benefits greater than those simulated in this study could be achieved through adaptively managing releases in conjunction with real-time streamflow data which is available at several locations from Sonoma Water.

Table 17: Overview of the pond release volumes and rates included in Scenarios 7 and 7b.

Location	50% of Residual Storage (ac-ft)	Sceanrio 7 Summer Release Rate (cfs)	Scenario 7b Spring Release Rate (cfs)
Upper Mark West Creek	16.0	0.087	0.383
Upper Humbug Creek	2.6	0.014	0.063
Upper Mill Creek	15.5	0.085	0.371
Total	**34.0**	**0.187**	**0.817**

<u>Climate Change Scenarios</u>
Four model scenarios were developed to evaluate the effects of future climate changes on hydrologic and aquatic habitat conditions in the upper Mark West Creek Watershed. Each of these scenarios was based on projections of future climate for the 2070-2099 timeframe derived from a Global Circulation Model (GCM) scenario. The scenarios reflect changes in precipitation and temperature as predicted by each GCM, but do not address other aspects of climate change that may affect hydrologic and habitat conditions such as long-term changes in vegetation or irrigation demands that may occur in response to a modified future climate regime.

Global Circulation Model Selection
The selection of the four GCM scenarios (‘futures’) was based largely on the recommendations from the Climate Ready North Bay Vulnerability Assessment and the North Coast Resource Partnership’s climate planning efforts (Micheli et al., 2016 & 2018). The vulnerability assessment selected a subset of six GCM futures from an ensemble of 18 futures analyzed by the USGS using the Basin Characterization Model (BCM) (Flint et al., 2013; Flint & Flint, 2014). These 18 futures were selected from the approximately 100 GCM futures included in the Intergovernmental Panel on Climate Change’s (IPCC) Fourth and Fifth Assessment Reports (IPCC 2007; 2014) using statistical cluster analysis. The North Coast Resource Partnership study selected six of the eighteen futures included in the BCM, and our analysis focuses on four of these six (Figure 73 & Table 18).

The selection of these futures was designed to represent the full range of plausible changes to precipitation and temperatures, and to include a scenario representative of the mean projections (Micheli et al., 2016 & 2018). Three of the futures represent the “business as usual” emissions scenario (rcp 8.5) adopted by the IPCC’s Fifth Assessment Report (IPPC, 2014). This pathway assumes high population growth and a slow adoption of clean and resource efficient technologies with atmospheric carbon dioxide concentrations rising to 936 ppm by 2100 (Hayhoe et al., 2017). One of the futures represents the “highly mitigated” emissions scenario (sres B1) reflecting a future with low population growth and the introduction of clean and resource efficient technologies; this pathway is comparable to rcp 4.5 with atmospheric carbon dioxide concentrations rising to 650 ppm by 2100 (Hayhoe et al., 2017).

Table 18: Overview of the four climate change scenarios evaluated with the MWC hydrologic model.

	GCM	Emissions Scenario	Change in Annual Precipitation (%)	Change in Maximum Temperature (°F)
Scenario 9	CNRM	rcp 8.5 (business as ususal)	37%	6.3
Scenario 10	CCSM 4	rcp 8.5 (business as ususal)	8%	5.4
Scenario 11	GFDL	sres B1 (highly mitigated)	-14%	3.7
Scenario 12	MIROC esm	rcp 8.5 (business as ususal)	-21%	11.0

Scenario 9 is a “Warm & High Rainfall” scenario based on the CNRM rcp 8.5 future, which projects a 37% increase in average annual precipitation and a 6.3°F increase in average maximum temperatures by the 2070 - 2099 timeframe relative to 1981 – 2010 (Table 18). Scenario 10 is a “Warm & Moderate Rainfall” scenario based on the CCSM4 rcp 8.5 future, which is close to the ensemble mean of the 18 futures selected for use in the BCM model and projects an 8% decrease in average annual precipitation and a 5.4°F increase in average maximum temperatures. Scenario 11 is a “Warm & Low Rainfall” scenario based on the GFDL sres B1 future which projects a 14% decrease in average annual precipitation and a 3.7°F increase in average maximum temperatures (Table 18; Figure 73). Lastly, Scenario 12 is a “Hot & Low Rainfall” scenario based on the MIROC esm rcp 8.5 future, which projects a 21% decrease in precipitation and an 11.0°F increase in temperature (Table 18).

Methodology

For all scenarios, precipitation and minimum and maximum temperature timeseries were derived from daily data from the World Climate Research Program’s Coupled Model Intercomparison Project Phases 3 & 5 (CMIP3 & CMIP5) (USBR et al., 2013). The CMIP provides monthly and daily outputs from the GCMs included in the IPCC’s Fourth and Fifth Risk Assessments statistically downscaled to a uniform 1/8th degree grid using a revised version of the bias corrected constructed analog method (BCCA v2).

Several studies have reported that GCMs are biased towards creating “drizzle” days with trace amounts of precipitation (Maurer et al., 2010). Mauer et al. (2010) claims that the BCCA method corrects this issue. However, when compared to observed precipitation records, downscaled precipitation timeseries still contained an un-representatively high number of days with trace precipitation. To address this documented issue, precipitation events with less than 0.02 in/day were removed from the precipitation timeseries. This removed between 50 and 105 trace events per year but changed average annual precipitation totals by only 0.6 – 1.2% over the 2070 - 2099 period. While this approach may not fully resolve the issue, it removes a

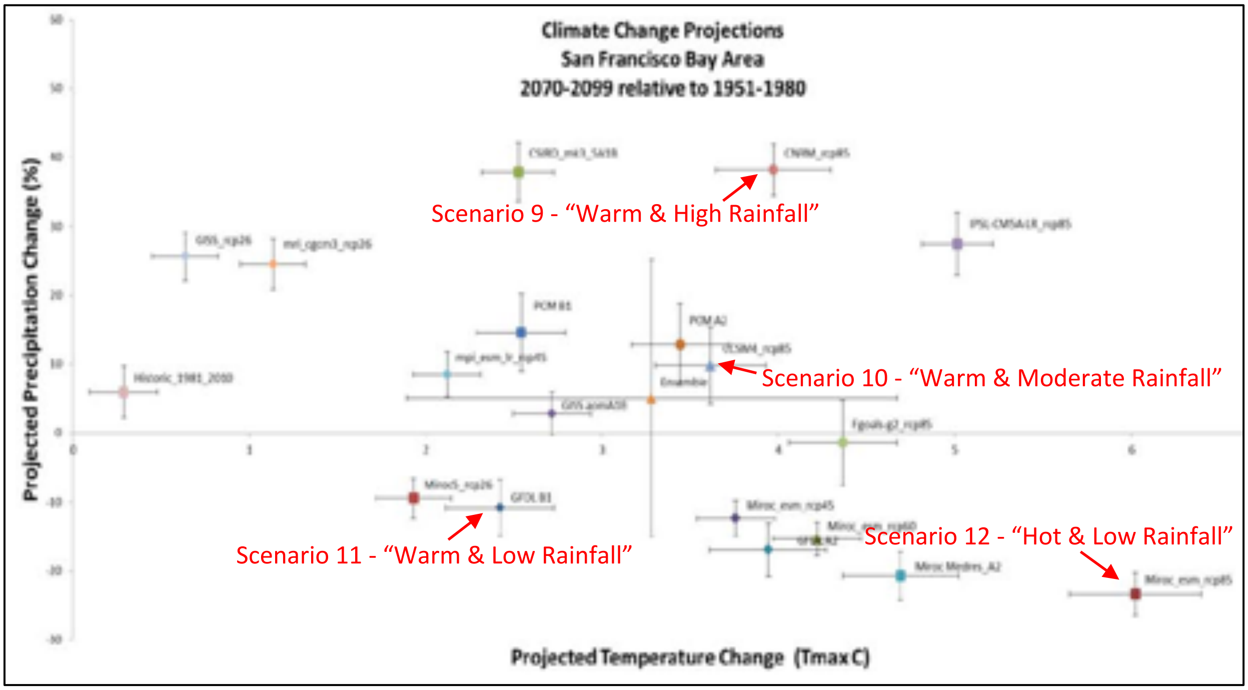


Figure 73: Projected regional changes in average annual precipitation and average maximum summer temperatures for the 18 GCMs analyzed using the Basin Characterization Model (BCM), modified from Micheli et al., 2016 to show the four scenarios included in this study.

significant number of trace precipitation events which if not filtered out could artificially increase simulated canopy interception and evapotranspiration.

Daily Potential Evapotranspiration (PET) timeseries were calculated from the CMIP minimum and maximum daily temperature timeseries using the Hargreaves-Samani Method (Hargreaves & Samani, 1982). These calculations used extraterrestrial solar radiation rates for a flat plane located at the model centroid and a KT value of 0.162 calibrated using reported temperature and evapotranspiration data from the Windsor CIMIS station. More details about the PET calculations can be found in Chapter 4.

As in the existing conditions model, precipitation and PET zone-based distributions were developed to account for the spatial variations in these parameters across the model domain. Precipitation zones are based on 1-inch average annual isohyets derived from the BCM 2070 - 2099 average annual precipitation dataset for each selected GCM future. Future PET distributions were created using the same methodology as the historic distribution discussed in the Chapter 4, in this case using average 2070 - 2099 monthly minimum and maximum temperature distributions from the BCM model. These distributions show similar spatial patterns to the historic distribution, although the range of values across each distribution varies significantly. Precipitation and PET timeseries were applied to these distributions using the same scaling factor approach as for historic conditions.

Scaling factors were calculated as the ratio of the value for each zone and the 2070 - 2099 means for the timeseries. Adjustments were made to the scaling factors applied for precipitation to correct for a high precipitation bias in the BCM dataset relative to historical conditions as observed at local climate stations (see Chapter 4 for further discussion). These adjustments were calculated such that simulated precipitation means preserve the percentage increases in mean annual precipitation between the 1981 – 2010 and 2070 – 2099 normals as estimated by the BCM.

To reduce computational requirements, each climate scenario uses timeseries from a continuous representative 10-year subset of the processed CMIP timeseries from the 2070 - 2099 period. These subsets were selected such that average annual precipitation was within 2% of the average annual precipitation estimated for the 2070 - 2099 normal for each future and such that each subset contained at least one extremely dry and one extremely wet year, as well as a multi-year drought (if present in the original 30-yr period). A summary of the annual and daily precipitation and PET inputs for the selected periods is shown in Figure 74-Figure 77. While the results of these scenarios will be compared against one another, it is not necessary for these time periods to match. GCMs simulate general climatic conditions, not specific weather events, and one would not expect conditions modeled for a given year to be comparable to conditions modeled for the same year using a different GCM.

Inputs Summary

Besides the changes in average annual precipitation and average maximum temperatures shown above in Table 18, the GCMs used as the basis for these scenarios predict several important inter- and intra-annual changes in precipitation and PET. Previous studies of large GCM ensembles have indicated that precipitation will become more volatile, that large precipitation events will become more frequent, and that the seasonal distribution of precipitation will concentrate in the core winter months (e.g. Swain et al., 2018). To assess the degree to which each of the selected GCM futures reflect these projected trends, several statistics were calculated. These include the frequency of historically wet and dry years (defined by the 80th and 20th percentile annual precipitation totals), the magnitude of large precipitation events (maximum 24-hr precipitation), and the seasonal distribution of precipitation (defined by the ratio of precipitation occurring during the core winter months of November - February and the peripheral months of October, March, and April). The baseline for these comparisons is the 2009-2019 simulation period, however as discussed in Chapter 4, conditions during this period are broadly representative of 1981-2010 conditions which is widely used as the baseline period for interpreting future climate changes.

The Scenario 9 (CNRM rcp8.5) future projects a general shift towards wetter conditions. Both the frequency and magnitude of wet years increases, as well as the frequency of higher intensity precipitation events (Table 19 & Figures 74-77). Much of this additional precipitation is projected during the core winter months, leading to a marked shift in the seasonal precipitation distribution. However, despite the large increase in average precipitation, the frequency and magnitude of dry years is projected to remain similar to historic conditions. Despite the low increase in average annual precipitation, the Scenario 10 (CCSM4 rcp8.5) future projects a large increase in annual and seasonal variability (Table 19 & Figures 74-77). It projects the single highest annual precipitation total (80.2 in), the greatest inter-annual variability, and the strongest seasonal shift in precipitation towards the winter months. It also predicts individual dry years of similar frequency and magnitude to historical conditions, but more frequent multi-year droughts.

The Scenario 11 (GFDL sresB1) future projects a general shift towards drier conditions, with increases in both the frequency and intensity of droughts (Table 19 & Figures 74-77). Although the MIROC esm rcp8.5 future projects slightly drier average conditions, the GFDL sres B1 future projects the single driest year, with an average of 11.8 inches of precipitation. This future also projects the lowest precipitation intensities, with maximum daily rainfall totals of less than 2.0 in for most years. The Scenario 12 (MIROC esm rcp8.5) future also projects a general shift towards drier conditions with both the frequency and intensity of droughts increasing (Table 19 & Figures 74-77). Historically dry years are projected to become roughly twice as common and precipitation decreases by up to 30% during the driest years. Although no years with annual totals exceeding the historic 80^{th} percentile are projected, moderately wet years with up to 47 inches of precipitation are still present. During these wetter years, maximum daily precipitation totals are projected to be similar to historic conditions, but much lower during normal and drier years.

Despite the large differences in future projections between the scenarios, all four scenarios share some commonalities. Regardless of the scenario, droughts are predicted to become more extreme and precipitation is predicted to have increased seasonality with more precipitation focused in the core winter months. Additionally, all four scenarios predict increases in PET which vary between scenarios based on the magnitude of the predicted increases in temperatures and represent increases of about 6-14% relative to historic conditions (Table 19 & Figures 74-77).

Mitigated Scenarios

To evaluate the scale of the predicted changes in hydrologic conditions under future climate relative to potential streamflow enhancement actions, we developed two mitigated scenarios. Scenario 13 combines the GFDL future climate simulation (Scenario 11) with the pond release scenarios (Scenarios 7 and 7B), and Scenario 14 combines the GFDL future climate with the combined management scenario (Scenario 8) (Table 15). To keep the number of scenarios to a reasonable level, we only ran the mitigation scenarios using future climate as predicted by the GFDL model. We selected this model because our results showed that it represented the second most extreme predictions of future changes in streamflows which we felt would provide the best overall picture of the degree of climate change induced impacts to streamflows that could be mitigated with the investigated management actions. A higher degree of mitigation would likely be possible if future climate more closely resembles the CNRM or CCSM4 model predictions and less mitigation would be possible if future climate more closely resembles the MIROC esm model predictions.

Table 19: Summary of key climate statistics for each climate scenario evaluated with the MWC hydrologic model.

	Historic	Scenario 9 CNRM	Scenario 10 CCSM4	Scenario 11 GFDL	Scenario 12 MIROC esm
Average Annual Precipitation (in)	36.0	49.3	38.9	30.9	28.6
Maximum Annual Precipitation (in)	61.2	75.2	80.2	46.9	47.3
Minimum Annual Precipitation (in)	19.5	18.6	17.6	11.8	13.3
Interannual Variability (in)	12.9	16.5	20.2	10.6	9.4
Frequency of 80^{th} Percentile Historic Annual Precipitation	-	5	2	0	0
Frequency of 20^{th} Percentile Historic Annual Precipitation	-	2	3	5	4
Seasonal Precipitation Distribution (Core:Periphery)	2.0	4.6	5.3	3.4	3.9
Maximum 24-hr Precipitation (in)	4.7	7.3	5.0	4.5	4.8
Average Annual PET (in)	45.4	50.1	49.5	48.0	51.7

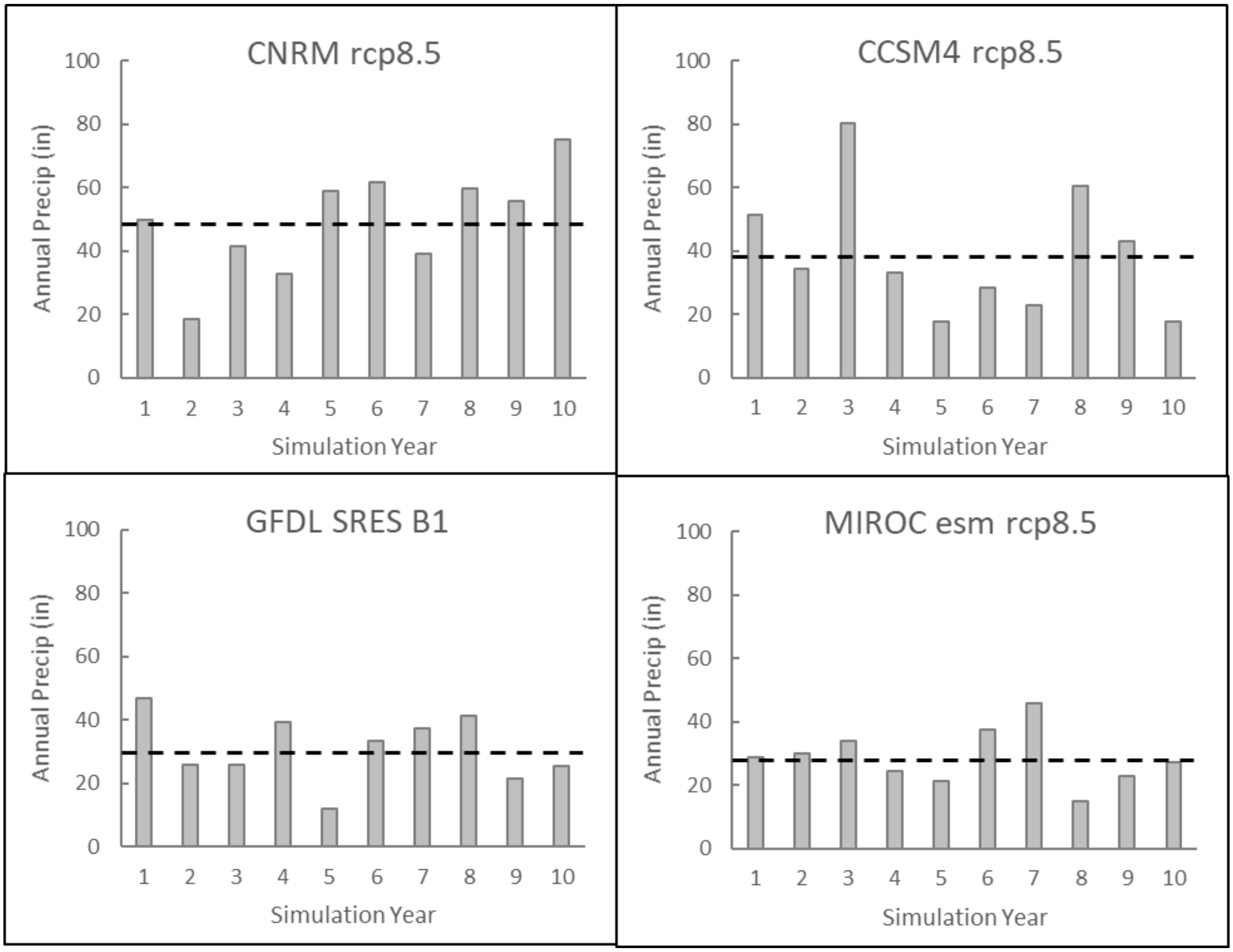


Figure 74: Spatially averaged annual precipitation within the model domain for each of the four selected climate scenarios (dashed black lines indicate the 2070-2099 mean).

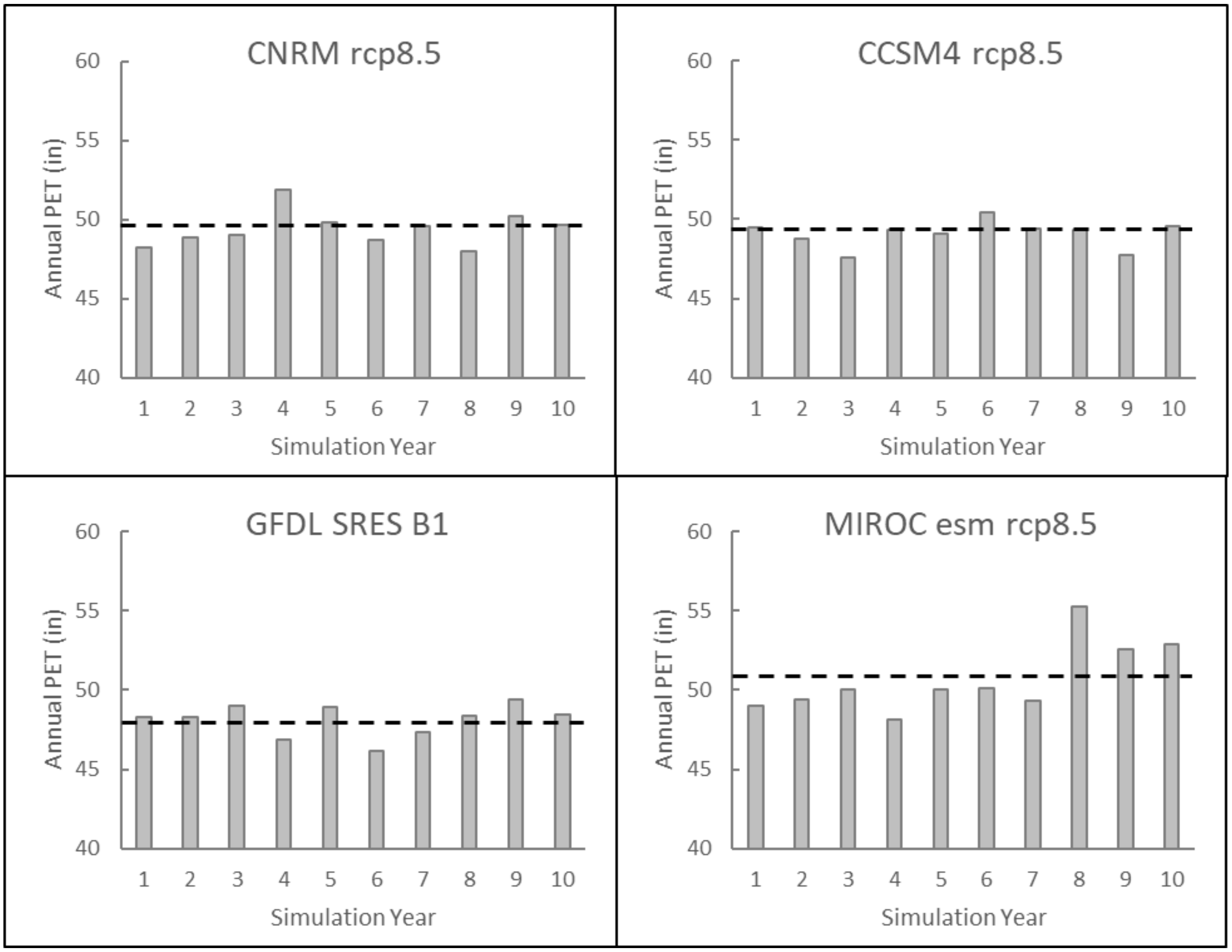


Figure 75: Spatially averaged annual Potential Evapotranspiration (PET) within the model domain for each of the four selected climate scenarios (dashed black lines indicate the 2070-2099 mean).

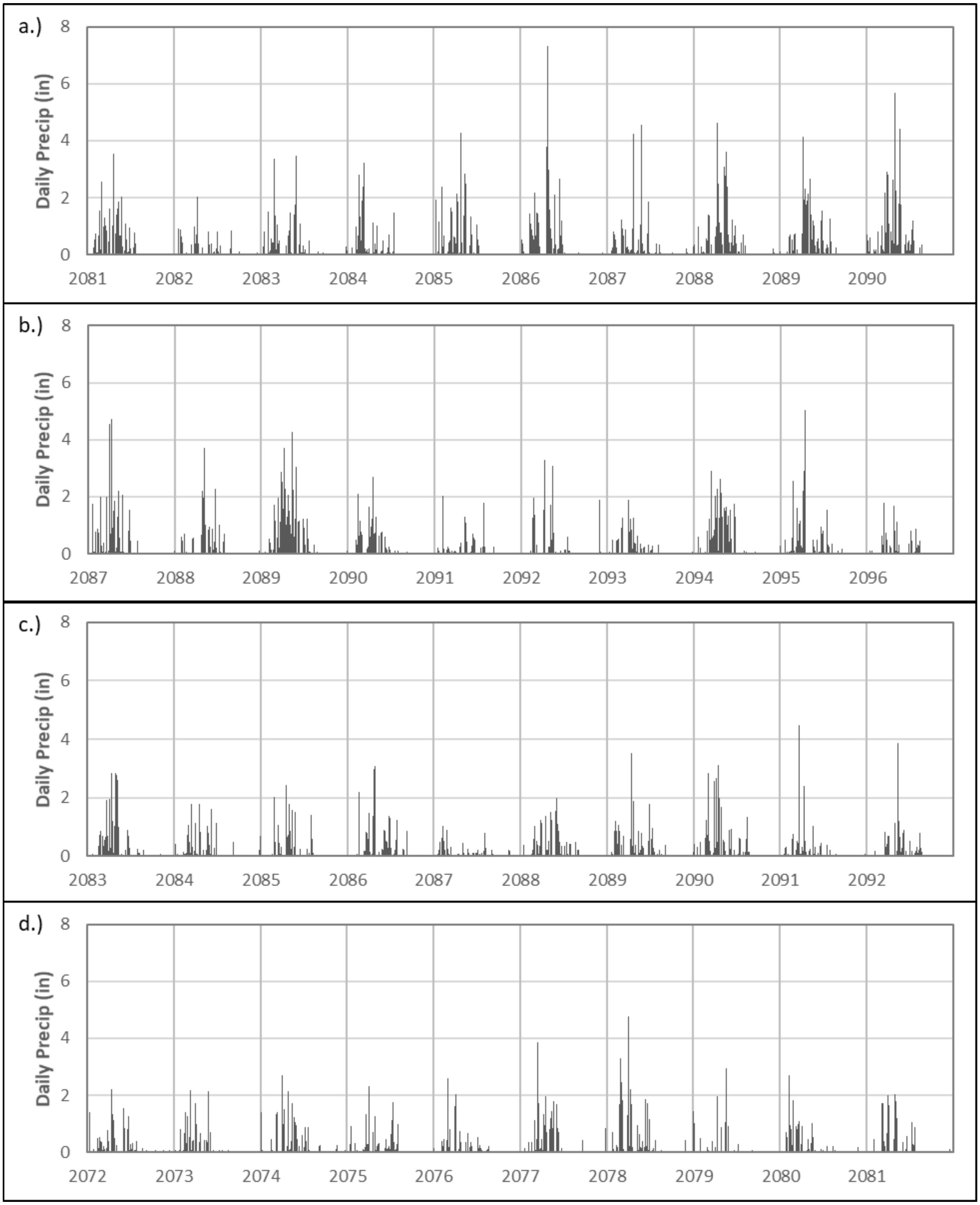


Figure 76: Spatially averaged daily precipitation used in scenarios (a) CNRM rcp8.5, (b) CCSM4 rcp8.5, (c) GFDL SRES B1, and (d) MIROC esm rcp8.5.

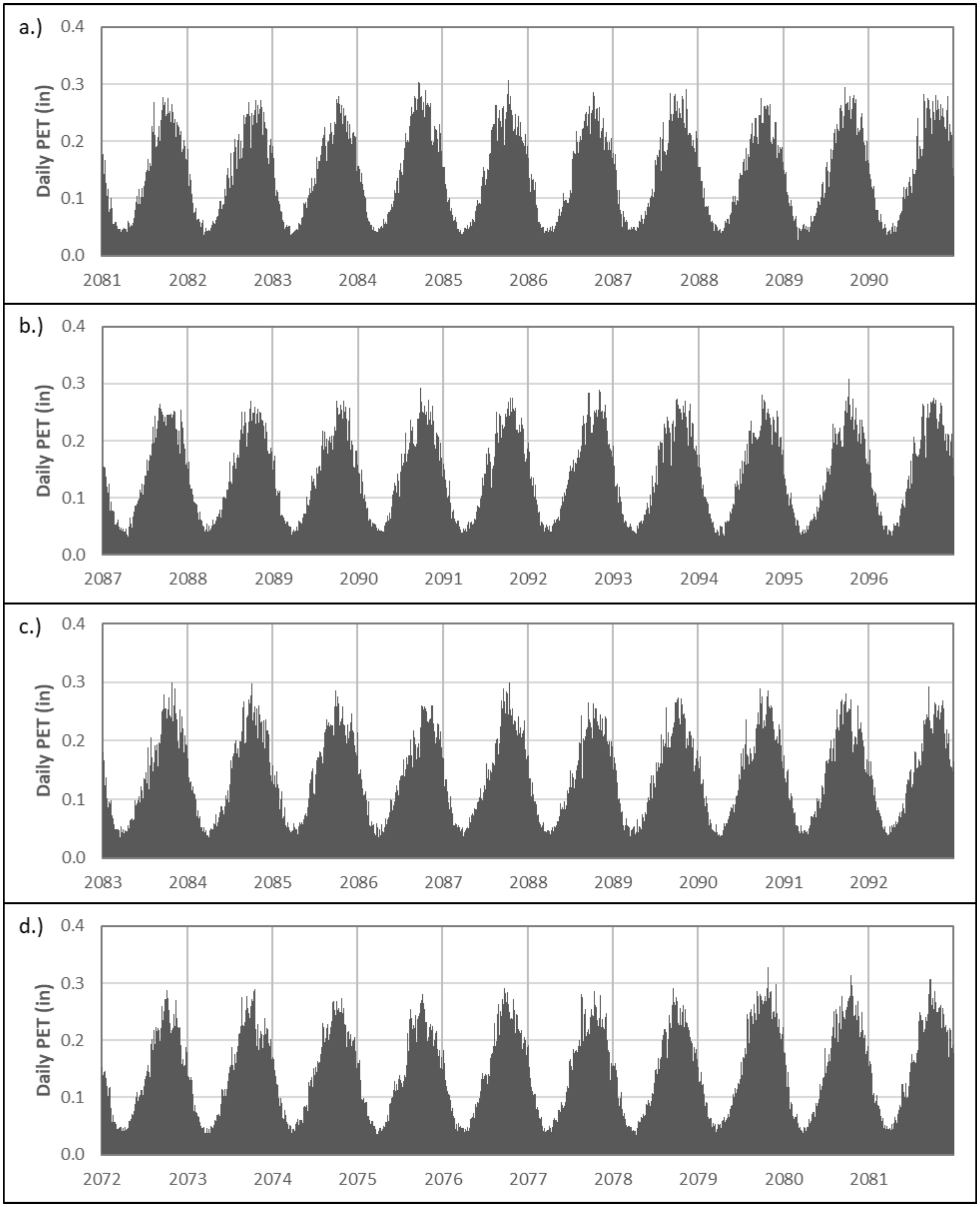


Figure 77: Spatially averaged daily Potential Evapotranspiration (PET) used in scenarios (a) CNRM rcp8.5, (b) CCSM4 rcp8.5, (c) GFDL SRES B1, and (d) MIROC esm rcp8.5.

Results

Water Use Scenarios

The no surface water diversion scenario (Scenario 1) revealed that the sustained cumulative effect of diversions in the watershed is relatively small. With diversions turned off, the average summer discharges increased by less than 0.01 cfs in most of the upper and middle reaches of Mark West Creek and by up to 0.03 cfs in the lowest reaches (Figure 78). The effects of diversions on mean springtime streamflow was similar but slightly greater than the summertime effects, with stream discharge increasing by 0.02-0.04 cfs at most locations downstream of Humbug Creek (Figure 81) with all diversions turned off. We compiled hourly discharge results to evaluate potential short-term diversion effects not captured with the mean summer discharge comparison. This revealed that diversions do have more significant short-term impacts on streamflow, with short-term increases in discharge under Scenario 1 of about 0.05 cfs upstream of Humbug Creek, 0.09 cfs downstream of Humbug Creek, and 0.07 cfs below Porter Creek (Figure 78).

The diversion impacts are discernable but minimal downstream of Monan's Rill and reach a maximum just downstream of Humbug Creek which has a high concentration of diversions (Figure 79). The timing of the simulated streamflow reductions is closely related to the model input assumptions regarding diversion timing and therefore the greatest changes occur on the first of each month when all diversions are active and are near zero during times when few diversions are active. Hence, it is likely that the short-term impacts are exaggerated given that the assumptions of coincident timing create a worst-case scenario. It is interesting to note that the fluctuations in flow throughout the summer due to other factors are generally larger than the fluctuations caused by diversions, therefore it would be very difficult or impossible to discern diversion impacts from examination of streamflow records alone (Figure 79).

The no groundwater pumping scenario (Scenario 2) revealed that the cumulative effect of groundwater pumping in the watershed is larger than that of surface water diversion but of modest magnitude. With groundwater pumping turned off, the average summer discharge increased by less than 0.01 cfs in the upper reaches of Mark West Creek and by up to about 0.06 cfs in the lowest reaches (Figure 80). Mean springtime discharge increases show a similar pattern to the summer increases with slightly larger changes (Figure 81). Examination of the water balance revealed that the aquifer system takes at least several decades to fully adjust to the change in pumping regime, and the reported flow increases represent the 10-yr period following 40-yrs of no pumping. Over the first 10-yr simulation cycle with no pumping, most of the volume that would have been pumped could be accounted for by increased groundwater storage, with only about 18% of the volume manifesting as increased groundwater discharge. During the fifth 10-yr cycle, the changes in storage were minimal and increased groundwater discharge accounted for about 76% of the pumped volume (Figure 82). Most of the remaining volume can be accounted for by increases in AET from the saturated zone and small decreases in recharge which serve to partially buffer the effects of pumping on streamflow (Figure 82).

We also examined the monthly changes in streamflow and other water balance components and found that volumetrically, the largest streamflow depletions occurred during December through April (~0.50 cfs at the watershed outlet) and the lowest rates occurred during July through September (0.06 cfs). This may seem counter-intuitive given that pumping rates peak in June and are at a minimum in January, however it is necessary to consider all of the effects of pumping on the water balance together to gain an understanding of the mechanisms behind the depletion seasonality. The largest month-to-month changes in the water balance occur as changes in storage. With pumping turned off and associated seasonal pumping drawdowns eliminated, not as much water enters storage during the recharge season resulting in more water available to contribute to groundwater discharge (Figure 83). Another significant but lesser effect is that higher groundwater elevations during the dry season result in more water available to riparian vegetation which serves to partially offset summer streamflow depletion through increases in AET from the saturated zone (Figure 83). This analysis suggests that strategies focused on deferring dry season pumping in favor of wet season pumping and storage (which may be effective in alluvial aquifers with short response time-scales) may not be very effective in bedrock aquifer settings like Mark West Creek. It is also important to note that the seasonal storage and AET effects from increasing levels of pumping may be expected to be asymptotic, and that since the total pumping volumes in the watershed are relatively low (~3% of annual infiltration recharge), the seasonality of streamflow depletion may be expected to become less pronounced under higher pumping stresses.

Results of the selective no pumping scenarios (Scenarios 2B-2E) indicate that the magnitude of summer streamflow depletion after 40-50 years of pumping does vary depending on distance from streams and springs, and likely also depending on well screen (perforated well casing) depth and hydrogeologic properties. To account for small differences in pumping volume reductions between the scenarios, we normalized the streamflow results by the change in pumping volume. Mean summer streamflow at the outlet of the watershed increased by 0.026 cfs per 100 ac-ft of pumping decrease for wells located within 500-ft of streams and screened within the upper 200-ft of aquifer material (Scenario 2B) (Table 20). This rate is approximately 137% of the rate determined for all wells from Scenario 2 (0.019 cfs/100 ac-ft of pumping decrease). The highest rate (0.029 cfs per 100 ac-ft of pumping decrease) was for wells located within 500-ft of springs (Scenario 2C). Wells screened within tuffaceous materials (Scenario 2D) showed streamflow effects similar to the average for all wells, and wells located more than 1,200-ft from streams and springs and not screened in the upper 200-ft of aquifer material (Scenario 2E) showed the smallest effects, with a rate of streamflow increase of 0.017 cfs per 100-ac-ft of pumping decrease which represents about 89% of the rate determined for all wells (Table 20).

This analysis suggests that proximity to springs and streams can be useful in determining the relative magnitudes of summer streamflow depletion within the 50-yr timeframe. However, it is important to note that all wells (including those distant from streams and screened at depth) may still be expected to result in streamflow depletion and the rate of depletion from near stream wells screened in the upper 200-ft was only about 1.7 times the rate for distant wells screened at depths greater than 200-ft (Table 20). It is also apparent that the 50-yr simulation timeframe is not long enough for the system to fully adjust to a change in pumping regime, and over longer timeframes it may be expected that the differences between proximal and distal well impacts would decline.

Simulation results from the no water use scenario (Scenario 3) which represents conditions in the 10-yr period following 40-yrs without water use indicate that the cumulative effect of all surface and groundwater uses in the watershed is equivalent to approximately 8% of summer streamflow. With all water uses turned off, mean summer streamflow increased by 0.01 to 0.02 cfs upstream of Van Buren Creek, by 0.02 to 0.04 cfs between Van Buren and Porter Creeks, and by 0.04 to 0.09 cfs in the reaches downstream of Porter Creek (Figure 80).

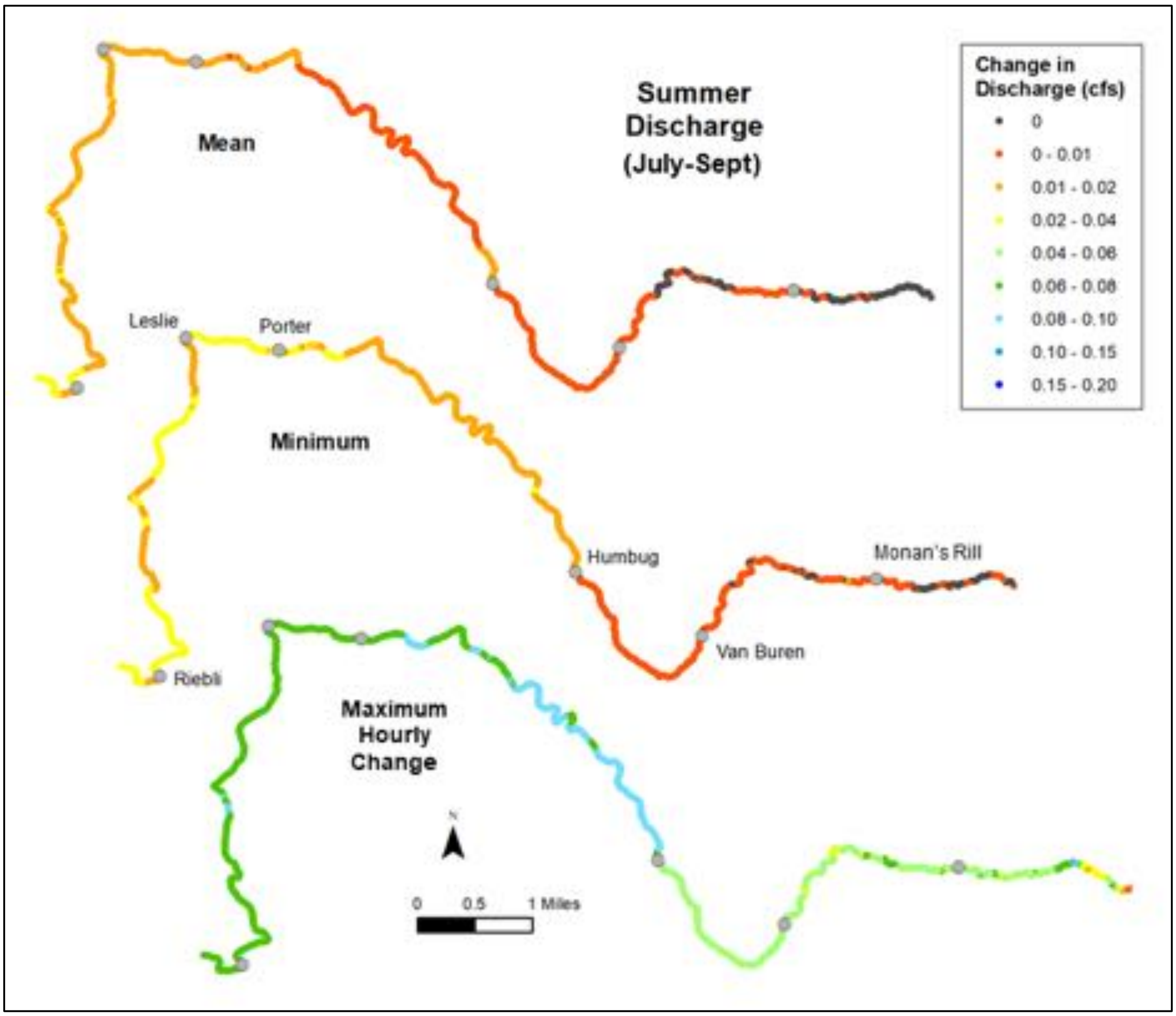


Figure 78: Changes to mean and minimum summer streamflow, and maximum hourly changes from cessation of all surface water diversions (Scenario 1).

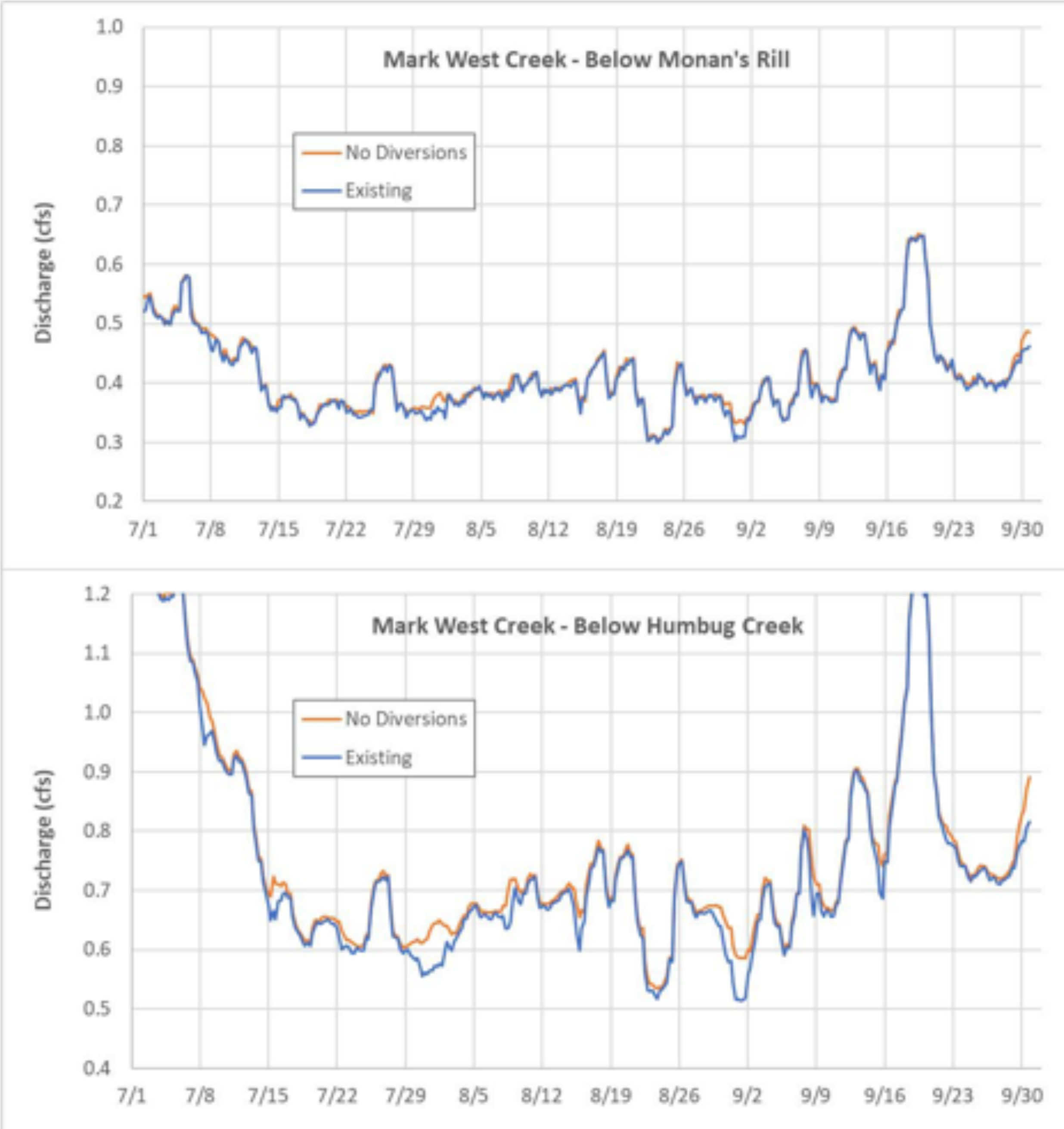


Figure 79: Simulated changes to hourly streamflow in Mark West Creek below Monan's Rill and below Humbug Creek resulting from cessation of all surface water diversions (Scenario 1).

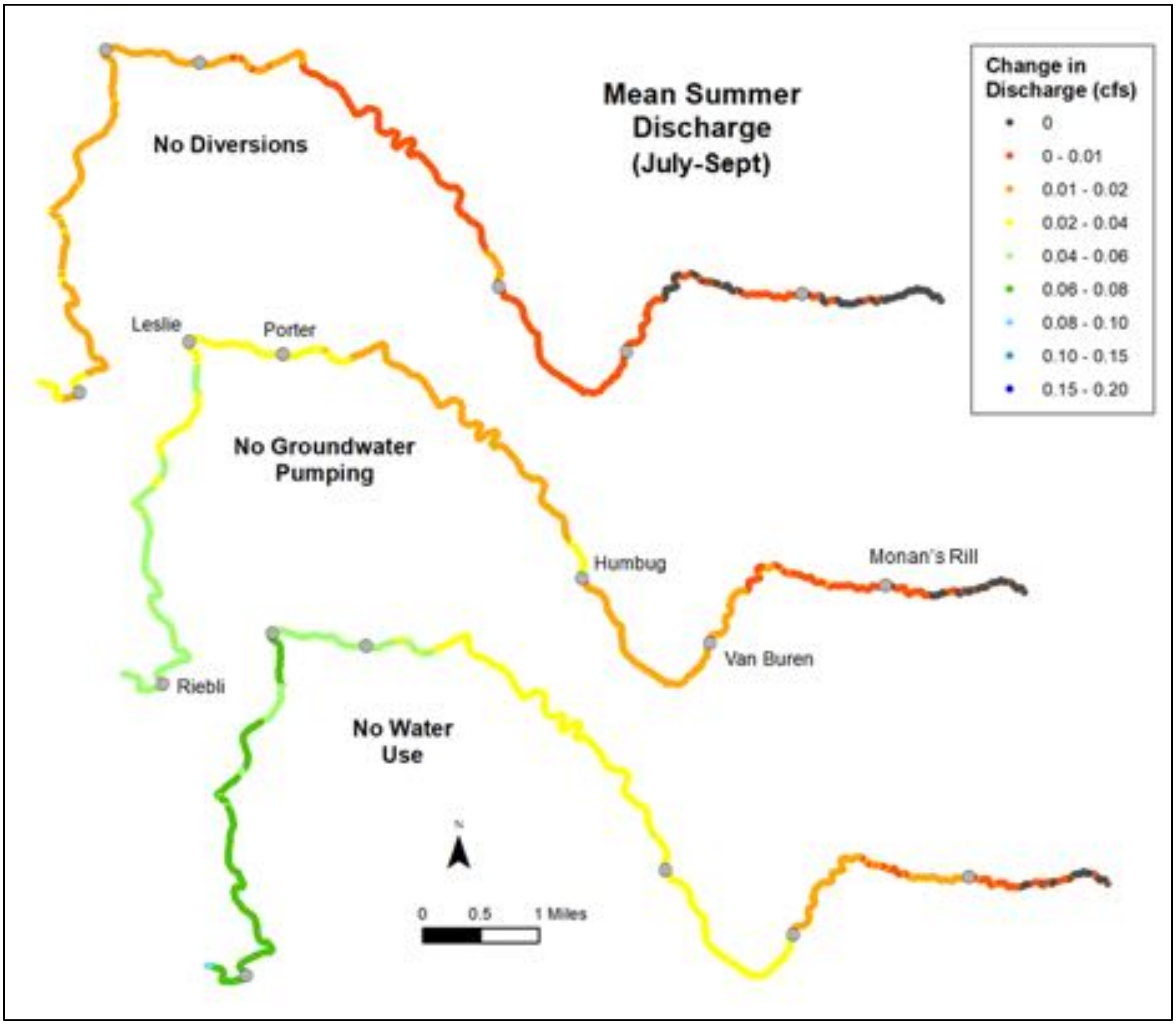


Figure 80: Simulated changes to mean summer streamflow for the three water use scenarios (Scenarios 1-3).

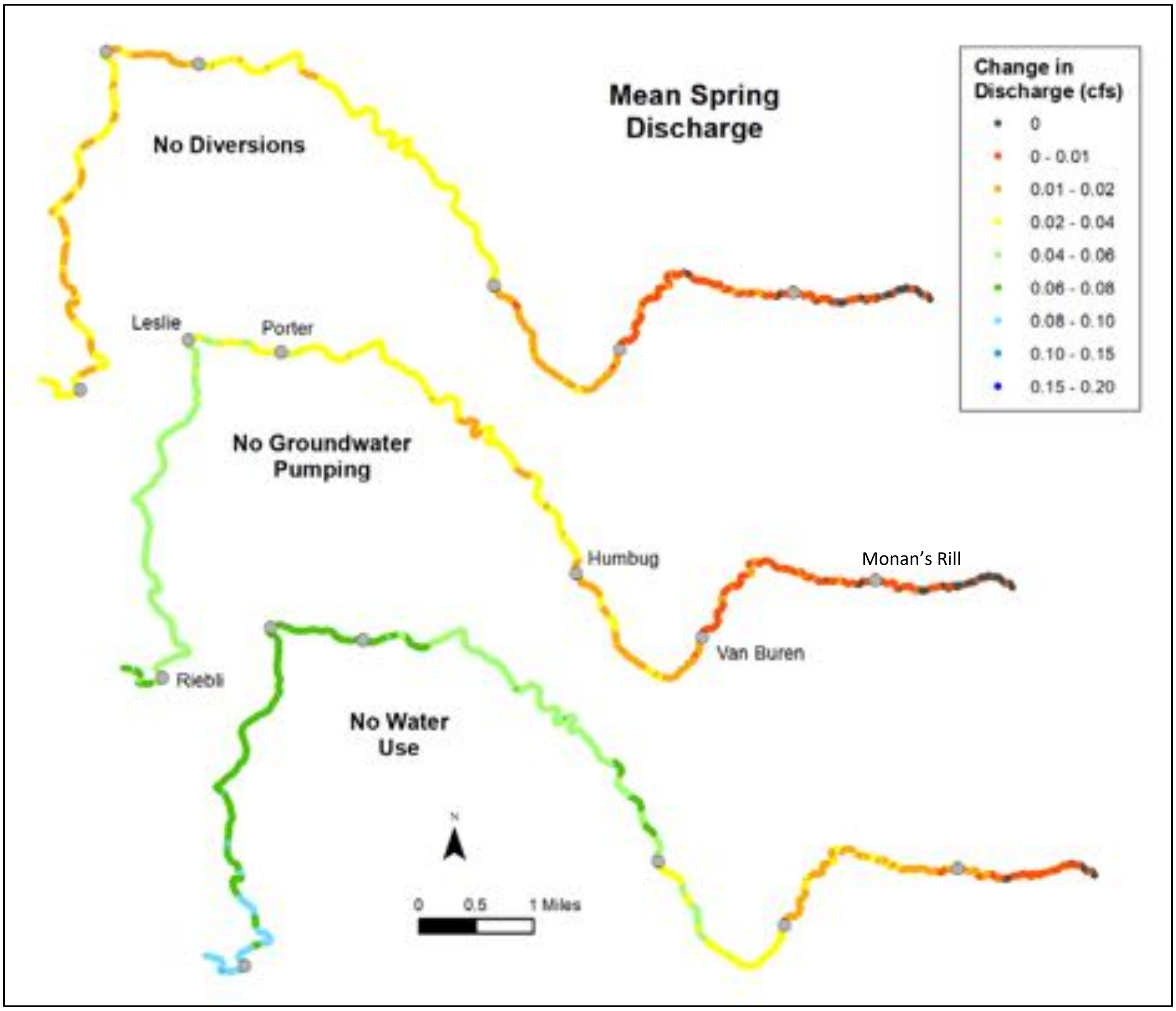


Figure 81: Simulated changes to mean spring streamflow for the three water use scenarios (Scenarios 1-3).

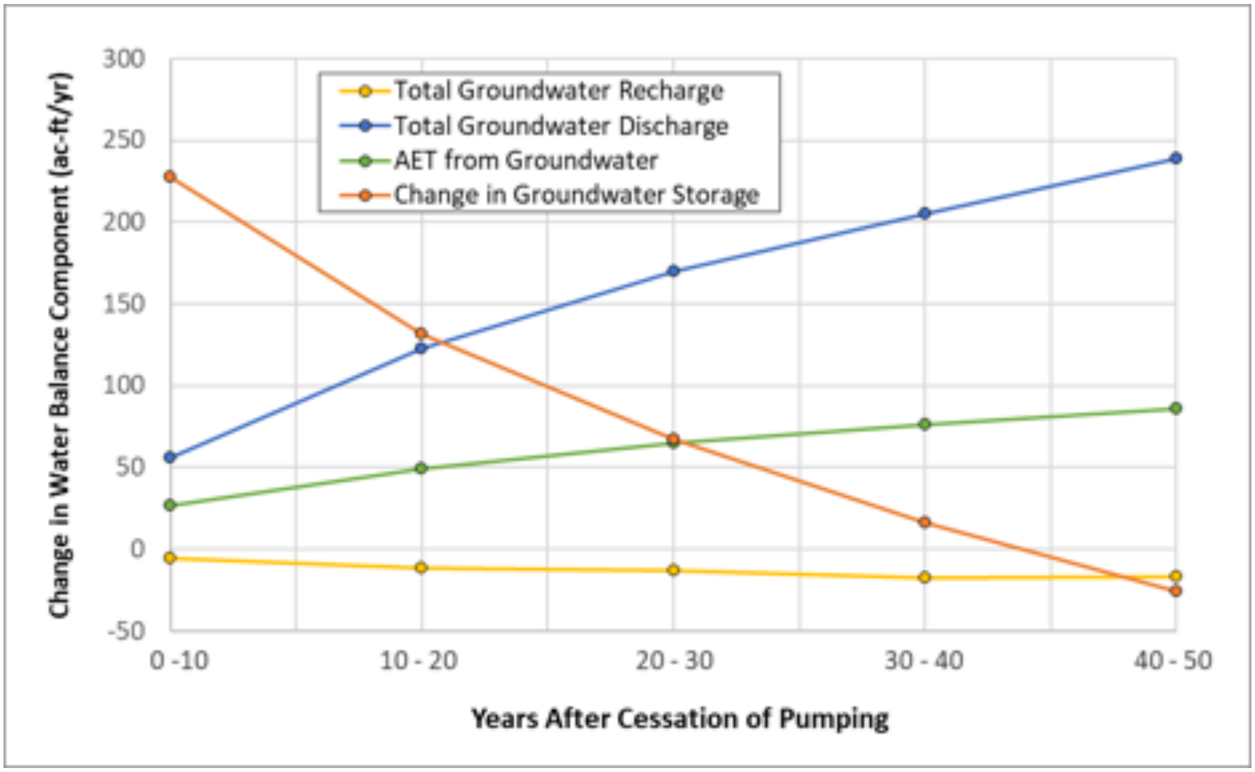


Figure 82: Changes to annual groundwater water balance components resulting from cessation of all groundwater pumping (Scenario 2) for each of the five 10-yr simulation cycles.

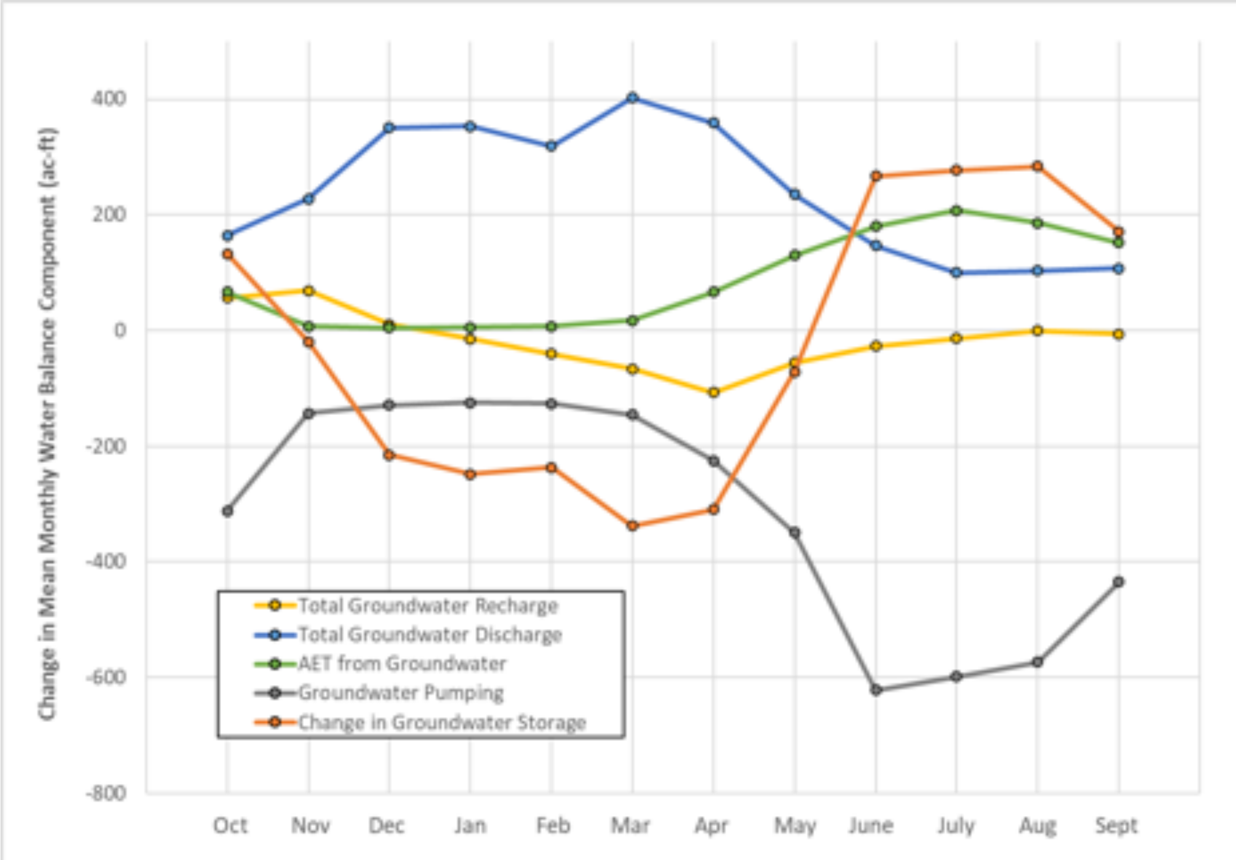


Figure 83: Mean monthly changes in the groundwater water balance resulting from cessation of all groundwater pumping (Scenario 2) for the fifth 10-yr simulation cycle.

Table 20: Summer streamflow depletion normalized by pumping volume for the various no pumping scenarios over the fifth 10-yr simulation cycle (Scenarios 2 & 2B-2E).

Scenario #	Scenario Name	Change in Mean Summer Discharge (cfs/100 ac-ft of pumping)
2	No Groundwater Pumping	0.019
2B	No Pumping Near Streams	0.026
2C	No Pumping Near Springs	0.029
2D	No Pumping From Tuff	0.019
2E	No Distal Pumping	0.017

Land/Water Management Scenarios

Forest, Grassland, and Runoff Management

The forest management scenario (Scenario 4) resulted in modest increases in mean summer discharges of 0.02 – 0.04 cfs throughout most of Mark West Creek upstream of Porter Creek and increases of 0.04 – 0.06 cfs below Porter Creek (Figure 84). These changes are equivalent to a 4-11% increase in mean summer flow depending on the location, and the average change over the full anadromous length of Mark West Creek was ~6%. The grassland management scenario (Scenario 5) resulted in smaller increases in mean summer flows of 0.02 or less throughout Mark West Creek (Figure 84). The runoff management scenario (Scenario 6) resulted in modest increases in mean summer discharges of less than 0.02 cfs upstream of Porter Creek. The majority of the area included in the scenario is located within and downstream of the Porter Creek watershed, and there is a substantial increase in the flow enhancement benefits below the confluence with Mark West Creek with mean summer discharges increasing by 0.06 - 0.12 cfs in the downstream reaches (Figure 86).

Increases in springtime streamflow for the forest management scenario were much larger than the changes for summer streamflow with increases of 0.5 - 0.6 cfs below Humbug Creek and 0.7 - 0.9 below Porter Creek (Figure 85); these changes represent 4 - 6% of the total flow. The changes in springtime streamflow for the forest management scenario are about three to five times larger than the changes for the other management scenarios. Springtime streamflow changes for the grassland management scenario were also larger than the summer changes with increases of 0.06 - 0.08 cfs below Humbug Creek and 0.10 - 0.18 cfs below Porter Creek (Figure 85). The runoff management scenario produced a similar but slightly greater increase in springtime streamflow relative to summer streamflow (Figure 87).

Comparison of the watershed-wide mean annual water balance between existing conditions and Scenarios 4 - 6 indicates that all three strategies (forest-, grassland-, and runoff-management) result in increases in infiltration recharge on the order of 2 - 4% on an annual basis (Figure 88). The mechanisms behind these increases are different for each case. Forest management results in about a 5% decrease in AET on treated lands which equates to a 1.4% decrease watershed-wide (579 ac-ft/yr) resulting in more water available for both runoff and infiltration recharge (Figure 88). In contrast, grassland management results in only minimal changes in AET and runoff and the increases in infiltration recharge are accomplished through increased soil water storage capacity which serves to extend the timeframe over which recharge can occur. Runoff management decreases runoff directly, resulting in both increases in infiltration recharge and AET (Figure 88).

The increases in infiltration recharge for all three scenarios represent a substantial volume of water (230-420 ac-ft/yr) which manifests in part through increases in groundwater discharge to streams as interflow, baseflow, and springflow (Figure 88). The springflow response is of particular interest in that springflow has been identified as the primary process generating summer streamflow in the watershed. The forest management scenario resulted in the largest increases in springflow (6.4%), followed by runoff management (3.9%), and grassland management (1.9%). The relative influence of the management actions on springflow is controlled in part by the spatial distribution of treatment areas. For example, the forest management scenario generates the largest increase in springflow despite generating the smallest increase in infiltration recharge owing to the concentrations of both springs and treatment areas in the upper watershed.

It is apparent that location on the landscape influences how changes in infiltration recharge are expressed, with the forest management scenario resulting in the smallest increases in recharge but the largest increases in springflow due to both treated forest areas and springs being concentrated in the upper watershed. It is also important to note that the acreages involved in the three scenarios are intended to represent large-scale implementation based on existing potential on the landscape, therefore the locations and acreages involved are very different between the scenarios. To compare the relative hydrologic effects of these various management actions it is useful to normalize the results by acres of managed area. This exercise reveals that runoff management is by far the most effective strategy with per area increases in summer streamflow 36 times greater than forest management and 51 times greater than grassland management (Table 21). The level of effort required to manage stormwater from one acre is, however, expected to be significantly greater than the effort involved in management of one acre of forest or grassland. Additional discussion of comparisons between strategies is included below under the heading Summary and Comparison of Scenarios.

Pond Releases

The summer pond release scenario (Scenario 7) resulted in the largest increases in summer streamflow of any of the scenarios discussed thus far. Between the pond release in upper Mark West Creek and the confluence with Mill Creek where the lower release enters, mean summer discharges increase by 0.06 – 0.07 cfs with the exception of localized increases of up to 0.09 cfs just downstream of the confluence of Humbug Creek where the middle release enters. Below the lower release on Mill Creek, discharges increase by 0.14 to 0.16 cfs (Figure 85). Averaged across the full length of anadromy in Mark West Creek, the changes in streamflow represent an increase in mean summer streamflow of approximately 13%.

The predominance of gaining conditions in most reaches of the stream result in only limited flow losses downstream of the releases, which makes this strategy particularly well-suited for this watershed which is characterized by a lack of thick alluvial deposits. The increase in summer streamflow above the middle release at Humbug Creek is equivalent to about 80% of the upper release rate and the increase in streamflow at the watershed outlet is equivalent to about 84% of the total release rate from all three releases. The losing reach below Porter Creek does reduce the increase in streamflow locally by about 0.02 cfs, but this effect does not persist downstream since much of the water that infiltrates through the streambed in this reach discharges back to the stream downstream.

The spring pond release scenario produced a similar but slightly smaller increase in springtime flows (Scenario 7B) than in summer flows (Scenario 7) (Figure 87). The spring pond release scenario was designed to increase flows over a short (3-week) period coinciding with the timing of the end of typical peak smolt outmigration in May. Examination of discharge and riffle depth hydrographs during the 2014 drought shows that the springtime releases substantially increase flows in the high priority reach during this critical time period extending the duration of passable conditions by approximately two weeks (Figure 89). The summer pond release scenario increases riffle depths significantly over the critical summer low flow period, but these changes are not large enough to maintain depths above 0.2-ft (Figure 89).

Combined Management

When all the land/water management scenarios are combined (Scenarios 4 - 7), mean summer discharge in Mark West Creek increased by 0.05 – 0.10 cfs between Monan's Rill and Van Buren Creek and by 0.10 – 0.15 between Van Buren Creek and Porter Creek. Downstream of Porter Creek streamflow increased by 0.25 – 0.35 cfs (Figure 90). These changes are similar but slightly less than the sum of the changes of the four individual scenarios. Averaged across the full length of anadromy in Mark West Creek, the changes in streamflow represent an increase in mean summer streamflow of approximately 23%.

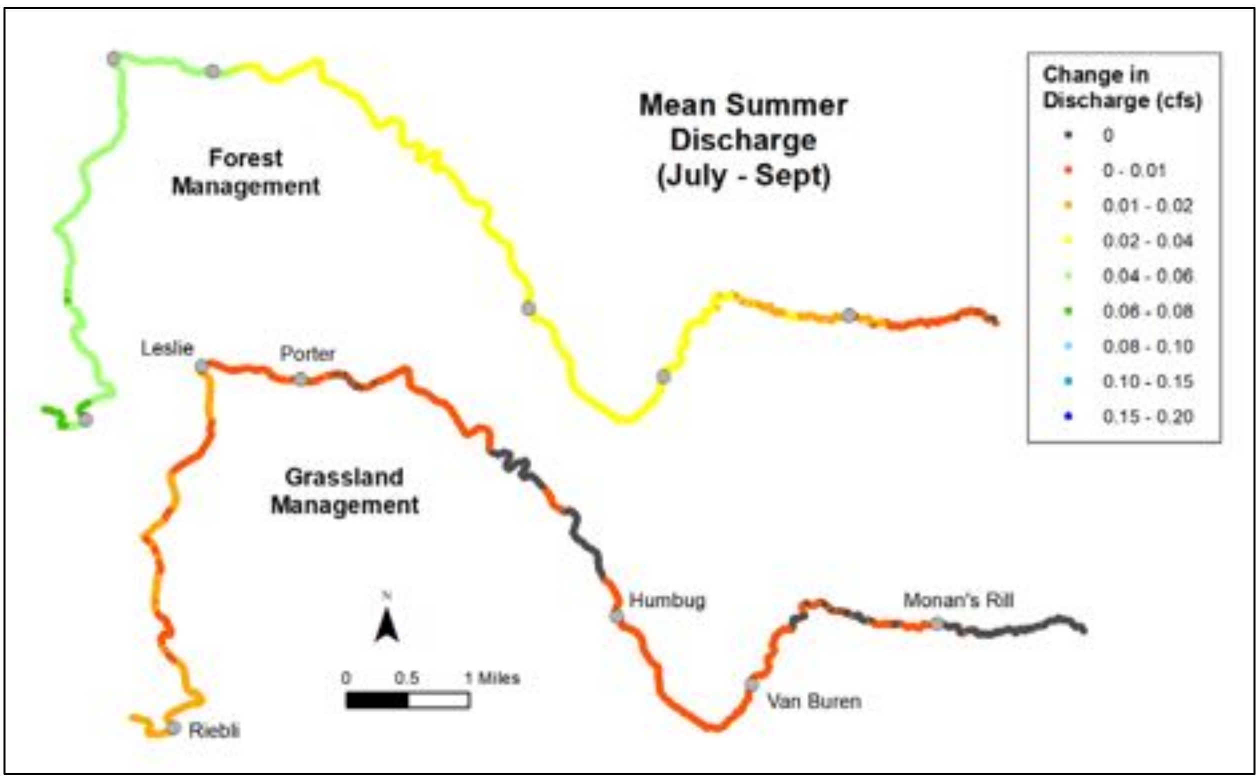


Figure 84 Simulated changes to mean summer streamflow for the forest and grassland management scenarios (Scenarios 4-5).

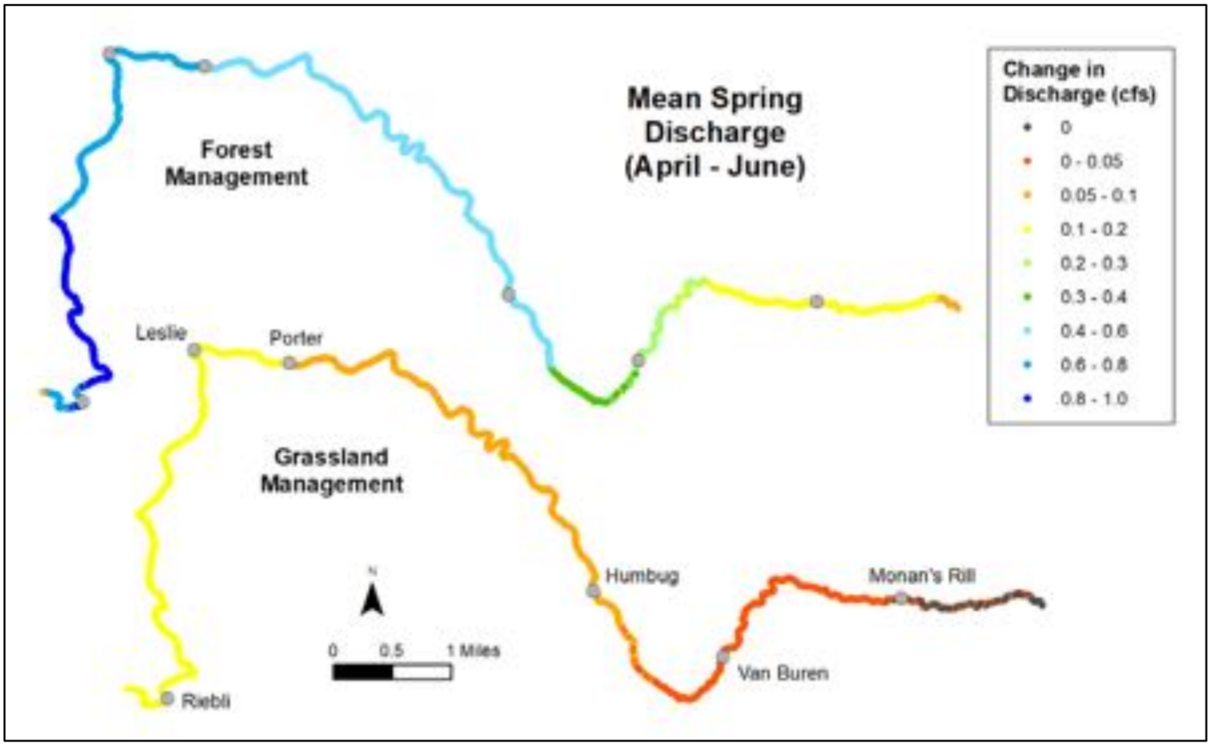


Figure 85: Simulated changes to mean springtime streamflow for the forest and grassland management scenarios (Scenarios 4-5).

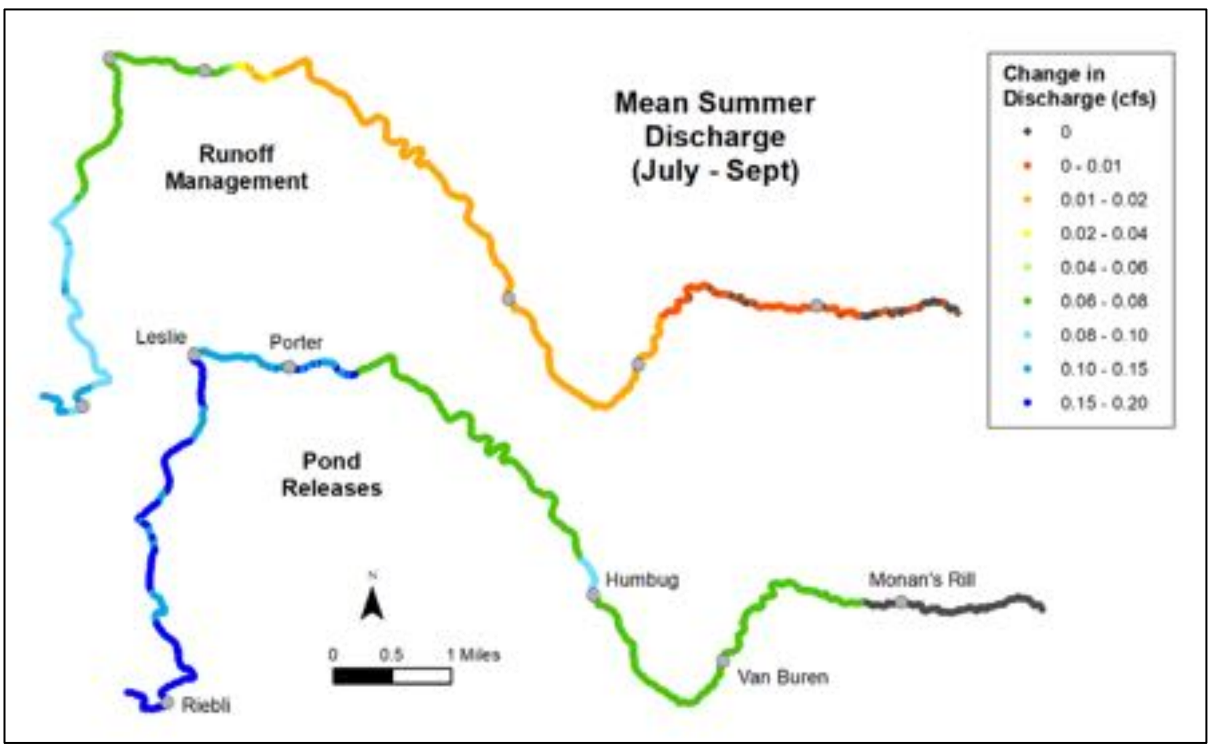


Figure 86: Simulated changes to mean springtime streamflow for the runoff management and summer pond release scenarios (Scenarios 6 & 7).

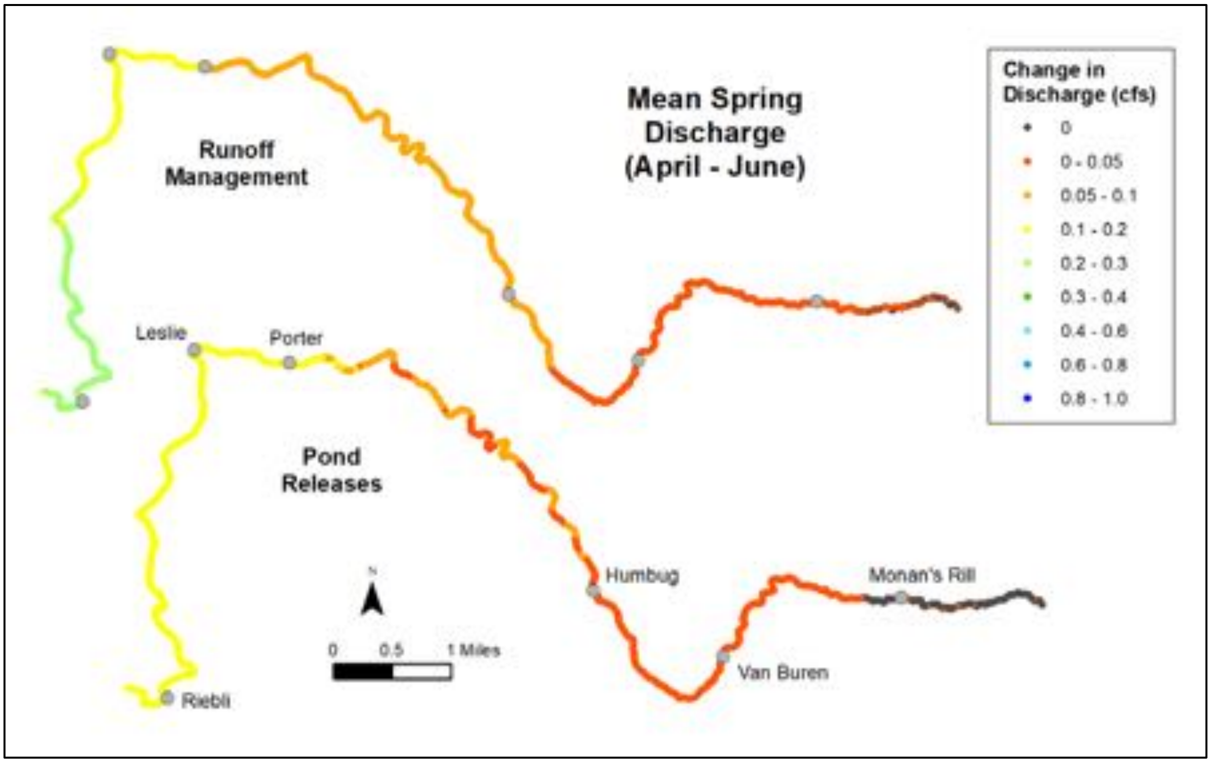


Figure 87: Simulated changes to mean springtime streamflow for the runoff management and springtime pond release scenarios (Scenarios 6 & 7B).

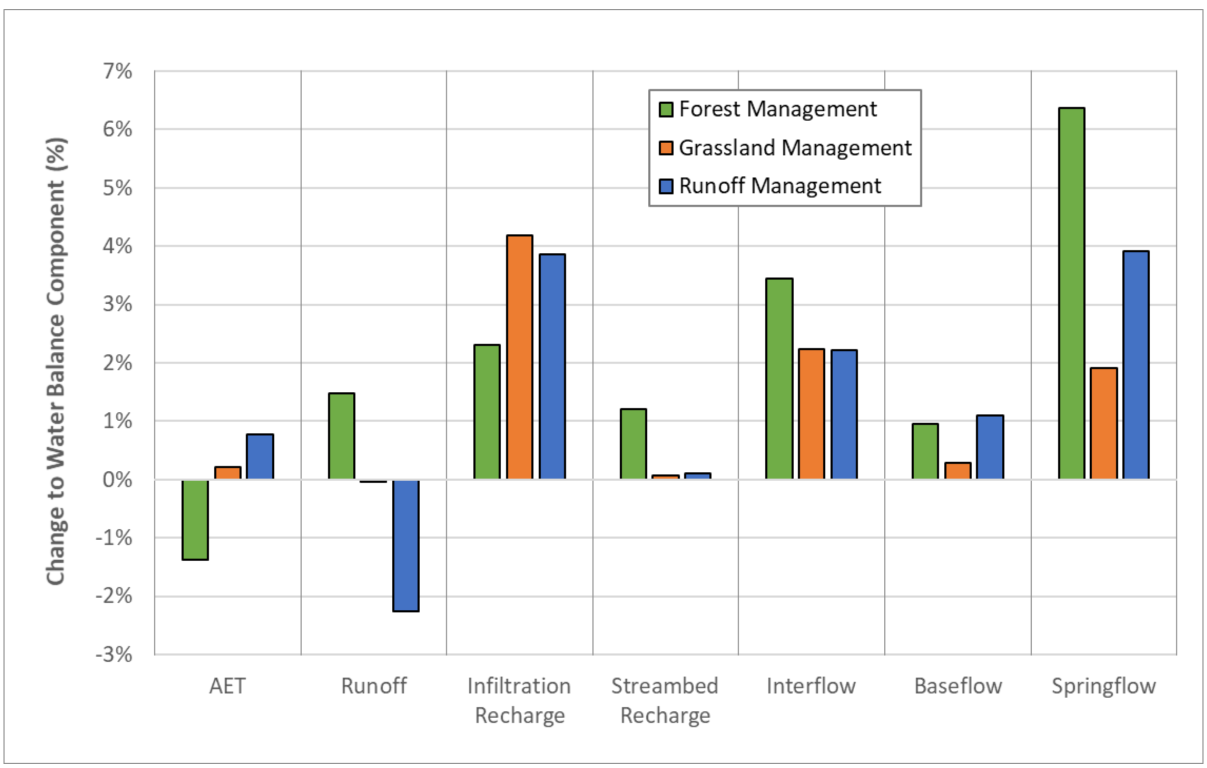


Figure 88: Percent change in select water balance components for Scenarios 4-6.

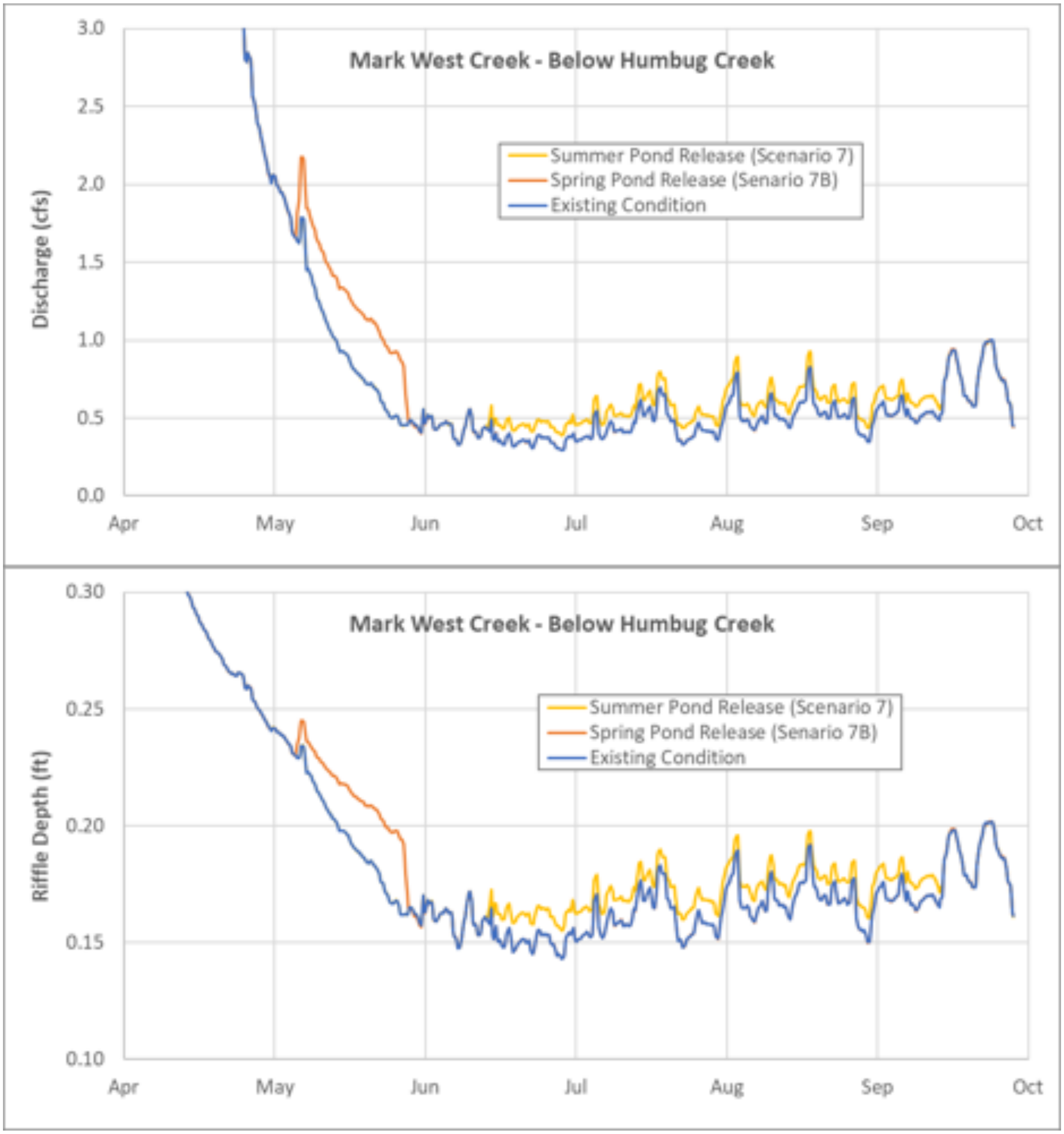


Figure 89: Spring and summer 2014 discharge (top) and riffle depth (bottom) in Mark West Creek below Humbug Creek for existing conditions and the spring and summer pond release scenarios (Scenarios 7 & 7B).

Table 21: Change in mean summer streamflow for forest, grassland, and runoff management (Scenarios 4-6) normalized to a 100-acre treatment area.

Scenario #	Scenario Name	Change in Mean Summer Discharge (cfs/100 acres of treatment area)
4	Forest Management	0.0010
5	Grassland Management	0.0007
6	Runoff Management	0.0355

Figure 90: Simulated changes to the 10-yr average mean summer streamflow for the combined management scenario (Scenario 8; note the scale in the legend is different from previous figures for other scenarios).

Climate Change Scenarios

The four climate change scenarios (Scenarios 9-12) generated a wide range of predictions of future (2070-2099 timeframe) changes in discharge in Mark West Creek; nevertheless, there are some commonalities in the predictions of future streamflow trajectories. The average 10-yr mean monthly discharge is predicted to increase during late fall and winter in three of the four scenarios, with mean January flows in the CNRM scenario more than 2.5 times greater than existing conditions (Figure 91). All four scenarios show large decreases in discharge during spring with mean monthly flows during March decreasing by 48-71%. The predictions for summer flows are more variable with two scenarios predicting decreases in the mean monthly August flow on the order of 38-51% and one predicting increases of 26% (Figure 91). The future changes are even more extreme during drought conditions where winter flows are predicted to decrease dramatically in all four scenarios with high streamflow events becoming essentially non-existent in the GFDL scenario (Figure 92). The declines in springtime flows are also extreme with decreases in mean monthly discharge in March of 60-97% (Figure 92).

More careful review of the range of predicted changes in summer flows reveals that mean summer discharges increase in the CNRM scenario by about 0.1 - 0.2 cfs throughout Mark West Creek, whereas in the MIROC esm scenario, discharges between Van Buren Creek and Porter Creek drop from about 0.5 - 0.8 cfs to 0.3 - 0.4 cfs, and below Porter Creek flows drop from about 1.0 - 1.5 cfs to 0.6 - 0.8 cfs (Figure 93). In contrast to the variable predictions in mean summer discharges, all four models predict large decreases in mean spring discharges. The CNRM scenario produces the smallest decreases with flows in Mark West Creek decreasing from 4-10 cfs to 0.5 - 1 cfs between Van Buren and Porter Creeks and from 10-20 cfs to 1 - 2 cfs downstream of Porter Creek (Figure 94). The MIROC esm scenario predicts even more dramatic decreases in springtime discharges with flow of <0.5 cfs between Van Buren Creek and Porter Creek and <1 cfs below Porter Creek (Figure 94).

Examination of the 10-yr mean annual water balance (representative of the 2070-2099 timeframe) reveals that the four climate scenarios predict very different changes to the mean annual water balance. Precipitation changes range from a 37% increase in the CNRM scenario to a 20% decrease in the MIROC esm scenario (Figure 95). The significantly higher precipitation in the CNMR scenario leads to increases in AET of about 13%, whereas the other three scenarios result in modest decreases in AET of between 2 and 7%. Runoff is predicted to increase in the CNRM and CCSM4 scenarios by 26-69% and decrease in the GFDL and MIROC esm scenarios by 25 - 32% (Figure 95). The CNRM scenario predicts large increases in both infiltration recharge (44%) and streambed recharge (33%), the CCSM4 model predicts minimal changes in recharge, and the GFDL and MIROC esm scenarios predict significant decreases in infiltration recharge (29 - 40%) and streambed recharge (17 - 25%). Increased recharge in the CNRM scenario results in increases in groundwater discharge expressed as interflow (32%), baseflow (11%), and springflow (36%). Similarly, groundwater discharge decreases in the scenarios that predict decreases in recharge. The largest decreases are predicted by the MIROC esm scenario where interflow, baseflow, and springflow are predicted to decrease by 30, 21, and 46% respectively (Figure 95).

Comparison of the water balance for the driest of the 10 years in each simulation reveals that the trajectories of the changes in the water balance between the four scenarios are more similar during drought conditions than for long term average conditions. AET is predicted to increase in all four models while runoff, infiltration recharge, and streambed recharge are predicted to decrease (Figure 96). The GFDL drought predictions are extreme with close to a complete loss of both runoff and infiltration recharge. The groundwater discharge results remain variable between the scenarios with the CNRM and CCSM4 scenarios resulting in increased discharge during droughts and the GFDL and MIROC esm scenarios resulting in decreased groundwater discharge reflecting that groundwater discharge responds more to long-term fluctuations in climate rather than individual water year conditions (Figure 96).

All four scenarios indicate increases in Climatic Water Deficit (CWD). The mean CWD for the watershed over the 10-yr simulation period is predicted to increase from 26.0 in/yr under existing conditions to between 30.3 and 33.9 in/yr under future climate conditions. Increases in CWD of this magnitude (17-30%) may be expected to lead to significant changes in vegetation communities and increases in fire risk. It is important to note that these simulations represent the hydrologic effects of changes in climate but do not include secondary effects that may be expected under a significantly altered future climate regime such as changes in vegetation cover and irrigation water demands.

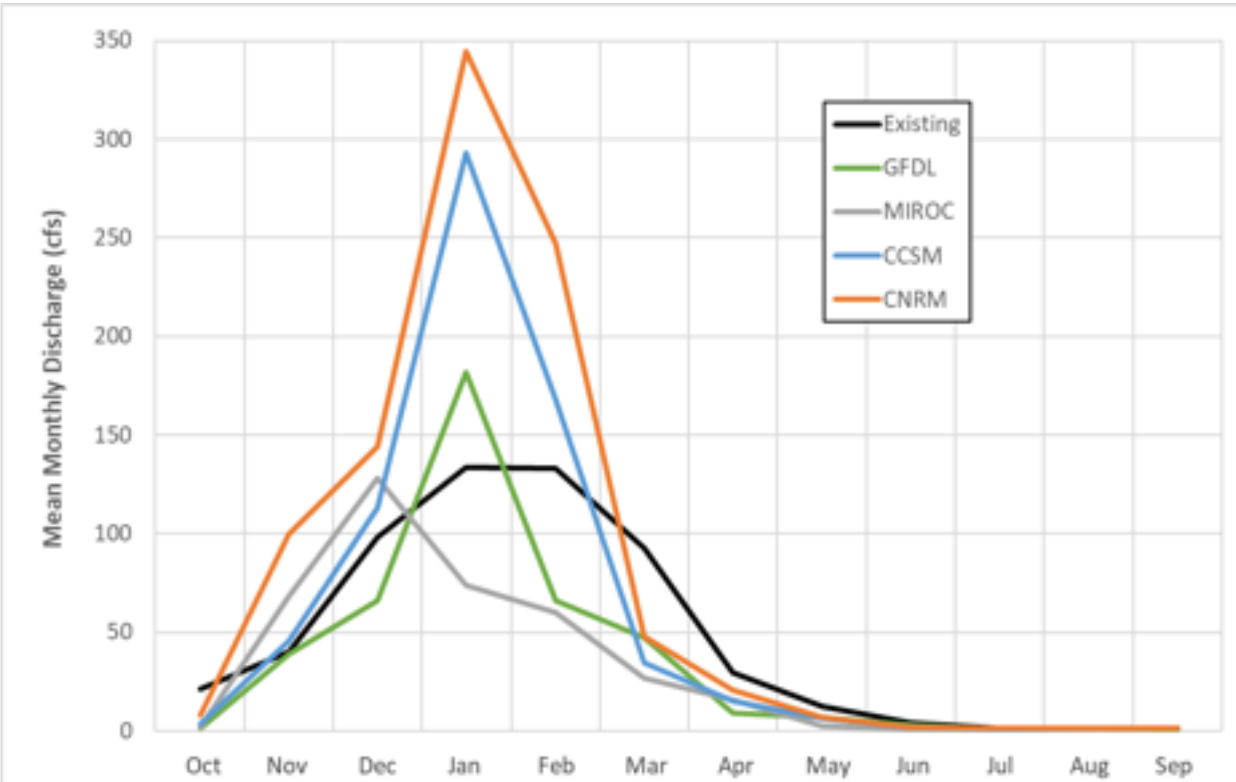


Figure 91: Comparison of mean monthly streamflow averaged over the 10-yr simulation periods for existing conditions and the four climate change scenarios (Scenarios 9-12).

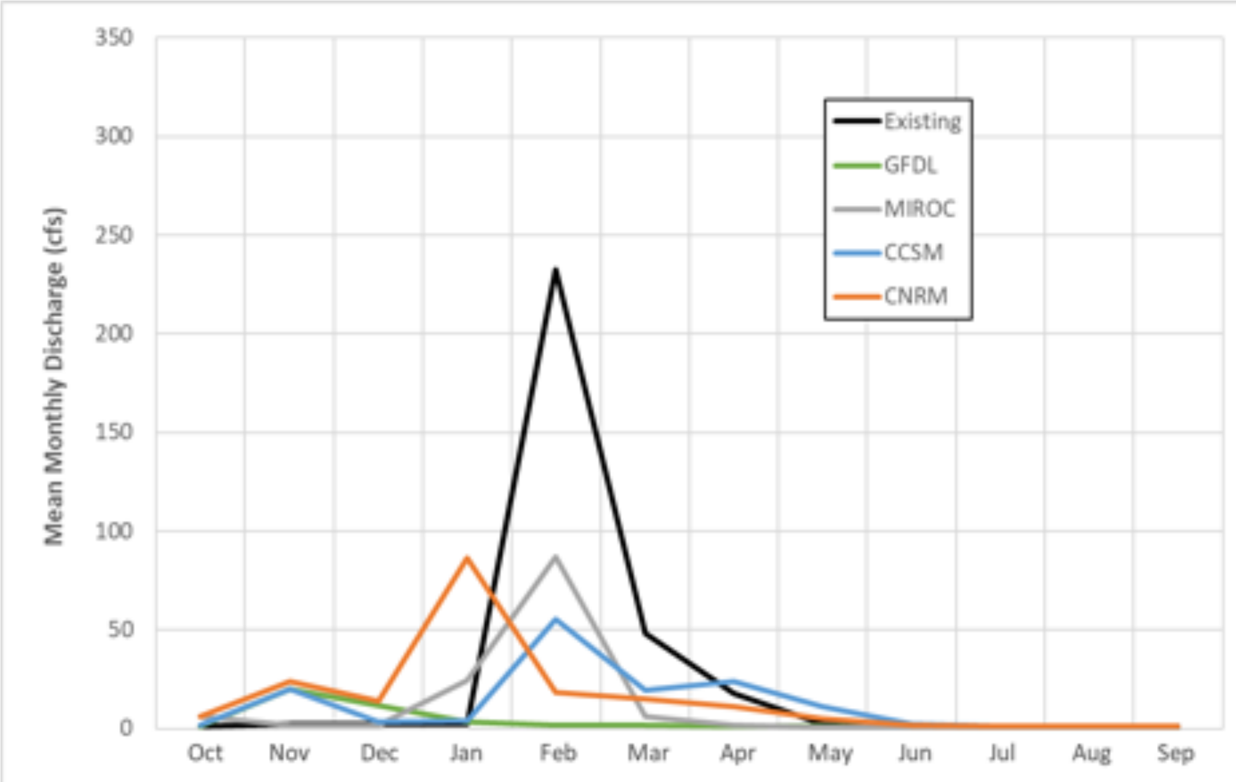


Figure 92: Comparison of mean monthly streamflow for the driest water year in each 10-yr simulation period for existing conditions and the four climate change scenarios (Scenarios 9-12).

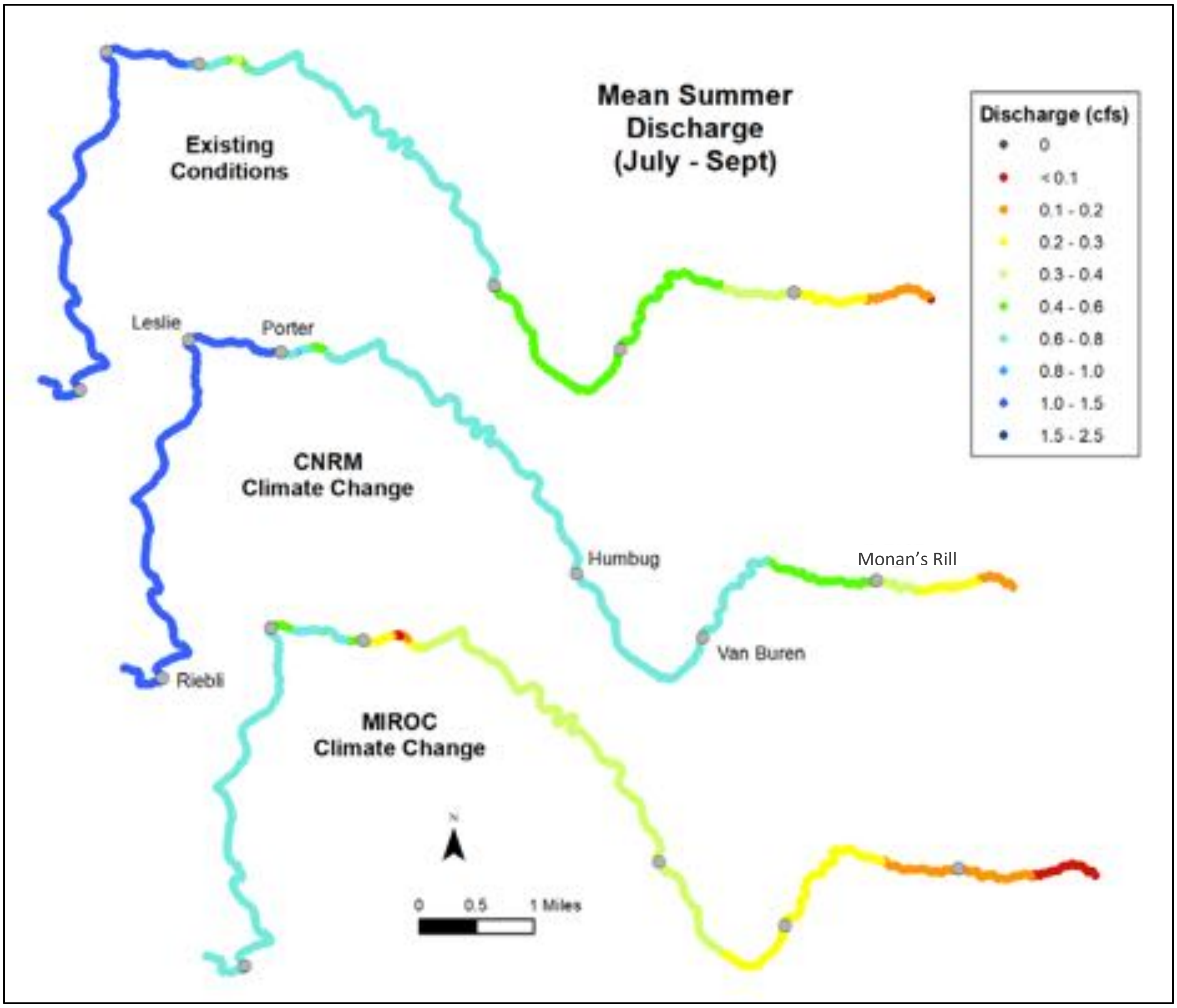


Figure 93: Simulated 10-yr average mean summer streamflow for existing conditions and the CNRM and MIROC esm scenarios (Scenarios 9 & 12) which represent the end-member predictions from the four climate change scenarios.

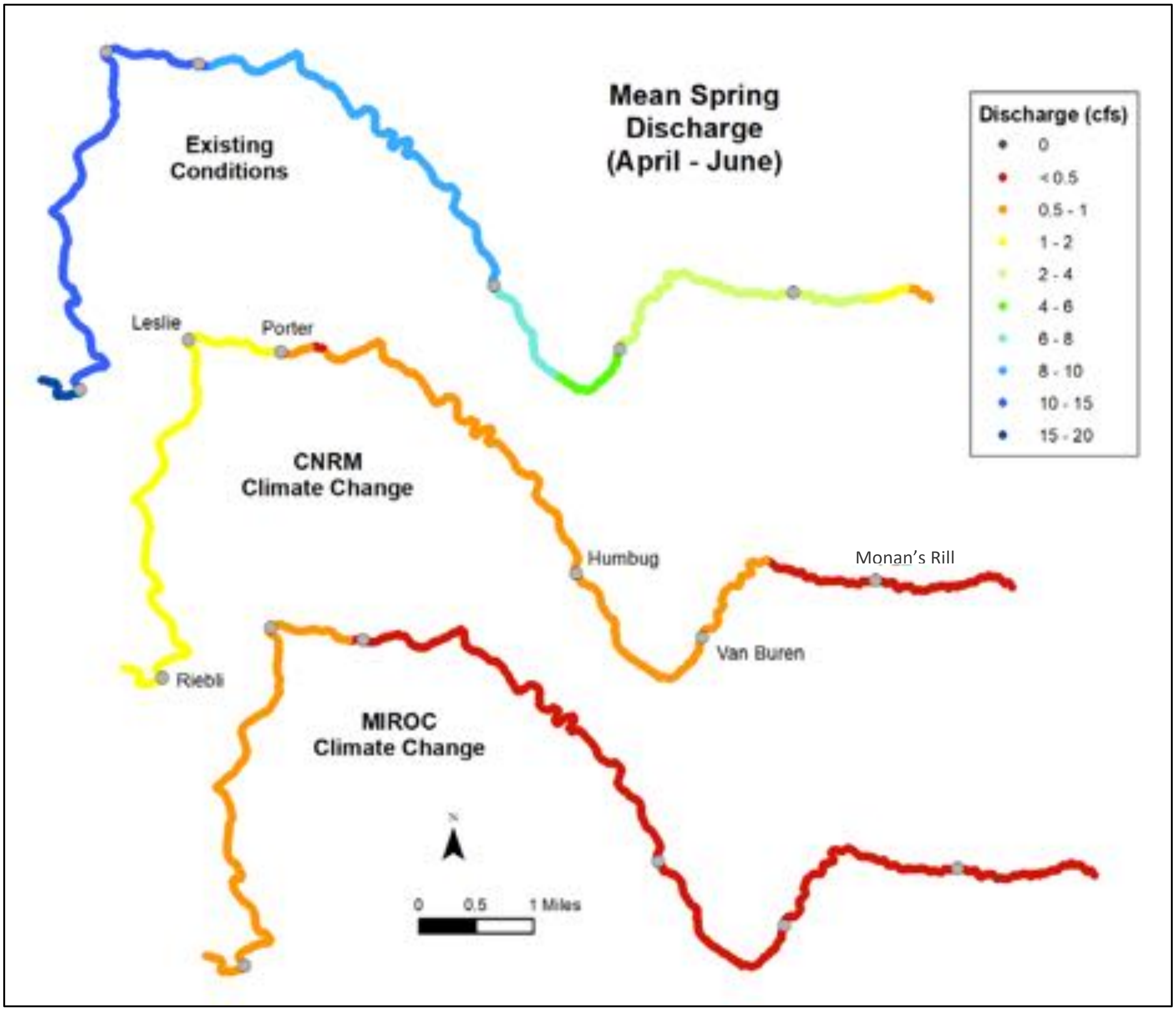


Figure 94: Simulated 10-yr average mean springtime streamflow for existing conditions and the CNRM and MIROC esm scenarios (Scenarios 9 & 12) which represent the end-member predictions from the four climate change scenarios.

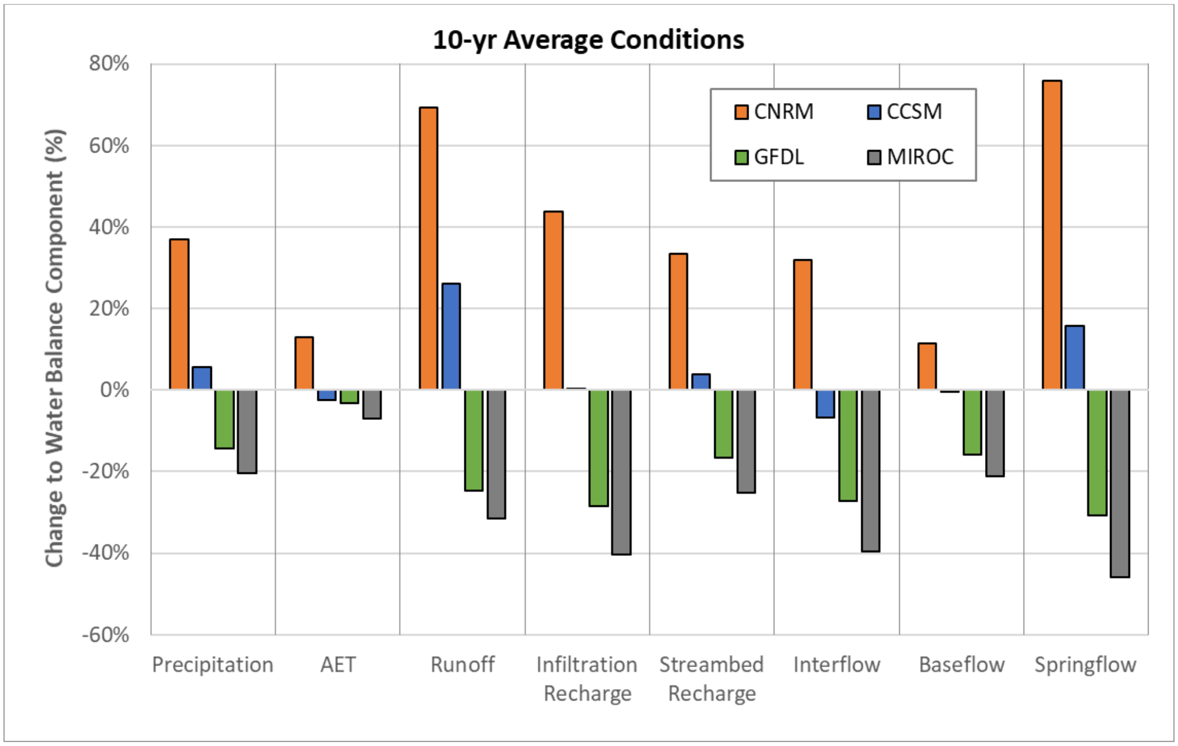


Figure 95: Percent change in various components of the water balance averaged over the 10-yr simulation periods for the four climate change scenarios relative to existing conditions.

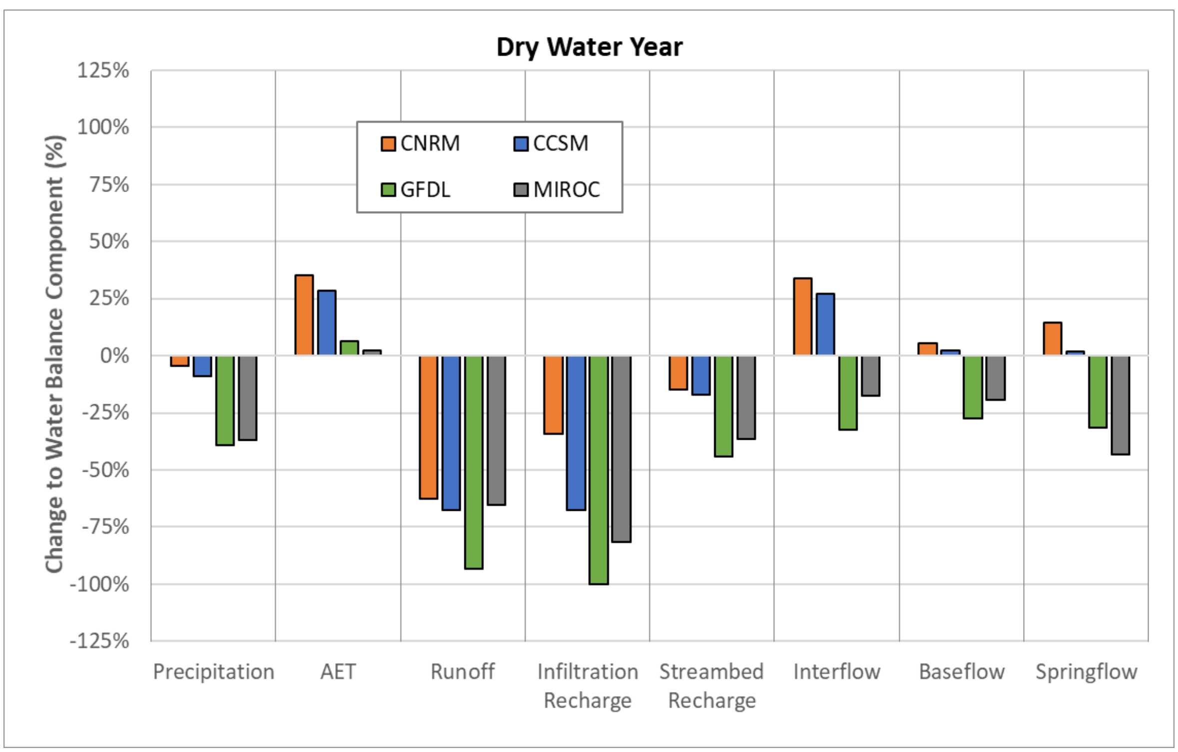


Figure 96: Percent change in various components of the water balance for the driest water year in each 10-yr simulation period for the four climate change scenarios relative to existing conditions.

Mitigated Scenarios

We combined the pond release scenarios (Scenarios 7 & 7B) and the combined management scenario (Scenario 8) with the GFDL climate scenario (Scenario 11) to evaluate the degree to which the various management actions may be capable of mitigating the changes in streamflow associated with future climate. We selected the GFDL model because it represents the second lowest predictions of future spring and summer streamflow of the four climate scenarios which provides a good benchmark for evaluating the scale of the management effects. If future climate more closely resembles the CNRM or CCSM4 scenarios the mitigating effects of the management actions would likely be larger than what is shown here, whereas if future climate more closely resembles the MIROC esm scenario, less mitigation would likely be possible.

The GFDL scenario predicts decreases in mean summer discharge of about 0.20 − 0.42 cfs at most locations in Mark West Creek, and the summer pond releases are large enough to significantly reduce these declines down to about 0.15 − 0.25 cfs (Figure 97). The combined actions of summer pond releases and forest, grassland, and recharge management generate increases in flow that are large enough to fully offset the predicted effects of the GFDL future climate on summer streamflows (Figure 97). None of the actions are capable of fully mitigating against the large decreases in springtime flows predicted by the climate scenarios; nevertheless, springtime flow releases may provide a critical management strategy to provide passable flow conditions for short critical periods of time during smolt outmigration.

Examination of riffle depth hydrographs below Humbug Creek during the driest water year in each 10-yr simulation cycle shows that under the GFDL future climate, riffle depths only reach the 0.2-ft minimum fish passage threshold for brief periods during March through May (Figure 98). This represents a dramatic change in the passage conditions experienced by outmigrants. Under existing conditions depths remain above 0.3-ft until mid-April and above 0.2-ft until early May. Springtime pond releases appear to be large enough to allow for a more sustained (several week) period with riffle depths remaining around 0.2-ft; in this scenario, releases were targeted towards the end of the primary outmigration period in May (Figure 98). Greater riffle depths could likely be achieved over shorter periods by increasing release rates and decreasing durations. The combined actions of summer pond releases, forest, grassland, and runoff management also had an appreciable effect on summer riffle depths generating depths under GFDL future climate that resemble those for existing climate (Figure 98). These findings suggest that aggressive management is capable of offsetting most or all of the summer declines in streamflow predicted for the GFDL future climate.

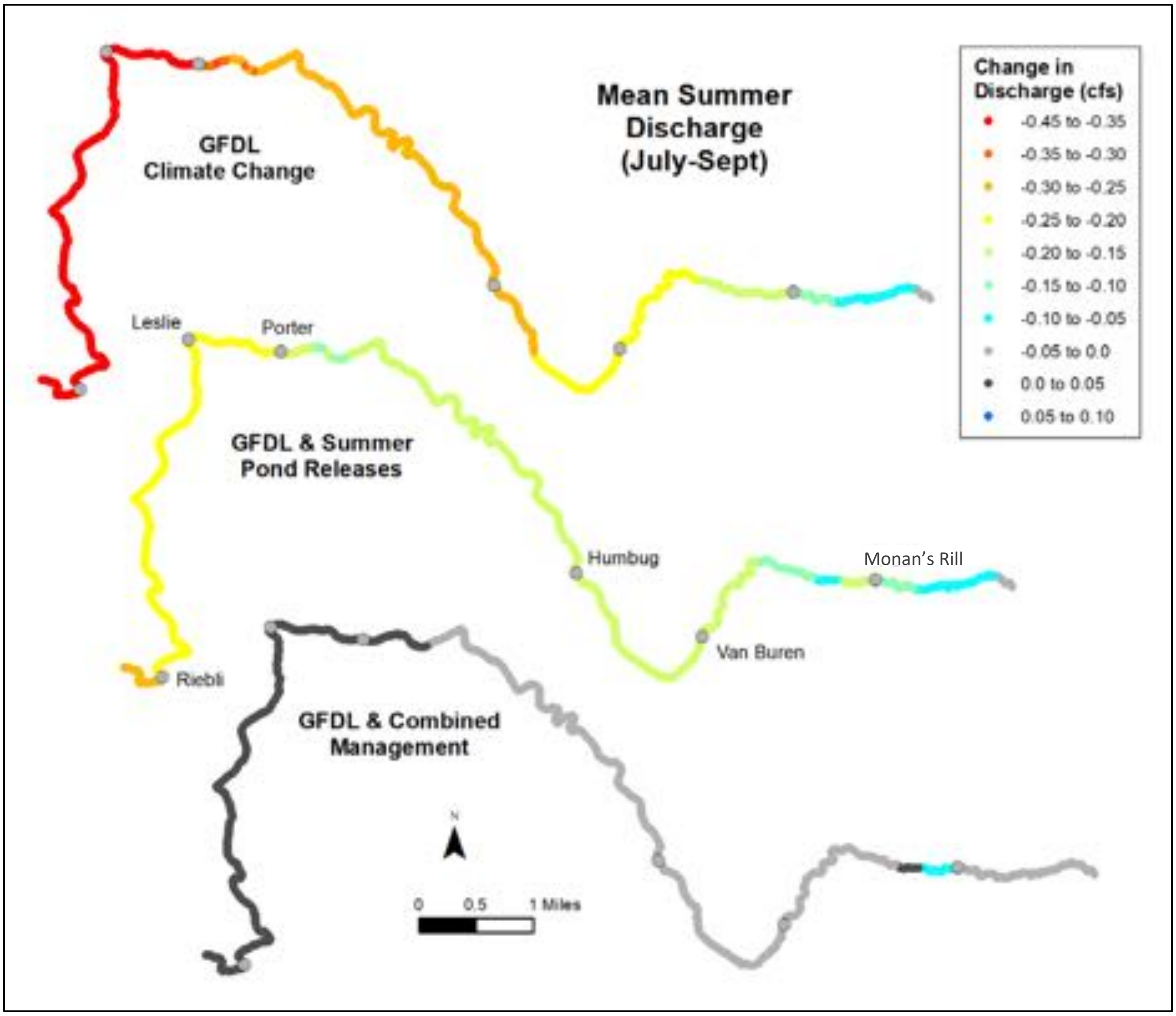


Figure 97: Simulated changes to the 10-yr mean summer streamflow for the GFDL future climate, the GFDL & spring pond release scenario (Scenario 13), and the GFDL & combined management scenario (Scenario 14).

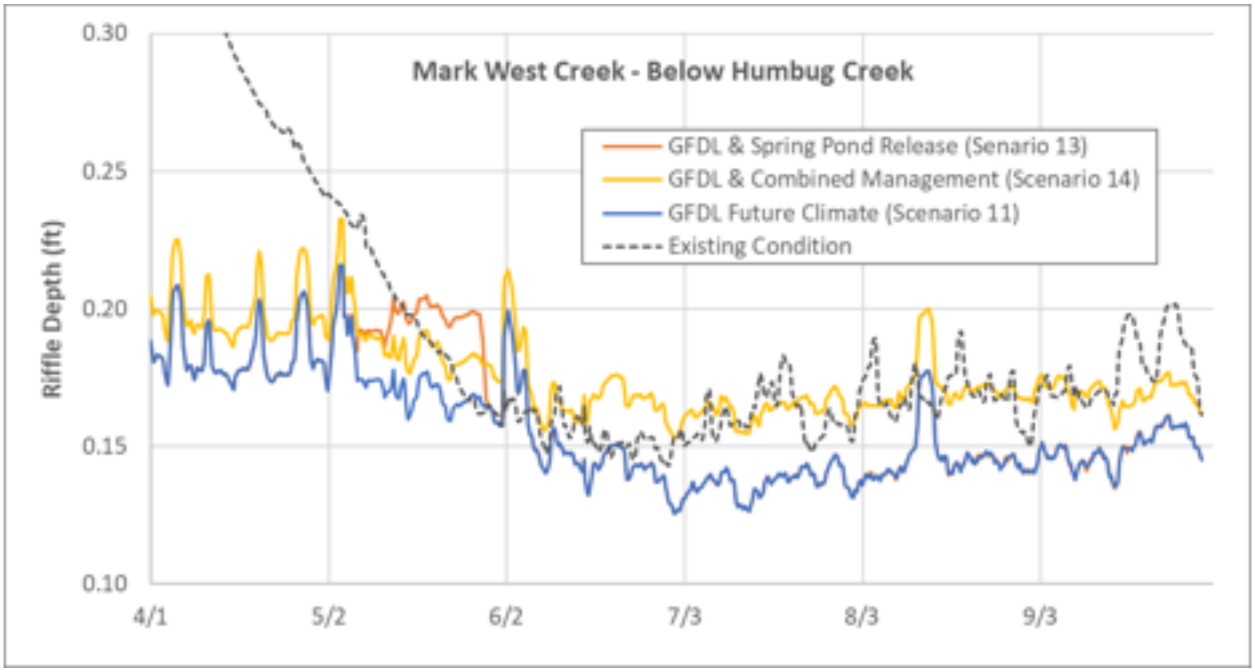


Figure 98: Spring and summer riffle depths for the driest year in the 10-yr simulation in Mark West Creek below Humbug Creek for existing conditions, GFDL future climate scenario (Scenario 11), the GFDL & springtime pond release scenario (Scenario 13), and the GFDL & combined management scenario (Scenario 14).

Summary and Comparison of Scenarios

Comparison of the changes in summer streamflow between the various scenarios indicates that the sustained cumulative effect of surface water and groundwater use are approximately equal and that cessation of all water use would eventually increase mean summer streamflow by about 6% in the ~4-mile high priority reach below Alpine Creek and ~8% at the watershed outlet (Figure 99). The pond release scenario generated the largest increases in summer streamflow of the stand-alone scenarios, with increases of about 13 - 14%. In the high priority reach, the next largest increases were from the forest management scenario, followed by the recharge management scenario (Figure 99). At the watershed outlet this order was reversed owing to the concentration of forest treatment areas in the upper watershed and the concentration of developed areas included in the runoff management scenario in the lower watershed. Runoff management generated about a 3% increase in summer streamflow in the high priority reach and a 10% increase at the outlet, whereas forest management generated about a 6% increase at both locations. The grassland management scenario generated the smallest increases in summer flows on the order of 2% (Figure 99).

The climate change scenarios generated a wide range of predictions with three of the four scenarios indicating decreases in summer streamflow of between 6 and 47% and one scenario indicating increases of about 15 - 19% (Figure 99). The mitigated scenarios indicate that pond releases can likely offset a significant portion of the projected decreases in summer streamflow predicted by some of the models and if combined with forest, grassland, and runoff management, are likely large enough to completely offset the projected decreases (Figure 99). If future climate more closely resembles the predictions of the CNRM or CCSM4 models, pond releases and combined management would be expected to result in flow enhancement above existing conditions.

The various large-scale flow enhancement actions represented by the scenarios and the foregoing comparisons are intended to represent implementation of projects of a given type based on the maximum potential on the landscape. The scenarios vary widely in their scale, feasibility, and expected cost. To better understand the relative streamflow benefits of implementing a given project, we normalized the simulated increases in streamflow based on areas for a ‘typical’ parcel/project in the watershed (Figure 100). To normalize the surface water diversion scenario results, we assumed a new well would be drilled to replace the entire diversion volume with groundwater pumping. We divided the cumulative diversion effects by the total number of diversions and then subtracted the cumulative groundwater pumping effects normalized by the volume of diversion offset. In most cases it is not possible or practical to completely offset groundwater pumping with rainwater or runoff capture and storage. Installation of storage tanks is a common and practical means of offsetting groundwater pumping and we assumed 10,000 gallons of tank storage offset to normalize the groundwater pumping scenario results. The average per parcel acreages of forest treatment, grassland treatment, and impervious area represented by the scenarios was used to normalize the results for these three scenarios; these acreages were 5.6, 4.6, and 0.38 acres respectively. The pond release scenario was normalized by simply dividing the cumulative enhancement benefits by the number of release projects (three).

We also developed a rough cost estimate for each typical project and normalized the results again based on a $25,000 project cost. The six projects and estimated costs include:

- <u>Groundwater Pumping Offset</u> – installation of a 10,000 gallon rainwater catchment tank and associated reduction in groundwater pumping - $38,000
- <u>Surface Diversion Replacement</u> – replacement of a direct or spring diversion with a new groundwater well - $33,000
- <u>Runoff Management</u> – construction of an infiltration basin sized to capture the 10-yr 48-hr storm volume from a 3,000 ft^2 rooftop or other impervious area - $22,500
- <u>Grassland Management</u> – compost application on 4.6 acres of grassland (average per parcel acreage in the model scenario) - $7,000
- <u>Forest Management</u> – thinning and/or controlled burning on 5.6 acres of forested lands requiring treatment (average per parcel acreage in the model scenario) - $15,000
- <u>Pond Release</u> – summer flow release of 11.3 ac-ft from an existing on-stream pond (average release volume of the three ponds in the model scenario) - $20,000

This comparison revealed that pond releases are by far the most effective strategy for enhancing streamflows (Figure 100). On a cost basis, the streamflow benefits of one flow release project were found to be more than 50 times greater than an average surface water diversion replacement project and more than 500 times greater than an average grassland management project (the second and third most effective strategies). Replacement of direct stream diversions or spring diversions of surface water with new wells is the second most effective strategy. Grassland and forest management showed a similar level of effectiveness on a cost basis and were about 3 - 4 times as effective as runoff management. Offsetting groundwater pumping with storage was the least effective of the six overall strategies considered.

It is important to recognize that runoff, forest, and grassland management may provide significant additional benefits besides streamflow enhancement compared to pond release and diversion replacement projects. These management strategies generate enhanced streamflow primarily via increasing groundwater discharge (see Figure 88), which may be expected to mitigate high water temperature, whereas flow releases from ponds may need to be carefully managed to avoid adverse temperature effects. These strategies also help reduce seasonal vegetation moisture stress which may decreases fire risk somewhat or at least help offset future increases in risk associated with climate change. In particular, the forest management scenario reduces actual evapotranspiration by about 5% on treated lands which represents a fairly large volume of water (615 ac-ft/yr), and the runoff management scenario results in a substantial decrease in the Climatic Water Deficit of about 25% on lands where they are implemented. These various benefits are in addition to the primary non-hydrologic benefits of forest and grassland management projects in reducing fuel loads and sequestering carbon respectively.

All four climate change scenarios representing the 2070-2099 timeframe indicate substantial decreases in springtime flows ranging from 35 - 62% (Figure 101). These changes greatly exceed the potential flow improvements associated with the various enhancement scenarios. Forest management generates the largest increases in mean spring discharges (~5 - 6%), and the other individual scenarios only increase spring flows by ~1 - 2% (Figure 101). As discussed above, while it may not be possible to significantly increase mean discharges during spring relative to the scale of expected decreases resulting from climate change, springtime pond releases lasting several days to weeks do provide a means of creating a period of passable flow conditions during critical outmigration periods which may be essential given the scale of the projected decreases in springtime flows (see Figure 98).

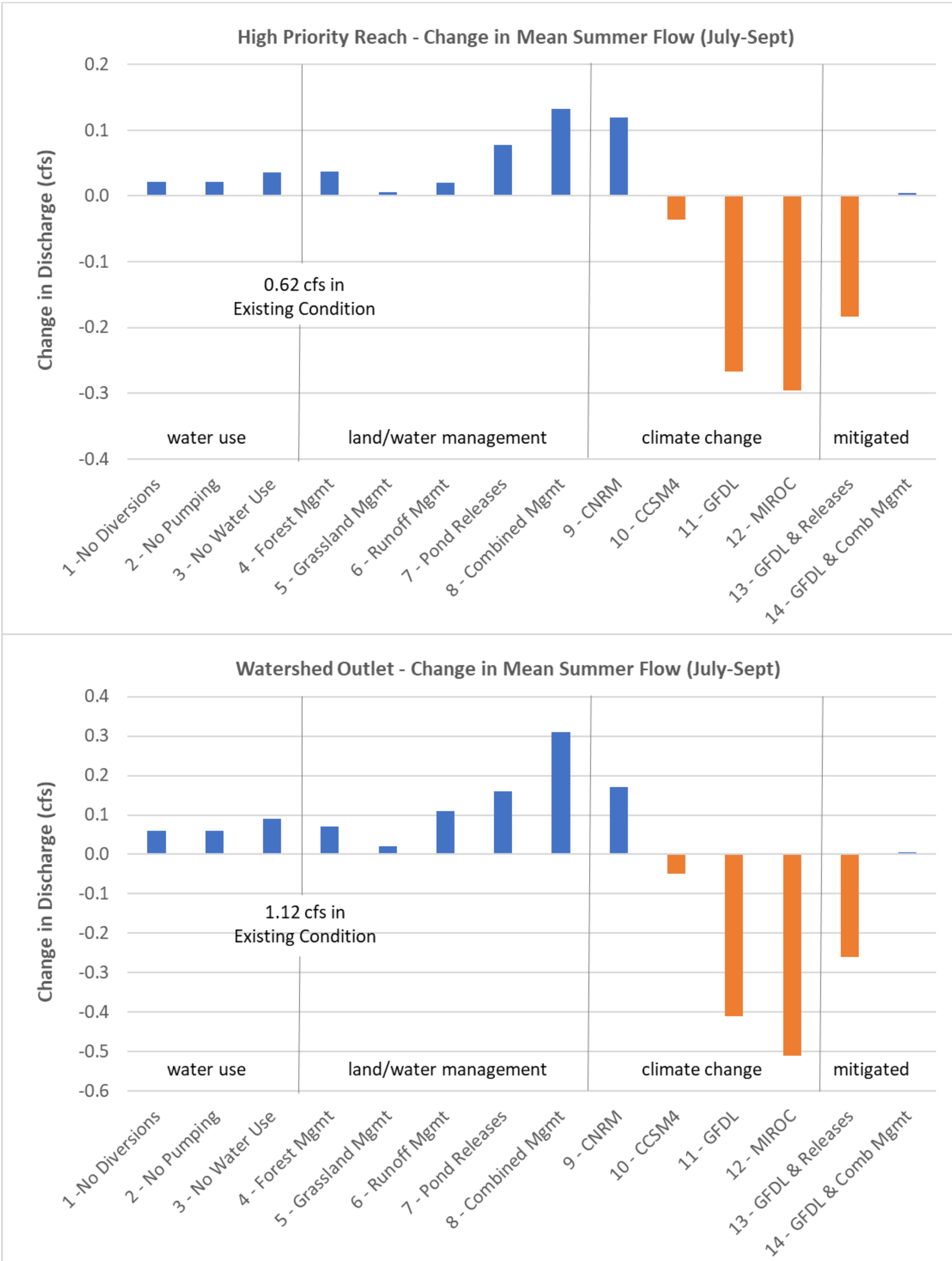


Figure 99: Summary of the simulated changes in mean summer streamflow for Scenarios 1-14 averaged over the high-priority habitat reach (top) and at the watershed outlet (bottom).

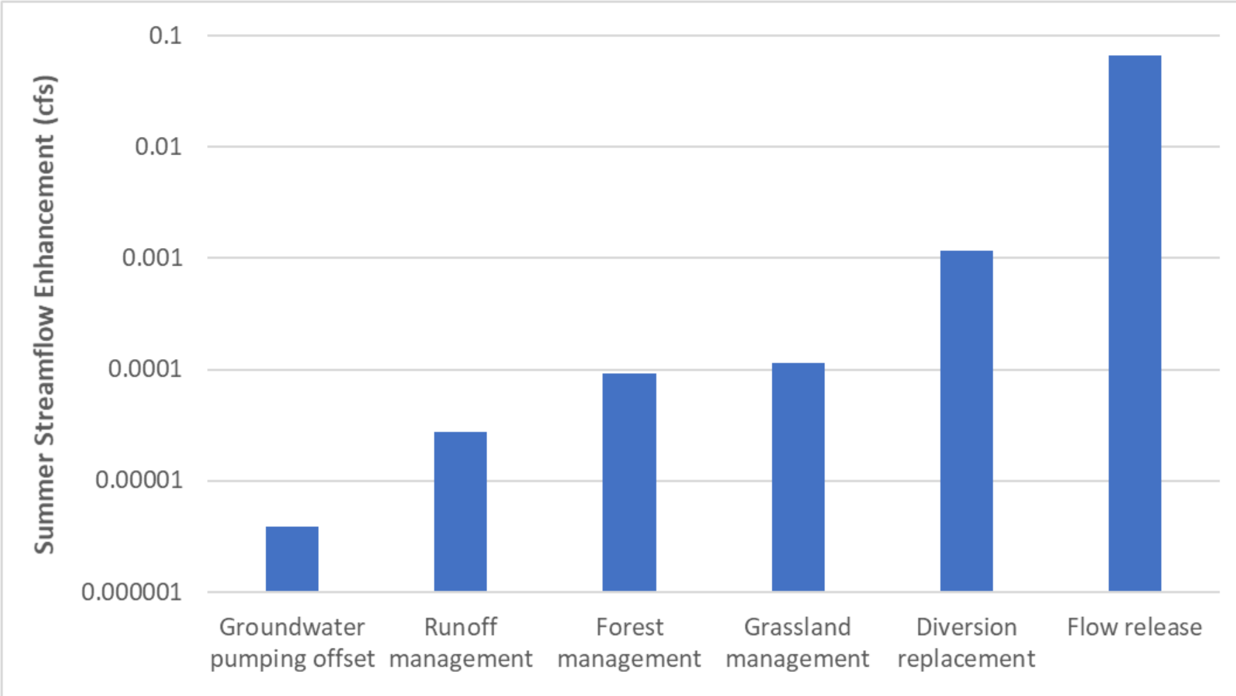


Figure 100: Summary of the simulated increase in mean summer streamflow for the six primary individual flow enhancement actions represented by the model scenarios normalized to a $25,000 project cost.

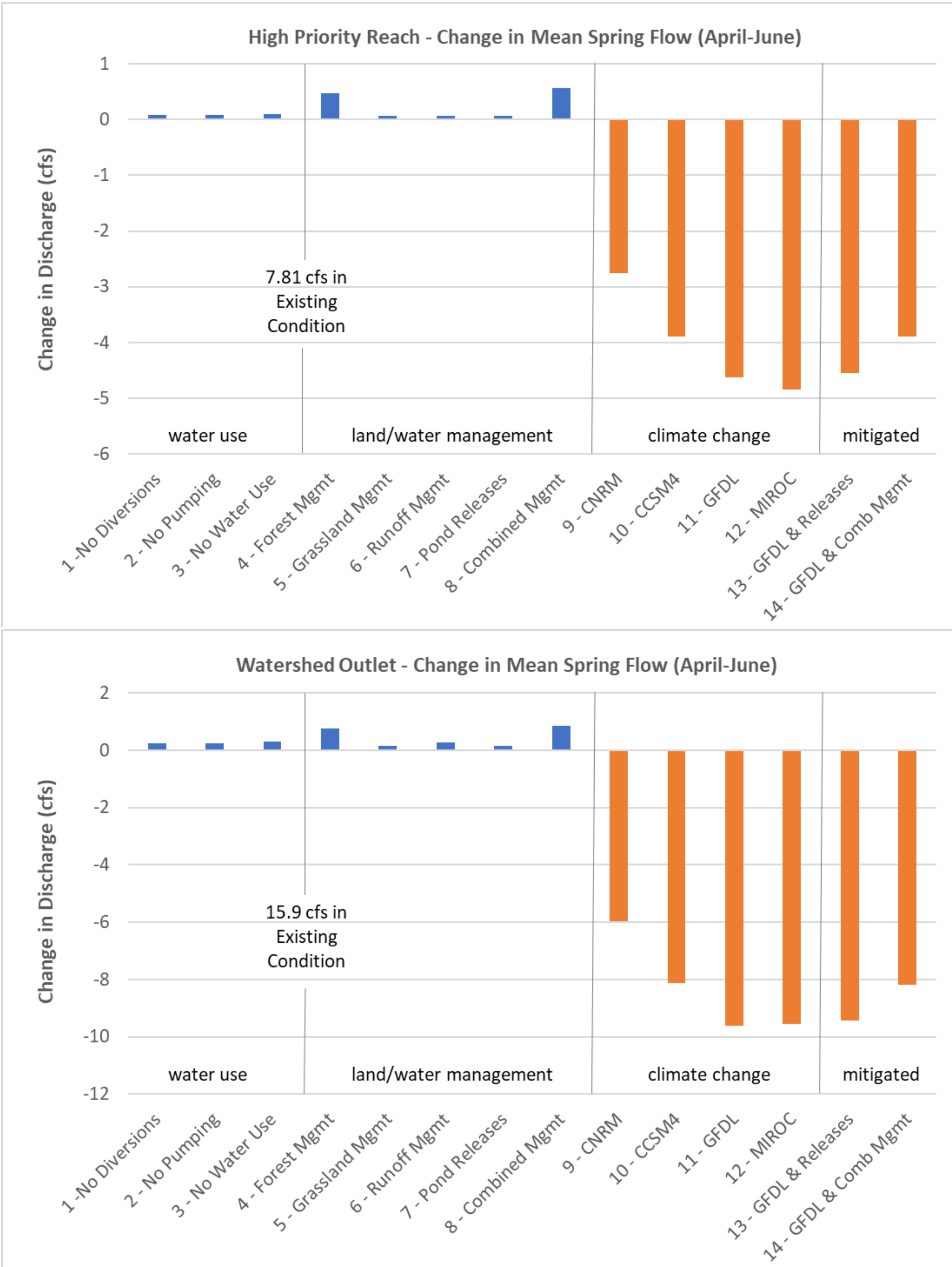


Figure 101: Summary of the simulated changes in mean springtime streamflow for Scenarios 1-14 averaged over the high-priority habitat reach (top) and at the watershed outlet (bottom).

Chapter 9 –Recommendations & Priority Restoration/Management Actions

Habitat Enhancement

Based on simulated riffle depth and observed water temperature data and informed by habitat inventory and fisheries monitoring data, the four mile reach extending from 0.2 miles upstream of Alpine Creek to 2.0 miles upstream of the Porter Creek confluence has the best overall habitat for salmonids (Figure 102). This analysis was focused on juvenile rearing and smolt outmigration; however, the identified reach is also believed to provide better spawning and winter rearing habitat conditions than upstream and downstream reaches. Conditions in the reach are far from optimal with impaired temperatures and insufficient summer streamflows. Nevertheless, the reach has the least impaired habitat conditions with significantly lower streamflows upstream and significantly higher temperatures downstream. We recommend that habitat enhancement projects be focused in this high priority reach where these efforts have the greatest likelihood of improving overall habitat conditions for salmonids.

Based on a limited number of sample sites, water temperatures in the high priority reach appear to remain below severely impaired levels in pools with depths above about 3.5-ft whereas severely impaired temperatures occur in shallower pools (see Figures Figure 62 & Figure 65). More temperature monitoring and pool inventory and analysis is recommended in the reach to identify pools providing critical temperature refugia. A temperature study is also warranted to better understand the factors affecting water temperature and to identify possible mitigation actions. Our preliminary findings suggest that streamflow is not the primary control on temperature and that encouraging formation of stable deep pools and maximizing shading are likely the most important immediate objectives. In-stream large wood (trees and logs) is very limited in Mark West Creek and installation of large wood on a broad scale at sites selected to encourage formation and protection of existing deep pools is recommended. Where needed, projects should also include riparian planting to maximize shading of the summer water surface. Opportunities for development of off-channel habitat projects to enhance winter rearing habitat are also available in the identified reach, and these types of projects are also recommended to support improved conditions in the reach for other limiting life cycle stages.

Flow Protection/Enhancement

Summer streamflow throughout Mark West Creek is generated primarily by spring discharge which most commonly occurs along streambanks with exposures of bedrock of the Sonoma Volcanics. Springflow is concentrated in the upper watershed with the watershed area upstream of Van Buren Creek supplying more than 55% of the total summer spring discharge in the watershed despite representing less than 17% of the total watershed area. We recommend that the various flow protection and enhancement actions described below be focused in the watershed area upstream of the Mill Creek confluence where they are more likely to provide flow benefits in the identified high priority reach. The watershed area upstream of Van Buren Creek could be considered even higher priority for flow protection and enhancement given the disproportionate role the area plays in generating summer streamflow supplied to downstream reaches (Figure 102).

Given that groundwater discharge from the Sonoma Volcanics is the primary driver of summer streamflow, additional monitoring and analysis of subsurface geologic conditions and connectivity of springs and recharge source areas is warranted. Collection of data from a series of dedicated monitoring wells screened in specific geologic units and paired with springflow measurements is recommended to allow for an improved understanding of groundwater processes in the volcanics. Significant prior and ongoing effort has been given to collecting stage data and summer streamflow records, however limited effort has been dedicated to comprehensive rating curve development and generation of continuous streamflow records. Such data is critical to establishing baselines and understanding the effects of flow enhancement actions and ongoing climate change in the watershed and we recommend that a comprehensive long-term streamflow monitoring program be implemented for the watershed.

Releasing water from existing ponds was found to be by far the most effective individual strategy for enhancing streamflow (see Figure 100). The streamflow benefits of a cost-normalized flow release project were found to be more than 50 times greater than surface water diversion replacement projects and more than 500 times greater than grassland management projects (the second and third most effective strategies). Except in the reach upstream of Porter Creek, thick alluvial deposits are uncommon with many reaches of exposed bedrock and predominately gaining conditions persisting throughout the summer. These conditions are ideal for allowing released flows to provide flow benefits that persist in downstream reaches. Examination of existing ponds revealed that there are only three ponds upstream of the high-priority reach with sufficient storage to provide meaningful releases and we recommend that flow release projects be developed for these ponds if possible. There are many challenges that must be overcome to implement these flow release projects including landowner willingness, uncertainty regarding longevity, water quality and invasive species considerations, and permitting and water rights requirements.

There are many existing ponds that could likely be enhanced and new ponds could be built specifically to store water for streamflow enhancement. Given the disproportionate impact that pond releases are expected to have as a mitigation strategy for effects of climate change on streamflow, this somewhat controversial idea should be seriously considered. Water temperature and other water quality considerations should be an important aspect of planning flow release projects since water temperatures are already impaired and it is critical that flow releases do not further increase temperatures. There are various strategies for coping with elevated pond temperatures (e.g. bottom releases, surface shading, cooling systems) to the extent that this poses an issue during planning and design.

Our findings suggest that direct stream and spring diversions may have a significant impact on summer streamflow conditions at least over short periods when diversions are active; however, the cumulative effects of groundwater pumping in the watershed were relatively small. While we did find some relationship between the degree of streamflow depletion and the screen depth and distance of wells from streams/springs, these differences were modest with a rate of depletion from near stream wells screened in the upper 200-ft about 1.7 times the rate from more distant wells screened at depths greater than 200-ft. We did not find any direct relationship between the timing of pumping and the timing of streamflow depletion with the primary effects of summer pumping manifesting largely as changes in water balance dynamics during the recharge season (see Figure 83). These findings suggest that replacing direct stream and spring diversions with storage and/or groundwater pumping is a viable approach for enhancing streamflow conditions but that offsetting groundwater pumping with storage or shifting the timing of pumping from summer to winter is unlikely to lead to appreciable improvements in flow conditions. Of the six general strategies considered, replacement of direct diversions is the second most-effective strategy after pond releases, whereas offsetting groundwater pumping was found to be the least effective strategy (see Figure 100).

Requiring new wells to be screened a set distance from a stream or spring or below a certain depth may extend the length of time before streamflow depletion occurs, but it will not prevent streamflow depletion from occurring. The long response timescale (decades) suggests that a volumetric approach to managing groundwater will likely lead to more successfully managing streamflow depletion compared to approaches focused on location or time of use. It is important to note that the total pumping stress in the watershed is relatively small (~3% of mean annual infiltration recharge) and that the limited degree of streamflow depletion under existing conditions should not be understood to suggest that significant streamflow depletion would not occur were the total volume of pumping to increase substantially in the future.

On a cost-normalized basis, grassland, forest, and runoff management all produced relatively small streamflow benefits with grassland and forest management being approximately 3-4 times as effective as runoff management (see Figure 100). These strategies also have important secondary hydrologic benefits in addition to enhancing streamflows in that they reduce seasonal vegetation moisture stress which may reduce fire risk. Specifically, forest management reduces actual evapotranspiration on treated lands by about 5% and runoff management decrease Climatic Water Deficits (CWD) in infiltration areas by about 25%; grassland management only resulted in a small decrease in CWD of about 1%. These benefits are in addition to the primary non-hydrologic benefits of these types of projects for reducing fuel loads (forest management) and sequestering carbon (grassland management). There are also potential negative consequences of extensive forest management in terms of potential habitat loss for avian and terrestrial species which must be considered, and the forest treatments would only be effective in the long-term if periodically repeated to maintain the intended reduction in fuel load.

We recommend that a planning study be conducted for the upper watershed to identify parcels most suitable for grassland, forest, and runoff management projects and that these projects be implemented where feasible. Given that the streamflow benefits of these strategies are more than an order of magnitude less than those of diversion replacement and more than two orders of magnitude less than those of pond releases, the various types of management projects are considered a lower priority than pond release or diversion replacement projects. That said, the long-term maintenance of streamflow under future climate conditions may require all of the flow enhancement strategies to be implemented and it is important to gain near-term experience with these management strategies and to attempt to monitor their effectiveness.

The optimal design and effectiveness of runoff management projects is highly site specific and it is recommended that projects be focused on parcels with significant impervious area that are currently well-connected to surface water features, have relatively high soil infiltration rates, and sufficient space and site conditions to allow for larger-scale infiltration features. Gravel-filled infiltration basins may be required in some cases to prevent ponding of stagnant waters for more than 72-hrs per Sonoma County vector control requirements. Native soil basins will likely work in some situations, and where space is limited basins can be combined or replaced with bioswales and/or features designed to distribute water evenly across the landscape.

In summary while runoff, forest, and grassland management may not result directly in substantial streamflow improvement, these efforts have multiple benefits and are likely important strategies for managing fire risk and mitigating climate change impacts as discussed in more detail below.

Climate Change Adaptation

Climate change is expected to result in a dramatic decrease in springtime flows particularly during drought conditions. Summer baseflows are also predicted to decrease in some simulations, however the future trajectory of summer flows is less certain with some scenarios predicting limited changes or modest increases. The decline in flows during spring is expected to have significant effects on salmonids particularly with respect to smolt outmigration with some of the climate scenarios predicting that in some years flows will fall below passage thresholds nearly continuously from mid-February through October. The only feasible means to at least partially mitigate this dire threat to salmonids appears to be the implementation of springtime pond releases. While it may not be possible to significantly improve conditions throughout the smolt outmigration period, relatively high release rates could be achieved for a period of several days to weeks to provide a period of passable flow conditions timed to coincide with expected peak smolt outmigration (see Figure 98). We recommend that flow release projects be developed and adaptively managed to provide a combination of larger pulses of streamflow during outmigration and enhanced streamflow during summer baseflow depending on conditions in a given year.

The runoff, forest, and grassland management strategies influence the quantity of streamflow from springs which in general is relatively cold, therefore these approaches may be expected to assist in mitigating elevated water temperatures whereas the more effective strategies (pond releases and diversion replacement) would not be expected to provide temperature benefits (see Figure 88). These strategies also help reduce vegetation moisture stress by increasing the quantity of water available to plants in the case of runoff and grassland management or decreasing water demand from the landscape for the case of forest management. This reduced moisture stress may be an important benefit for wildfire hazard reduction and the increase in wildfire hazard expected as a result of climate change.

In summary, implementation of runoff, forest, and grassland management projects are expected to help build resiliency to climate change by providing multiple benefits beyond potential streamflow improvement and spring and summer pond releases provide a means of adaptively managing flow conditions for salmonids in the face of a changing climate.

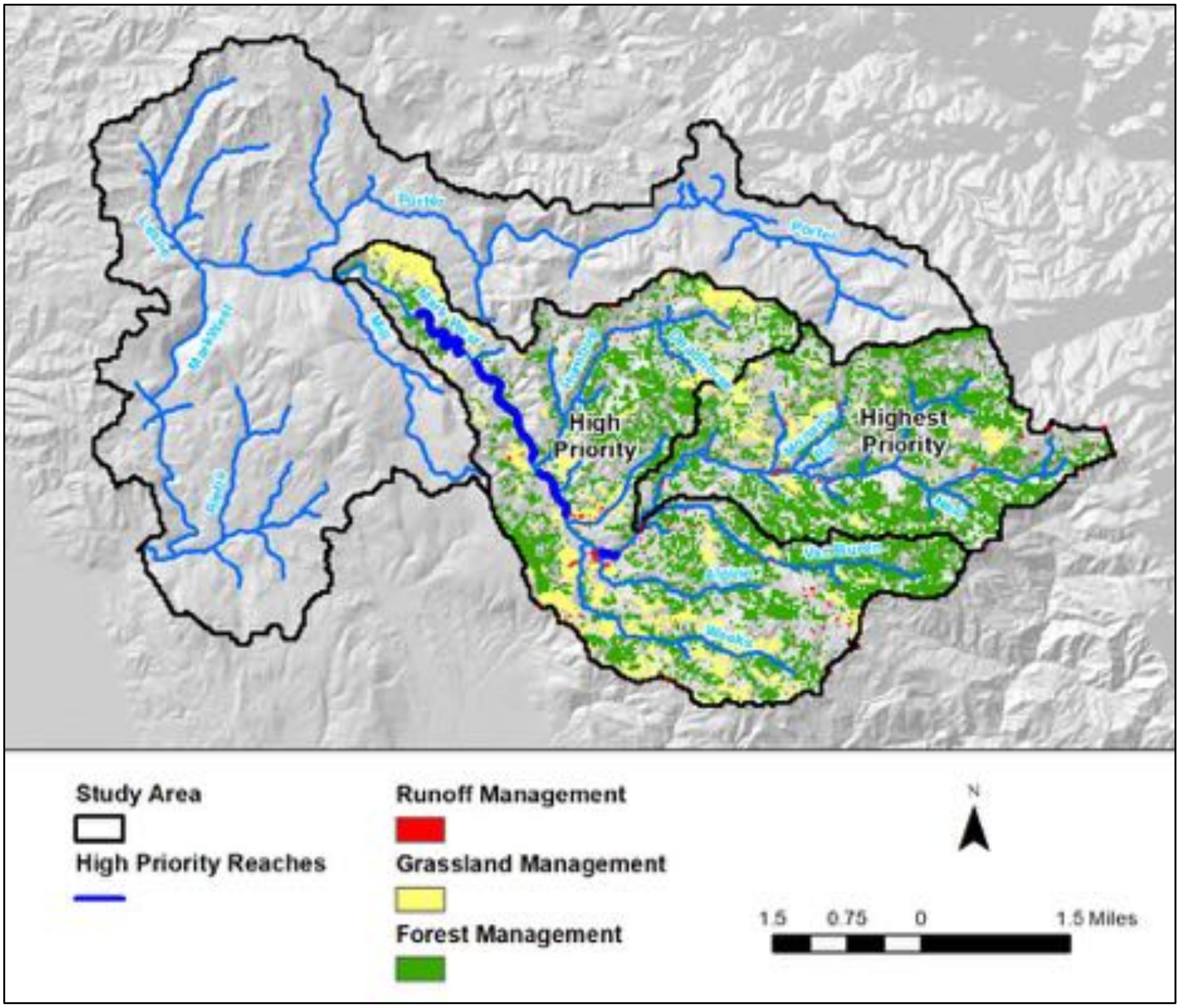


Figure 102: Locations of the identified high priority reaches for habitat enhancement projects and high priority watershed areas for flow enhancement projects.

Chapter 10 – Conceptual Design Development

The final phase of the project involved development of conceptual designs for two site specific streamflow enhancement projects. The projects focus on the approach of runoff management and were selected to take advantage of local site conditions and project opportunities on properties managed by our project partners the Pepperwood Foundation and Sonoma County Regional Parks. The projects illustrate two possible approaches to managing runoff for enhanced groundwater recharge and we anticipate similar approaches as well as other alternative methods could be applied on parcels throughout the watershed.

Goodman Meadow

Site 1 is located within the Pepperwood Preserve at the Goodman Meadow near the headwaters of Leslie Creek in the northwest corner of the watershed (Figure 103). The Goodman Meadow site consists of a relatively flat, approximately 12-acre natural basin perched on a topographic

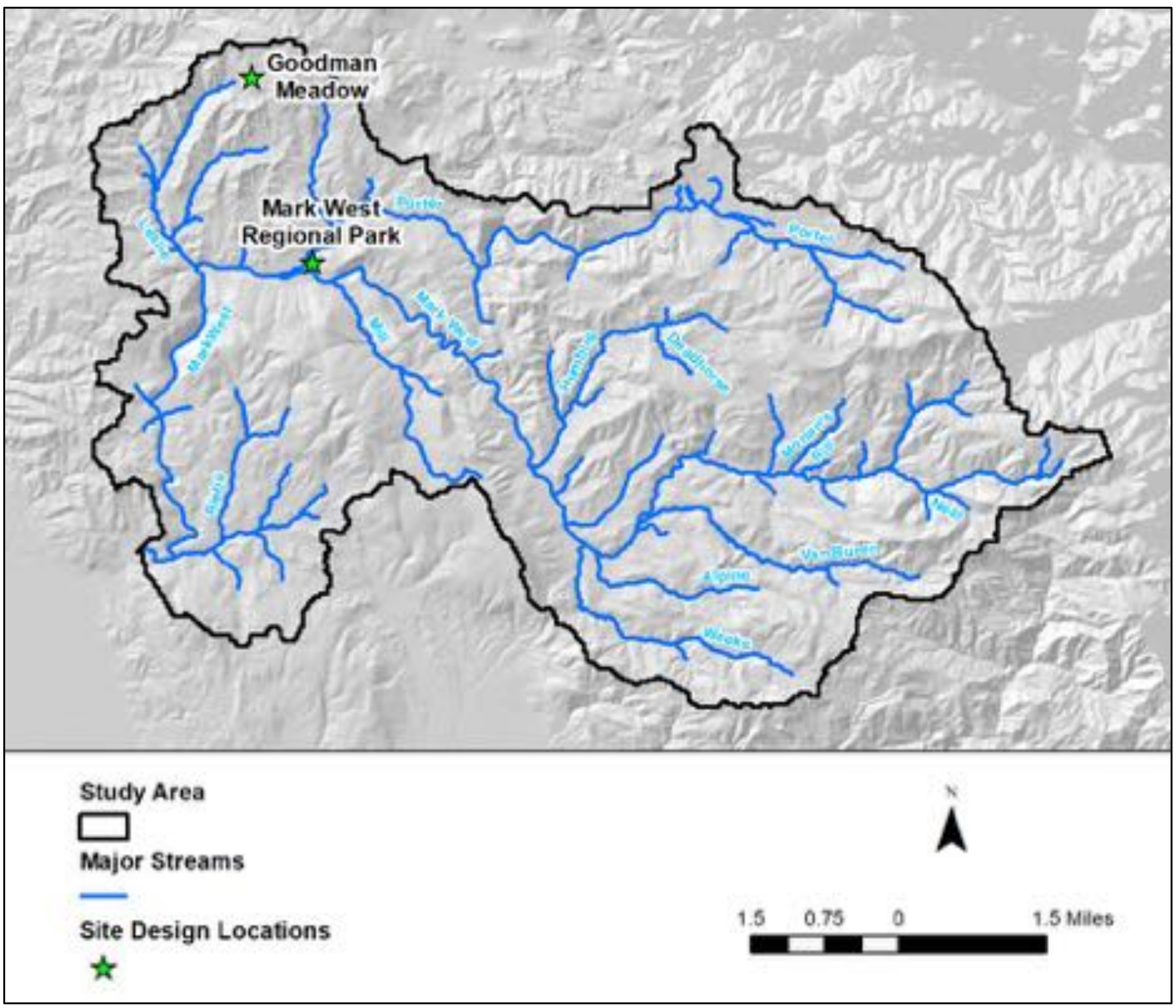


Figure 103: Locations of the two streamflow enhancement sites where conceptual designs have been developed.

bench and drained by an incised channel cutting through its western margin (see Appendix A, profile A to A'). The design consists of constructing a berm across the narrow valley at the basin outlet to retain winter runoff within the meadow and promote enhanced groundwater recharge. A channel exits the basin flowing southwest through a relatively narrow valley (approximately 60-ft wide at the base of adjacent slopes, see Appendix A section B to B') creating an optimal site for a berm or small dam. Approximately 94 acres of watershed area drain to the proposed berm site. The contributing area consists of mostly oak woodland and is not developed outside of an unpaved ranch road which traverses the hillside at the upper end of the meadow.

The basin outlet elevation will control the volume of water captured and stored within the basin. Various types of outlet structures are possible and for this conceptual design we assumed a 50-ft wide broad-crested weir with Low (1,128.0-ft) and High (1,132.5-ft) outlet elevation options (Appendix A). The Low elevation option would create an impoundment area of approximately 0.5 acres capable of storing approximately 1.1 ac-ft of water. Assuming 2-ft of freeboard above the outlet elevation, the Low elevation option would require a berm with an average height at the outlet of 4 feet above the meadow plain and a height of about 7-ft at the outlet above the incised channel bed. Based on existing LiDAR elevation data collected in 2013 (WSI, 2016), an ~98-ft long berm would be required. Assuming a 2H:1V berm side slope and a 4-ft berm top width, this would require approximately 274 yd^3 of fill (Appendix A). The High elevation option would create an impoundment area of approximately 1.4 acres and approximately 5.3 ac-ft of storage. The required berm would have an average outlet height of 8.5-ft above the meadow plain and a height of 11.5-ft at the outlet above the incised channel bed. Based on existing LiDAR elevation data, an ~132-ft long berm would be required. Assuming a 2H:1V berm side slope and a 4-ft berm top width, this would require approximately 692 yd^3 of fill (Appendix A).

A flow release structure should also be included near the base of the outlet to allow for drainage of retained water for maintenance purposes and/or for seasonal drainage if desired. An appropriate release schedule would be guided by Pepperwood Preserve's overall management strategy for the meadow and include consideration of the effects of the changed hydroperiod on grassland communities. These details would be further investigated and determined during subsequent design phases.

To evaluate the anticipated recharge and streamflow enhancement benefits associated with construction of the Goodman Meadow project, we implemented the conceptual design (using the higher of the two outlet elevations) as a scenario in the hydrologic model. The model represents the basin using a stage-storage relationship and calculates daily water levels as a function of simulated inflows from runoff and groundwater and simulated outflows across a broad-crested weir outlet structure and from evaporation and infiltration recharge.

The storage volume of the basin is relatively small compared to the available runoff and it fills to capacity during the first significant rainfall event of each year (typically in November or December). The basin remains near capacity throughout the rainy season with water levels typically beginning to decline in May or early June (Figure 104). Water levels typically reach a minimum in October by which point the upper portions of the basin are dry with 4-6-ft of water

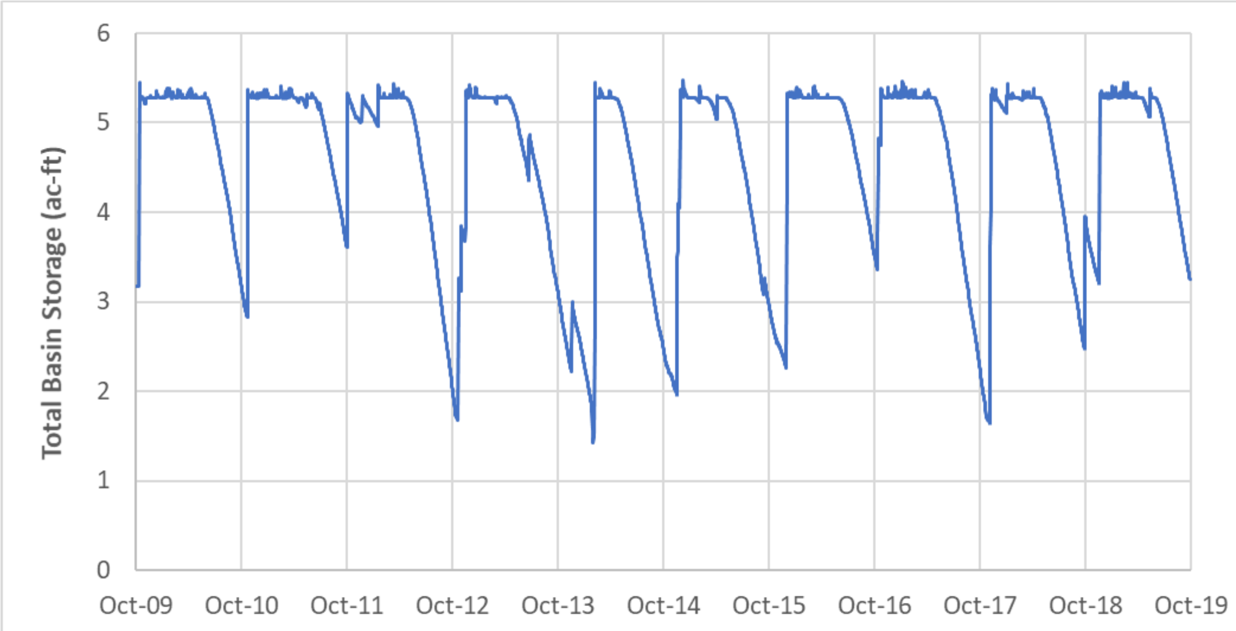


Figure 104: Daily fluctuations in storage in the Goodman Meadow recharge basin over the 10-yr hydrologic model simulation period.

remaining in the lower portions of the basin. The seasonal drawdown is dependent primarily on the duration of the dry season with minimum storage levels ranging from 1.4 to 3.6 ac-ft (26-68% of total capacity) (Figure 104).

Under existing conditions, mean annual infiltration recharge in the basin footprint was ~3.6 in/yr, and under proposed conditions this rate increases to ~18.7 in/yr. The total volume of additional recharge provided by the project is estimated to be about 1.9 ac-ft/yr. This additional recharge generates a modest increase in streamflow downstream in Leslie Creek. The upper reaches of the creek are intermittent and typically dry out sometime between late April and late June. The recharge enhancement serves to extend the length of time that the stream remains flowing each spring by between 12 and 21 days and the 10-yr mean streamflow over the April through June timeframe increases by about 0.01 cfs, representing about a 7% increase in flow.

Mark West Regional Park

Site 2 is located on a terrace on the east bank of Porter Creek just upstream of its confluence with Mark West Creek (Figure 103). The site is slated to be developed as the main entrance and parking area for the newly formed Mark West Regional Park operated by Sonoma County Regional Parks. Park facilities have not yet been designed in detail but are expected to be contained within approximately 3.1 acres currently occupied by a barn structure and an adjacent parking area and gravel road (Appendix B). The stormwater management design described here could become a part of the overall design for the park facilities and consists of collecting runoff from the developed portions of the park entrance in a network of diversion ditches and directing these flows into a series of two linear, gravel filled infiltration basins designed to maximize groundwater recharge. These basins are also expected to provide ancillary benefits by reducing peak runoff and providing filtration of pollutants from the parking area.

The basin alignment corresponds to an existing ditch that runs along the base of the slope southeast of the barn and parking lot. The upper basin is approximately 130-ft in length and runs adjacent to the existing parking area maintaining the existing slope of 0.6%. The lower basin runs approximately 490-ft behind the existing barn and maintains the existing slope of 0.2%. The two basins are separated by a road crossing where a 2.5-ft diameter, 150-ft long culvert is proposed to transport flows (Appendix B).

In addition to runoff collected from the developed footprint, the basins and associated channel will also receive flows from the adjacent hillslope which encompasses approximately 15.4 acres. The main intent of this infiltration basin design is to detain runoff from the developed areas associated with the new Mark West Regional Park entrance facilities and as such the basin has been sized to provide storage for a volume associated with a representative design storm for that area. Typically, infiltration basins are not recommended to receive runoff from drainage areas greater than 2 acres of undeveloped area due to concerns of sediment clogging which, over time could lead to a reduction in basin storage and groundwater recharge potential. Preliminary field observations suggest that runoff from the hillslope likely occurs primarily as sheetflow rather than as concentrated flow which suggests that sediment delivery to the basin may be minimal. Nevertheless, subsequent design work should include measures to minimize concentrated flow and sediment delivery to the basin from the adjacent undeveloped area such as a vegetation buffer with erosion control features along the base of the hillslope parallel to and up-gradient of the basin.

Channel dimensions were based on capacity calculations associated with the 100-yr recurrence interval storm runoff from the combined areas of the developed park and the 15.4-acre hillside. A simple Rational Runoff model for this area estimated 100-yr peak flows from the 3.1 acres of park facility and the adjacent 15.4-acre undeveloped watershed to be approximately 28 cfs. The channel and culvert sizes needed to accommodate this peak discharge were determined using standard open-channel and culvert hydraulic calculations and representative cross sections. The design channel is 2-ft deep, has a bottom width of 5-ft, and has side slopes blending into the existing topography with maximum slopes of 2:1 (Appendix B). A 2.5-ft diameter circular culvert with a slope of 2% connecting the two basins is required to convey the 100-year event (Appendix B).

This design is preliminary and further work by Sonoma County Regional Parks would be necessary to confirm feasibility of this approach. Topographic surveys, soil analysis, and infiltration testing will be necessary to generate construction ready design plans and provide infiltration performance estimates. Typical stormwater retention designs are required to eliminate ponded surface water within 72 hours to prevent mosquitos from breeding; however, this is largely mitigated by the gravel-filled basin design. We did not explicitly simulate this design in the hydrologic model because the scale of the design features is too small to accurately resolve using the 0.5-acre regional model grid. Nevertheless, results from the Runoff Management scenario described in Chapter 8 provide some context regarding the groundwater recharge enhancement and associated streamflow benefits expected from the project.

The regional scenario indicated that management of runoff from 98 acres in the Porter Creek watershed would generate approximately 73.4 ac-ft of additional infiltration recharge. The project design includes a storage volume equivalent to about 1.7% of the storage volume assumed in the regional scenario but only about 0.4% of the surface area. There are many additional factors that may increase or decrease the effectiveness of the design relative to the assumptions of the regional scenario. Nevertheless, these proportions serve as a general guide for estimating the recharge benefits of the proposed project and yield a range of expected additional recharge above background rates of between 0.3 and 1.2-ac-ft/yr.

The reach of Porter Creek adjacent to and downstream of the project site typically goes dry sometime between late May and late July depending on rainfall conditions. The regional modeling indicated that large-scale management of runoff in the Porter Creek watershed could extend the duration of streamflow adjacent to the project reach by 5 to 13 days and increase the mean April through June streamflow by about 0.05 cfs. As discussed above, the project would likely result in less than 2% of the recharge enhancement represented by the regional scenario suggesting that the streamflow benefits of the project by itself would be unlikely to significantly improve flow conditions in lower Porter Creek; though the project’s proximity to the intermittent reach of Porter Creek suggests that it may provide greater streamflow benefits than projects located in upstream areas.

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Re: Amendments to the Medical Cannabis Land Use Ordinance

Dear Members of the Board of Supervisors:

This firm represents the Friends of the Mark West Watershed ("FMWW") in connection with the amendments to the County's Cannabis Ordinance ("Project"). As set forth in this letter, the California Environmental Quality Act ("CEQA") requires the preparation of an environmental impact report ("EIR") before the County may approve the Project. The Project is not exempt from environmental review as asserted in the Planning Commission Staff Report ("PC Staff Report") at 1.

Our review of the documents describing the ordinance amendments, including the draft ordinance amendments and the June 7, 2018 PC Staff Report, served to deepen our concern that the County erred in relying upon CEQA exemptions to approve this Project. This assessment has been further confirmed by the investigation of our expert consultant, Kamman Hydrology and Engineering, whose letter dated August 3, 2018 is attached as Appendix A.

In addition, the Project conflicts with the Sonoma County's General Plan in violation of state Planning and Zoning Law, Govt. Code § 65000 et seq. As described in more detail below, the Project would conflict with multiple policies designed to protect the County's natural and agricultural resources.

Finally, based on the Project's significant environmental impacts and its inconsistency with the County's General Plan, the County must exclude the Mark West watershed from the Cannabis Ordinance. As detailed below, the state of California has determined that the Mark West watershed is impaired and the cannabis operations authorized by the Project would exacerbate the already fragile nature of this important ecosystem. Therefore, the County must exclude the Mark West watershed from areas where cannabis operations would be permitted in the County. Without such an exclusion, the County would violate not only the requirements of CEQA and state planning and zoning law, it would also create unnecessary conflicts with state regulations prohibiting the issuance of permits to grow cannabis in impaired watersheds.

I. The County May Not Approve the Project Without Preparing An Environmental Impact Report Under CEQA.

CEQA is designed to ensure that "the long-term protection of the environment shall be the guiding criterion in public decisions." *Friends of College of San Mateo Gardens v. San Mateo County Community College District* (2017) 11 Cal.App.5th 596, 604 [hereinafter "*San Mateo Gardens II*"] (quoting *No Oil, Inc. v. Los Angeles* (1974) 13 Cal.3d 68, 74). Thus, the statute requires an agency evaluating a project to develop an Environmental Impact Report (EIR) whenever "substantial evidence supports a fair argument that a proposed project 'may have a significant effect on the environment.'" *Committee for Re-Evaluation of T-Line Loop v. San Francisco Municipal Transportation Agency* (2016) 6 Cal.App.5th 1237, 1245-46 (quoting *Laurel Heights Improvement Assn. v. Regents of University of California* (1993) 6 Cal.4th 1112, 1123).

When an agency approves changes to a previously approved project, the agency must undertake a two-part decision-making process to determine what additional environmental review is required. *See Friends of College of San Mateo Gardens, v. San Mateo Community College District* (2016) 1 Cal.5th 937 (2016) [hereinafter "*San Mateo Gardens I*"]; *see also* Pub. Res. Code § 21166; CEQA Guidelines § 15126. First, the agency must determine, based on substantial evidence on the record as a whole, whether the previous environmental document "retains some informational value" in light of the proposed changes. *San Mateo Gardens I*, 1 Cal.5th at 951. If the proposed modifications "render[] the prior environmental review wholly irrelevant," the agency must conduct a new environmental review process. *Id.* at 952, n.3.

If, on the other hand, the agency determines that the prior environmental documents retain some relevance, then the agency must conduct additional environmental review under the provisions of Public Resources Code Section 21166. When an agency has previously prepared a negative declaration, additional subsequent environmental review is required when "whenever there is substantial evidence to support a fair argument that proposed changes 'might have a significant environmental impact not previously considered . . . .'" *San Mateo Gardens II*, 11 Cal.App.5th at 606 (quoting *San Mateo Gardens I*, 1 Cal.5th at 959).

The standard of review for an agency's decision to prepare a subsequent EIR or MND to account for changes to a project previously approved with a negative declaration thus mirrors the "fair argument" standard applicable to the decision to prepare an EIR or negative declaration in the first instance. *See San Mateo Gardens I*, 1 Cal.5th at 953. A subsequent EIR *must* be prepared if substantial evidence supports a fair argument that the proposed changes to the project may result in a significant environmental impact. *San Mateo Gardens II*, 11 Cal.App.5th at 606-07. Proposed changes might have a significant impact "when there is some competent evidence to suggest such an impact, even if other evidence suggests otherwise." *Id*. at 607.

The proposed amendments to the Cannabis Ordinance constitute substantial revisions that require additional environmental review. The amendments would allow the expansion of commercial cannabis operations in areas where they were not previously permitted. Moreover, in many cases, the expanded uses would be allowed with issuance of ministerial permits, which would preclude CEQA review at a future date. See PC Staff Report, Exhibit B, Draft ORD 18-0003 Summary of Allowed Land Uses and Permit Requirements for Cannabis Uses.

In addition, as explained further below, and in more detail in the attached Kamman Letter, ample evidence exists to support a "fair argument" that the proposed amendments may result in significant cumulative environmental impacts. These impacts would include, but not be limited to: impacts to water quality resulting from increased erosion and siltation; impacts to listed aquatic species resulting from worsening water quality; impacts to sensitive habitat and sensitive species due to conversion of open space to cannabis production; and impacts to groundwater resources resulting from a substantial increase in groundwater use. Because the proposed amendments expand uses into Agricultural and Resources designated areas, and because these amendments have the potential to result in significant cumulative impacts, the County is required to prepare an EIR before it may approve the amendments.

II. The Project Has the Potential to Result in Significant Environmental Impacts.

The proposed ordinance amendments would allow cultivation of cannabis in agricultural, industrial, commercial and resource zones countywide. This means that undeveloped areas containing sensitive habitats and species, as well as areas critical to maintaining water quality and watershed health, would be vulnerable to new cannabis cultivation uses under the ordinance provisions.

FMWW is particularly concerned that implementation of the Project would result in significant adverse impacts to Mark West Creek and its watershed. The Mark West Creek watershed ("MWW") supports a number of state and federally protected plant and animal species. Mark West Creek is designated as a core or Phase I area in the Final Recovery Plan for Central California Coast Coho Salmon Evolutionarily Significant Unit in the 2012 NMFS Coho Recovery Plan. *See*, http://cohopartnership.org/watersheds.html. Therefore, the Mark West Creek is a designated, precisely mapped resource of critical concern for purposes of Guidelines § 15300.2(a)), due to its designation as critical habitat for two species listed under the federal Endangered Species Act—the Central California Coast Steelhead and Central California Coast Coho Salmon. Report on the Hydrologic Characteristics of Mark West Creek, Center for Ecosystem Management and Restoration ("CEMAR"), November 14, 2014 at 2, attached as Appendix B. Furthermore, Mark West Creek flows into the Russian River, which is also listed as critical habitat for both species.

The State Water Board has also listed portions of Mark West Creek and its tributaries as 303(d) impaired water bodies for sedimentation and temperature (upstream of the confluence with the Laguna de Santa Rosa). Other portions of Mark West Creek (downstream of the confluence with the Laguna) Mark West Creek is also impaired for aluminum, dissolved oxygen, phosphorous, and manganese. *See*, *Study Plan - Habitat and Instream Flow Evaluation for Anadromous Steelhead and Coho Salmon in Upper Mark West Creek, Sonoma County*, California Department of Fish and Wildlife, June 2018, attached as Appendix C at 26. Because hydrological resources in the MWW and downstream are already impaired, expansion of cannabis operations has the potential to significantly impact those resources.

The investigation by Kamman Hydrology and Engineering, Inc. also indicates that the MWW is vulnerable to both groundwater overdraft and to reduced groundwater recharge. *See*, Kamman Letter at 3-6. As explained in the Kamman letter, given the conditions in the watershed, allowing expanded cannabis operations in the MWW would exacerbate groundwater overdraft. *Id*. at 5.

In addition, erosion resulting from activities allowed by the proposed Project—both from the change in use and from associated construction of cannabis production facilities—is likely to lead to increased sedimentation of Mark West Creek and its tributaries, impairing this critical habitat area. The delivery of fine sediment from erosion and runoff has been documented to have negative effects on water and habitat quality, specifically degrading spawning gravel habitat, juvenile rearing pool habitats, and juvenile salmonid survival and growth. Therefore, an increase in high-intensity uses, such as those associated with cannabis cultivation, are likely result in sediment deposits to Mark West Creek and increase negative impacts on aquatic habitat. The precise extent and potential significance of such increases would only become evident with a more detailed investigation of the specific construction features and methods associated with the activities that would be allowed under the ordinance amendments. Given this potential for erosion in a critical habitat area, it is crucial that the County perform a thorough analysis of this issue prior to approving the Project.

The proposed amendments would result in allowing cannabis production countywide in much of the undeveloped areas of the County. Without further environmental review, the County would be making this broad approval with far-reaching effects without having answers to critical questions. As Supervisor Gorin has noted, there are many unanswered questions about the impacts of cannabis cultivation: How much energy does cannabis cultivation require? What is the typical water demand for cannabis cultivation? How does that water demand compare to other agricultural and industrial uses in the County? What sorts of impacts related to contaminated run-off can be anticipated from these operations? Are there areas of the County that may be more appropriate for cultivation than others? Without answers to these and other questions, the County cannot know the extent of potential impacts to biotic, water, agricultural and other sensitive resources. These are exactly the type of impacts that must be analyzed in an EIR.

III. The Project Does Not Qualify for Exemption From CEQA Review

A. 'General Rule' or 'Common Sense' Exemption

The PC Staff Report states that the Project is exempt from CEQA review under Section 15061(b)(3) of the CEQA Guidelines. PC Staff Report at 1. The PC Staff Report further states that the Project is exempt under CEQA Guidelines sections 15307 and 15308 (hence forth referred to as Class 7 and Class 8 exemptions) as an action taken to assure protection of natural resources and the environment. PC Staff Report at 16. None of these exemptions applies to the proposed amendments.

First, the exemption provided under CEQA Guidelines section 15061(b)(3)—the so-called "commonsense exemption"—only applies "[w]here it can be seen *with certainty* that there is *no possibility* that the activity in question may have a significant effect on the environment[.]" CEQA Guidelines Section 15061(b)(3). Even "if legitimate questions can be raised about whether the project might have a significant impact and there is any dispute about the possibility of such an impact, the agency cannot find with certainty that a project is exempt." *Davidon Homes v. City of San Jose* (1997) 54 Cal. App. 4th 106,.117. As detailed above, however, the amendments will have numerous significant impacts. Therefore, far from qualifying for the commonsense exemption, the County must prepare an EIR before it may approve the amendments.

B. Class 7 and Class 8 Exemptions

The County's reliance on the Class 7 and 8 exemptions is even more far-fetched. The categorical exemptions listed in CEQA Guidelines Section 15307 and 15308 do not apply to the amendments to the County's ordinance because the amendments allow or expand an activity that may have a significant effect on the environment. These categorical exemptions only apply to actions that "assure the maintenance, restoration, or enhancement" of natural resources or the environment, respectively. *Save Our Big Trees v. City of Santa Cruz* (2015) 241 Cal.App.4th 694, 706-12. They apply, for example, where a project unambiguously phases out an activity that causes environmental harms. *Magan v. County of Kings* (2002) 105 Cal.App.4th 468, 476.

In contrast, the exemptions do *not* apply where a project permits or expands activities that may have a significant environmental impact. *Save Our Big Trees*, 241 Cal.App.4th at 706-12; *see also Wildlife Alive v. Chickering* (1976) 18 Cal.3d 190, 205-06 (holding that a regulation setting a hunting season did not fall under the Section 15307 exemption because hunting could have negative environmental impacts and the regulation permitted hunting.) Sections 15307 and 15308 do not apply to the County's amendments here, because the amendments would allow an expansion of a use that has many significant impacts, including impacts to water quality, water supply, and construction related impacts.

These exemptions are also unavailable because the Project may result in significant cumulative impacts over time and there is a reasonable possibility of a significant environmental effect due to unusual circumstances. CEQA Guidelines § 15300.2(b) and (c). Unfortunately, the County appears to have overlooked evidence that plainly triggers these "exceptions to the exemptions."

C. Business and Professions Code Section 26055(h)

Finally, the exemption for local cannabis ordinances that allow discretionary review, Business and Professions Code Section 26055(h), does not apply to this ordinance. This exemption applies to ordinances that require discretionary review for commercial cannabis activity, provided that that subsequent discretionary review itself includes CEQA review. Bus. & Prof. Code § 26055(h). The exemption thus ensures that the environmental impacts of commercial cannabis activity will ultimately be reviewed.

The Section 26055(h) exemption does not apply to the proposed amendments to the County's ordinance because they expand the use of ministerial zoning permits for certain commercial cannabis activities. By its terms, Section 26055(h) does not exempt ordinances allowing ministerial authorizations of cannabis activity. The reason for this is clear: unlike an ordinance that defers CEQA review to a subsequent discretionary approval, an ordinance that permits ministerial authorizations allows the County to entirely avoid ever reviewing the environmental impacts of certain cannabis activities. These ministerially-approved activities may each individually have an environmentally significant impact, and, as noted above, their cumulative impacts may be considerable—especially when considered in combination with the activity authorized by discretionary permits. Section 26055(h) is not intended to allow such activity to avoid CEQA review.

Given that a project determined to be within a categorical exemption is excused from any further compliance with CEQA, courts "construe the exemptions narrowly in order to afford the fullest possible environmental protection." *See, e.g., Azusa Land Reclamation Co., Inc. v. Main San Gabriel Basin Watermaster* (1997) 52 Cal. App. 4th 1165, 1193-94; "[E]xemption categories are not to be expanded or broadened beyond the reasonable scope of their statutory language." *Save Our Carmel River v. Monterey Peninsula Water Mgmt.* (2006) 141 Cal. App. 4th 677, 697. Thus, only "the clearest cases of categorical exemptions" will avoid environmental review. *Id.* This is not such a case.

IV. Approval of the Proposed Ordinance Amendments as Proposed—Which Are Inconsistent with the County's General Plan—Would Violate Planning and Zoning Law.

The state Planning and Zoning Law (Gov't Code § 65000 et seq.) requires that development approvals be consistent with the jurisdiction's general plan. As reiterated by the courts, "[u]nder state law, the propriety of virtually any local decision affecting land use and development depends upon consistency with the applicable general plan and its elements." *Resource Defense Fund v. County of Santa Cruz* (1982) 133 Cal.App.3d 800, 806. Accordingly, "[t]he consistency doctrine [is] the linchpin of California's land use and development laws; it is the principle which infuses the concept of planned growth with the force of law." *Families Unafraid to Uphold Rural El Dorado County v. Board of Supervisors* (1998) 62 Cal.App.4th 1332, 1336.

It is an abuse of discretion to approve a project that "frustrate[s] the General Plan's goals and policies." *Napa Citizens for Honest Gov't v. Napa County* (2001) 91 Cal.App.4th 342, 379. The project need not present an "outright conflict" with a general plan provision to be considered inconsistent; the determining question is instead whether the project "is compatible with and will not frustrate the General Plan's goals and policies." *Napa Citizens*, 91 Cal.App.4th at 379. Here, the proposed Project does more than just frustrate the General Plan's goals. As discussed in more detail below, the Project is directly inconsistent with numerous provisions in the General Plan.

The MWW is located within portions of Plan Area 3 (Healdsburg and Environs) and portions of Plan Area 5 (Santa Rosa and Environs) and is also within the Franz Valley Specific Plan Area. The proposed ordinance revisions would conflict with policies applicable to these plan areas. For example, the Sonoma County General Plan Land Use Element includes objectives and policies directed at locating commercial and industrial development in areas that protect rural and agricultural lands. These policies include:

> Franz Valley Specific Plan
> Hydrology - Within groundwater recharge areas, construction activities, creation of impervious surfaces, and changes in drainage should be avoided through discretionary actions.
>
> Healdsburg and Environs (Plan Area 3)
> Objective LU-14.2: Make Windsor and Healdsburg the commercial and industrial centers for the planning area. *Avoid additional commercial and industrial uses* and tourist related businesses *in the*

> *rural areas of this region*. Maintain compact urban boundaries for Windsor and Healdsburg. (Emphasis added.)
>
> Santa Rosa and Environs (Plan Area 5)
> Policy LU-16f: Avoid amendments to include additional commercial or industrial use outside urban service areas.

The Project is inconsistent with these policies because it would allow cannabis cultivation (both indoors and outdoors) in rural areas outside urban service areas. The ordinance revisions would also allow cannabis cultivation in some circumstances without discretionary review, which would be inconsistent with the Franz Valley Specific Plan.

The Sonoma County General Plan Land Use Element includes multiple objectives and policies directed at locating development in areas that protect environmentally sensitive areas. These policies include:

> Goal LU-7: Prevent unnecessary exposure of people and property to environmental risks and hazards. *Limit development on lands that are especially vulnerable or sensitive to environmental damage*. (Emphasis added.)
>
> Objective LU-7.1: Restrict development in areas that are constrained by the natural limitations of the land, including but not limited to, flood, fire, geologic hazards, *groundwater availability* and septic suitability. (Emphasis added.)
>
> GOAL LU-10: The uses and intensities of any land development shall be consistent with preservation of important biotic resource areas and scenic features.
>
> Objective LU-10.1: Accomplish development on lands with important biotic resources and scenic features in a manner which preserves or enhances these features.

The Project is inconsistent with these policies because it would allow cannabis uses in Agricultural and Resources and Rural Development designations without adequate limitations to ensure that environmentally sensitive resources, and groundwater resources are protected.

The Land Use Element also includes multiple policies directed at the protection of water resources. Specifically:

> Goal LU-8: Protect Sonoma County's water resources on a sustainable yield basis that avoids long term declines in available surface and groundwater resources or water quality.
>
> Objective LU-8.1: Protect, restore, and enhance the quality of surface and groundwater resources to meet the needs of all beneficial uses.
>
> Objective LU-8.5: Improve understanding and sound management of water resources on a watershed basis.
>
> Policy LU-8h: Support use of a watershed management approach for water quality programs and water supply assessments and for other plans and studies where appropriate.
>
> Policy LU-11g: Encourage development and land uses that reduce the use of water. Where appropriate, use recycled water on site, and employ innovative wastewater treatment that minimizes or eliminates the use of harmful chemicals and/or toxics.

The Project is inconsistent with these policies because, as explained in the Kamman Letter, cannabis cultivation within the MWW would exacerbate groundwater overdraft and reduced groundwater recharge, which would adversely impact biotic resources. Cannabis cultivation is a water-intensive use that requires approximately twice as much water as wine grapes. See, K. Ashworth and W. Vizuete, *High Time to Assess the Environmental Impacts of Cannabis Cultivation*, Environmental Science & Technology (2017) at 2531-2533, attached as Appendix D and at https://pubs.acs.org/doi/10.1021/acs.est.6b06343. According to the article, a study of illegal outdoor grow operations in northern California found that "rates of water extraction from streams threatened aquatic ecosystems and that water effluent contained high levels of growth nutrients, as well as pesticides, herbicides and fungicides, further damaging aquatic wildlife." *Id*. Another article indicates that "water demand for marijuana cultivation has the potential to divert substantial portions of streamflow in the study watersheds, with an estimated flow reduction of up to 23% of the annual seven-day low flow in the least impacted of the study watersheds. Estimates from the other study watersheds indicate that water demand for marijuana cultivation exceeds streamflow during the low-flow period. In the most impacted study watersheds, diminished streamflow is likely to have lethal or sub-lethal effects on state-and federally-listed salmon and steelhead trout and to cause further decline of sensitive amphibian species." *See*, Bauer et al., *Impacts of Surface Water Diversions for Marijuana Cultivation on Aquatic Habitat in Four Northwestern California Watersheds*, PLos ONE (2015), attached as Appendix E and at http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0120016. This increased intensity in water use has the potential to result in significant impacts to biotic resources and to other users.

Cannabis cultivation also has the potential to lead to increased use of fertilizers and pesticides that could impact groundwater and source waters and pose unique challenges related to treatment and disposal of chemicals in run-off and wastewater. These impacts would be even more pronounced in sensitive watersheds, such the Mark West Creek watershed and other Russian River tributaries.

Similarly, the Project would be inconsistent with the following Land Use Element objectives and policies calling for the protection of agricultural lands:

> GOAL LU-9: Protect lands currently in agricultural production and lands with soils and other characteristics that make them potentially suitable for agricultural use. Retain large parcel sizes and avoid incompatible non-agricultural uses.
>
> Objective LU-9.1: Avoid conversion of lands currently used for agricultural production to non-agricultural use.
>
> Objective LU-9.2: Retain large parcels in agricultural production areas and avoid new parcels less than 20 acres in the "Land Intensive Agriculture" category.
>
> Objective LU-9.3: Agricultural lands not currently used for farming but which have soils or other characteristics that make them suitable for farming shall not be developed in a way that would preclude future agricultural use.

In contrast to these General Plan goals and objectives, the proposed amendments would allow conversion of lands designated for agricultural uses for cannabis production, which includes construction of buildings to house indoor cultivation and would allow such production on parcels smaller than 10 acres.

As noted above, the Project will have substantial environmental impacts that have not been addressed by the County. These unanalyzed impacts will also result in inconsistencies with the General Plan. Therefore, the County must fully evaluate and mitigate the impacts of the Project before it can find the Project consistent with the County General Plan.

V. The County Must Exclude the Mark West Watershed from the Proposed Ordinance.

The proposed amendment to the Cannabis Ordinance include, Article 73 Section 26-73-005 describing a Cannabis Exclusion Combining District, which provides for the exclusion of cannabis related uses in areas so designated. June 7, 2018 Planning Commission Staff Report, Exhibit C. This section specifies criteria for areas to be included in the Exclusion Combining District, which include the following:

> (d) Areas where, because of topography, access, water availability or vegetation, there is a significant fire hazard; and
>
> (e) Areas with sensitive biotic resources or significant environmentally sensitivity exists.

Here, the MWW satisfies both criteria. First the area is characterized by steep sloped areas and encompasses areas identified as moderate, high, and very high wildland fire hazard zones. Sonoma County General Plan 2020, Public Safety Element, Figure PS-1G. Second, as discussed above and in the attached Kamman letter, the MWW is an "area with sensitive biotic resources or significant environmental sensitivity", which satisfies the criteria under Section 26-73-005 (e) for exclusion.

As enumerated in the Kamman letter and above, the MWW hosts critical aquatic and riparian habitat and endangered and sensitive aquatic species. Because of its unique physical and biological characteristics, the watershed has been identified in numerous natural resource planning efforts for protection and enhancement. See Kamman letter at 1 and 2.

There is also a documented trend in decreased groundwater availability in the MWW. This trend, and an acknowledged strong linkage between groundwater and creek summer base flow, indicate that the MWW is susceptible to groundwater overdraft conditions. Kamman at 5.

In addition, the Groundwater Management Plan (GMP) for the Santa Rosa Plain Watershed indicates that groundwater levels have decreased in response to groundwater pumping in the Santa Rosa Plain groundwater basin. Kamman at 6. Mark West Creek flows into the Santa Rosa Plain. The GMP indicates that seepage from streams flowing onto the Santa Rosa Plain, including Mark West Creek, are a major source of recharge to the groundwater basin. Sustainable Groundwater Management Act requires governments and water agencies of high and medium priority basins (such as the Santa Rosa Plain Watershed) to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge. *Id*.

As explained in the Kamman Letter, any incremental increase in groundwater pumping within the upper Mark West Creek watershed would not only exacerbate overdraft of local aquifers, but would reduce streamflow in Mark West Creek and associated downstream recharge, additionally exacerbating overdraft in the Santa Rosa Plain groundwater basin. Any future increases in groundwater pumping due to cannabis cultivation in the upper Mark West Creek watershed would also exacerbate groundwater overdraft in the Santa Rosa Plain basin. *Id*.

State regulations governing cannabis activities in environmentally sensitive watersheds further support exclusion of the Mark West watershed. Specifically, the Department of Food and Agriculture is prohibited from issuing new licenses for commercial cannabis activities in watersheds that the State Water Resources Control Board or the Department of Fish and Wildlife determine are significantly impacted by cannabis cultivation. Cal. Code Regs. § 8216; *see also* Bus. & Prof. Code § 26069; Water Code § 13149. If the County were to issue licenses for cannabis cultivation in these areas, it would conflict with the intent of the state regulations to protect sensitive environments from cannabis-related impairments. Further, by issuing permits for cultivation in impaired areas, the County could create a situation in which it is actively permitting activities that may be prohibited by the State, putting cannabis cultivators and the County itself in an untenable legal position.

Though the State Water Resources Control Board and the Department of Fish and Wildlife have not yet determined that cannabis activities have significantly impacted the Mark West watershed, it seems foolish to wait for this eventuality—and the associated degradation of a sensitive habitat—to occur. As this letter has emphasized, the Mark West watershed has already been identified as impaired in various respects. For example, the North Coast Regional Water Quality Control Board has identified Mark West Creek as impaired with respect to aluminum, dissolved oxygen, phosphorus, manganese, sedimentation/siltation, and temperature.[1] Further, the Mark West Creek is one of five streams the California Water Action Plan selected for an effort to restore important habitat for anadromous salmonids. See, *Study Plan* - CDFW, June 2018, at i.v., 9-11, attached as Appendix C. The study plan for this effort notes that "Water diversions, modifications to riparian vegetation, and sediment delivery to streams [like Mark West Creek] . . . have contributed to the degradation and loss of habitat" for endangered salmonid species. *Id*. Considering (1) the existing sensitivity of the watershed, and (2) the numerous impacts on water and aquatic resources resulting from cannabis cultivation that are contemplated by the State Water Resources Control Board's Cannabis Cultivation Policy,[2] it makes no sense to allow cannabis cultivation in the Mark West watershed. Instead, excluding cannabis cultivation from the Mark West watershed avoids incompatibility with state regulations, prevents the County from issuing permits to cultivators who may then be unable to receive state licenses, and avoids degradation of a valuable environmental resource.

Therefore, the FMWW request that the Mark West watershed be designated as part of the exclusion zone. Only by excluding cannabis operations from the MWW can the County ensure that sensitive biotic resources present in the watershed are protected.

Finally, it is important to note that property owners do not have an absolute right to grow cannabis. State and federal law simply provide that the County must allow an economically reasonable use of property. *Agins v. Tiburon* (1980) 447 U.S. 255, 260. Property owners are not entitled to any particular use of property nor are they entitled to compensation for even a "very substantial" diminution in the value of their property. *Long Beach Equities v. County of Ventura* (1991) 231 Cal. App. 3d 1016, 1036. By contrast, the County has an obligation to protect public trust resources and to comply with state law. *National Audubon Society v. Superior Court* (1983) 33 Cal. 3d 419.

Even if ensuring compliance with these state and local laws substantially diminishes the value of the applicant's property, there is no automatic taking or County liability. For example, in *MacLeod v. Santa Clara County*, a property owner sued for a

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[1] *See Laguna de Santa Rosa TMDLs*, North Coast Regional Water Quality Control Board, https://www.waterboards.ca.gov/northcoast/water_issues/programs/tmdls/laguna_de_santa_rosa/.

[2] *Cannabis Cultivation Policy: Principals and Guidelines for Cannabis Cultivation*, California State Water Resources Control Board, Oct. 17, 2017, https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2017/final_cannabis_policy_with_att_a.pdf.

taking after he was denied a timber harvesting permit for his 7,000 acre ranch. (9th Cir. 1984) 749 F.2d 541, 542-44. On appeal, a 9th Circuit court held that the denial of the permit was not a taking because the owner could continue to use or lease the land for cattle grazing as well as hold the property as an investment. *Id*. at 547. "The fact that the denial of the permit prevented [the owner] from pursuing the highest and best use of his property does not mean that it constituted a taking." *Id*. at 548. Similarly, in *Long Beach Equities*, the court found that even where "zoning restrictions preclude recovery of the initial investment made." they do not result in a taking as long as some use of the property remains. 231 Cal. App. 3d at 1038.

Designation of the Mark West watershed as an exclusion zone will simply prohibit the cultivation of cannabis in an area that is ecologically sensitive; it will not preclude other uses of property in the area. Because other less impactful uses of property remain, the County will have more than met its obligation to ensure some economic use of property in the watershed.

VI. Conclusion

In view of the foregoing, FMWW respectfully requests that the County designate the Mark West watershed as part of an Cannabis Exclusion Combining District and that if it does proceed with approval of Project, that it first prepare an EIR to fully disclose, evaluate, and mitigate the Project's significant environmental impacts.

Very truly yours,

SHUTE, MIHALY & WEINBERGER LLP

Ellison Folk

Carmen J. Borg, AICP
Urban Planner

cc: Supervisor Susan Gorin
Supervisor David Rabbitt
Supervisor Shirlee Zane
Supervisor James Gore
Supervisor Lynda Hopkins

List of Appendices

Appendix A	Kamman Hydrology and Engineering, Expert Consultant, August 2, 2018
Appendix B	Report on the Hydrologic Characteristics of Mark West Creek, Center for Ecosystem Management and Restoration ("CEMAR"), November 14, 2014
Appendix C	*Study Plan –"Habitat and Instream Flow Evaluation for Anadromous Steelhead and Coho Salmon in Upper Mark West Creek, Sonoma County"*, California Department of Fish and Wildlife, June 2018

Appendix D	*"High Time to Assess the Environmental Impacts of Cannabis Cultivation"*, K. Ashworth and W. Vizuete, Environmental Science & Technology (2017)
Appendix E	*"Impacts of Surface Water Diversions for Marijuana Cultivation on Aquatic Habitat in Four Northwestern California Watersheds"*, Bauer et al., (2015)

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APPENDIX A

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August 3, 2018

Ms. Carmen Borg and Ms. Ellison Folk
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396 Hayes Street
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Subject: Review of Amendments to the Sonoma County Cannabis Ordinance

Dear Ms. Borg and Ms. Folk:

I have been retained by you to review and evaluate documents related to the Amendments to the Sonoma County Cannabis Ordinance. A bibliography of materials I reviewed is attached to this letter along with my resume. Based on this review, I've prepared the following comments on key issues related to water resources, with focus on the upper Mark West Creek watershed (MWW)[1].

1. <u>Upper MWW should be designated Cannabis Exclusion Combining District due to presence of sensitive biotic resources</u>

The Mark West Creek watershed is unique to Sonoma County in that it hosts critical aquatic and riparian habitat and endangered and sensitive aquatic species. Because of its unique physical and biological characteristics, the watershed has been identified in numerous natural resource planning efforts for protection and enhancement, including the following.

- Upper Mark West Creek provides habitat for the following listed species under the U.S. Endangered Species Act (ESA): CCC steelhead listed as threatened in 1997; CC Chinook Salmon listed as threatened in 1999; CCC Coho Salmon listed as endangered in 2005. Coho in the Russian River watershed have also been listed as endangered under the California Endangered Species Act (CESA) in 2005 and were nearly extirpated from the watershed in the late 1990s (CDFW, 2018). Other aquatic species of special concern found in the upper watershed include California Roach (*Lavinia symmetricus*), Northwestern Pond Turtle (*Actinemys marmorata*), and Foothill Yellow-Legged Frog (*Rana boylii*) (Ibid).
- Mark West Creek is ranked as critical habitat for steelhead and coho salmon and assigned as a Phase 1 (highest priority) stream for coho recovery in National

[1] For purposes of this letter, the upper Mark West watershed is defined as the Critical Habitat Area of the Porter Creek-Mark West Creek drainage indicated on the County's Groundwater Availability map, dated December 6, 2016 and contained in Policy and Procedure Number 8-1-14, "Procedures for Groundwater Analysis and Hydrogeologic Reports" (PRMD, 2017).

Marine Fisheries Service's (NMFS) Central California Coast Evolutionary Significant Unit (CCC ESU) Coho Recovery Plan (NMFS, 2012).

- The Mark West Creek watershed was selected in 2014 as one of only five watersheds under the California Water Action Plan (CWAP) to receive coordinated efforts by the SWRCB and California Department of Fish and Wildlife (CDFW) to enhance stream flows in systems that support critical habitat for anadromous fish (SWRCB, 2018).
- In response to the CWAP, the CDFW has recently begun a Habitat and Instream Flow Study in the upper Mark West Creek. Goals and objectives of the study are to identify and develop relationships between stream flow and available salmonid habitat and determine the flows and water quality conditions needed to maintain rearing habitat and connectivity for juvenile salmonids and their food sources (CDFW, 2018).
- The upper Mark West Creek watershed was designated a "Natural Landscape"[2] Priority Conservation Area (PCA) by ABAG in 2008. Priority Conservation Areas (PCAs) are open spaces that provide agricultural, natural resource, scenic, recreational, and/or ecological values and ecosystem functions. These areas are identified through consensus by local jurisdictions and park/open space districts as lands in need of protection due to pressure from urban development or other factors.
- The majority of the upper Mark West Creek watershed that falls within the jurisdiction of the Franz Valley Specific Plan study area (1979) and has been assigned a "resource conservation" designation, recognizing the resource suitability, environmental and public service constraints, and natural sensitivities of the area[3]. Because the majority of the Plan area occurs within areas of marginal (or less) groundwater availability, the Plan recommends that construction activities, creation of impervious surfaces and changes in drainage should be avoided through the Planning Division's discretionary actions. The Plan also recommends, "Maintain a low intensity of residential development in the Mark West Creek area to maintain future County preserve options; especially observe riparian setbacks along this creek".
- In 2008, with funding from the Sonoma County Water Agency through the Cooperative Russian River Watershed Program, Sotoyome Resource Conservation District initiated the Upper Mark West Watershed Management Plan. The goals of the Plan are to meet water quality standards for sediment, support aquatic life and restore aquatic habitat, protect and enhance wetland habitat, promote native biodiversity in upland habitats and improve water conservation.

As demonstrated in the planning and study efforts listed above, the Mark West Creek watershed is an "area with sensitive biotic resources or significant environmental

[2] PCAs are categorized by four designations: Natural Landscapes, Agricultural Lands, Urban Greening and Regional Recreation.
[3] The 1979 Plan contains substantial description and analysis of natural resources in the study area. This original background language was deleted from all subsequent modified versions (1993, 2008 and 2012) of the Plan. The landuse designations cited here are from the 1979 Plan.

sensitivity" which satisfies the criteria for designating the watershed as a Cannabis Exclusion Combining District.

2. <u>Upper MWW should be designated Cannabis Exclusion Combining District because local groundwater aquifers are in overdraft</u>

The County funded a study by Kleinfelder, Inc. in 2003 to explore the factors affecting the availability of groundwater in three water scarce areas experiencing concentrated building and well construction (Kleinfelder, 2003). One area, the Mark West Study Area, is a 7.5 square mile intermountain valley located just north of Santa Rosa lying within the Mark West Springs Creek watershed[4]. The aquifer underlying the Study Area is primarily fractured bedrock of the Sonoma Volcanics, though thick deposits of the Glen Ellen formation occur in the northwest portion of the area where there is relatively little development. Kleinfelder states that the availability of groundwater in these formations is not predictable, but where groundwater is found, it is generally sufficient to supply current demand.

As part of their study, Kleinfelder quantified changes in residential and urban water demands between 1950 and 1997 along with construction depth and water levels of numerous wells. They found that the mean depth to water in new wells trends downward in each study area over time; the trend in Mark West Study Area drops from 90 feet in 1950 to about 175 feet in 1997. They conclude that the downward trend in depth-to-water in new wells corresponds to the trend of overall development. They also found a clear trend of increasing average well depths over time. They attribute the trend of increasing well depths to the need for drillers to reach groundwater levels that are lowering over time.

Kleinfelder's analysis of the annual average depth to water in new wells shows a trend of decreasing water levels over time in the three Study Areas. They conclude the decline in water levels is most likely explained by increased groundwater extraction over time. The trend analysis of depth to water in new wells together with reports of dropping water levels, seasonal well failures, and complete well failures all suggest groundwater overdraft[5] conditions. Additional development beyond the 1997 levels will likely increase overdraft as indicated in the following excerpt from the Kleinfelder report (pg. 40).

> *There is a potential for further residential and agricultural development in the Study Areas because they have not been developed to the maximum density allowed by existing zoning ordinances. New homes and vineyards require water and more wells would be needed to meet demand. Additional groundwater extraction is likely to increase the rate of overdraft and result in further decline of groundwater levels. In fact, if an overdraft condition currently exists, groundwater levels may continue to*

[4] The other two study areas included the Joy Road and Bennett Valley Areas.

[5] Groundwater overdraft occurs when groundwater use exceeds the amount of recharge into an aquifer, which leads to a decline in groundwater level.

decline even if no additional extraction occurs. Levels will continue to drop as long as extraction exceeds recharge.

In response to the expansion of vineyards and rural residences in rural Sonoma County over the recent decades, CEMAR (Center for Ecosystem Management and Restoration) completed a study on how human development has effected hydrologic conditions and salmonid habitat in the upper Mark West Creek watershed[6] (CEMAR, 2014). CEMAR states that in the Mark West Creek watershed irrigated agriculture and rural residences are the two most evident forms of water use, with vineyards being the most prevalent agricultural cover type. As part of their study, CEMAR quantified annual water demands for human uses in the upper watershed for comparison to summer streamflow data collected at several locations along the main stem Mark West Creek. Key findings and conclusions from the CEMAR report include the following.

- The upper watershed is geologically and topographically diverse. The majority of the watershed is underlain by Sonoma Volcanics and a large portion is Franciscan Complex.
- The source of summer base flows in Mark West Creek come from springs and groundwater seepage from the Sonoma Volcanics[7]. Although flow rates are low (ranging from around 0.5 to 0.03 ft^3/s, the creek exhibits consistent stable low flow through summer months, especially in headwaters.
- Study estimates indicate that residential and agricultural summer water demands exceed creek flow rates throughout the dry season May-October.
- Though there may be very few surface water diversions directly from Mark West Creek, water needs satisfied through pumping groundwater or from spring boxes likely remove water that would otherwise become base flow.
- Base flow in late summer could increase substantially if human water needs met through pumping groundwater or diverting from streams during the dry season were reduced.
- The potential for groundwater pumping to deplete streamflow is much greater for Sonoma Volcanic geology than Franciscan bedrock, even if Franciscan bedrock is thicker and closer in proximity to the stream.
- The data describing depth to water in well completion reports indicates an overall trend of greater depth to water among those wells located within the entire study region, as well as those wells within one-quarter mile of Mark West Creek for the period 1965-2014[8].

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[6] The CEMAR report focuses specifically on the area upstream of the confluence with Humbug Creek with Mark West Creek (near the west end of St. Helena Road).

[7] The 1979 Franz Valley Specific Plan corroborates this conclusion in the following statements, "In addition to the valley recharge in the alluvial soils and the stream gravels of the Franz and Knight Valleys, the more permeable and fractured areas of the Sonoma Volcanics are of major importance for groundwater recharge. Two areas along the upper reaches of Mark West Creek are responsible for maintaining summer flow and the high quality of the riparian vegetation and the fishery habitat of the creek".

[8] Although not stated in the CEMAR report, similar to the Kleinfelder study, the long-term trend of declining (lowering) groundwater levels suggest groundwater overdraft.

- Summer base flows are lower or recede into subsurface alluvium in portions of the main stem Mark West Creek and North Fork Mark West Creek due to excessive sediment accumulation and channel aggradation.
- Groundwater pumping likely results in reduced creek base flow, especially if wells are located in bedrock fractures that would otherwise provide base flow in summer.
- Given the range of possible scenarios for describing surface water-groundwater relationships in fractured bedrock, it is not possible to know how pumping groundwater from fractured bedrock may affect streamflow without conducting a test of well operation and streamflow response to see whether and how streamflow patterns deviate from baseline conditions when water is pumped.

In 2016, a notably dry year, the State Water Resources Control Board (SWRCB) submitted an Emergency Regulatory Action regarding enhanced water conservation and additional reporting requirements for the protection of specific fisheries in the Mark West Creek watershed. The SWRCB has authority to ensure the protection and preservation of streams and to limit diversions to protect critical flows for species, including for state- and federally- threatened and endangered salmon and steelhead species. An important and relevant statement in this emergency order is the acknowledged role groundwater plays in sustaining creek flows. The order states, "*Due to the known hydraulic connection between sub-surface water and surface streams in the Russian River watershed, as well as the limited water use information in the area, additional information on diversions, whether surface or subsurface, and use of water is needed to better assess impacts on surface stream flows*". The emergency regulatory action was effective from 3/30/2016 to 12/28/16.

Based on available technical studies, groundwater supplies in the upper Mark West Creek Watershed have steadily declined over the past 70 years and several local aquifers are in overdraft condition. It is acknowledged that groundwater sustains summer creek base flows. Existing creek base flow rate in upper Mark West Creek are very low during summer and is reduced to a level that threatens salmonids and other aquatic species during dry year-types. The increased water demands associated with expanded cannabis cultivation will only further exacerbate existing cumulative impacts on water/aquatic resources in upper Mark West Creek. Because of the documented trend in decreased groundwater availability and strong linkage between groundwater and creek summer base flow, it is recommended that the upper Mark West Creek watershed be designated a Cannabis Exclusion Combining District.

3. <u>Upper MWW should be designated Cannabis Exclusion Combining District due to existing water quality impacts in the watershed</u>

The RWQCB has listed Mark West Creek and its tributaries upstream and downstream of the confluence with the Laguna de Santa Rosa as 303(d) impaired water bodies for sedimentation/siltation and temperature (RWQCB, 2018). Downstream of the confluence with the Laguna, Mark West Creek is also listed as impaired for aluminum, dissolved oxygen, phosphorous, and manganese. Cannabis cultivation typically requires earth disturbance that generates potential sediment discharge to nearby water bodies, especially in steep or unstable terrain or where in close proximity to drainages. Given the existing upper watershed is impacted by sediment delivery to the creek, even small and unintentional sediment loading will add to existing cumulative adverse impacts to the creek. Therefore, it is recommended that the upper Mark West Creek watershed should be designated Cannabis Exclusion Combining District to avoid this impact.

4. Upper MWW should be designated Cannabis Exclusion Combining District due to reduced recharge to the Santa Rosa Plain Groundwater Basin

The County is developing a Groundwater Management Plan (GMP) for the Santa Rosa Plain Watershed (Santa Rosa Plain Basin Advisory Panel, 2014) pursuant to the state Sustainable Groundwater Management Act (SGMA). As stated in the GMP, groundwater levels have decreased in response to groundwater pumping in the Santa Rosa Plain groundwater basin. SGMA requires governments and water agencies of high and medium priority basins[9] to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge.

The GMP indicates that seepage from streams flowing onto the Santa Rosa Plain, including Mark West Creek, are a major source of recharge to the groundwater basin. Thus, any incremental increase in groundwater pumping within the upper Mark West Creek watershed would not only exacerbate overdraft of local aquifers, but would reduce streamflow in Mark West Creek and associated downstream recharge, additionally exacerbating overdraft in the Santa Rosa Plain groundwater basin. Any future increases in groundwater pumping due to cannabis cultivation in the upper Mark West Creek watershed would also exacerbate groundwater overdraft in the Santa Rosa Plain basin. Therefore, it is recommended that the upper Mark West Creek watershed should be designated Cannabis Exclusion Combining District to avoid this impact.

5. Further amendments to the Ordinance are needed to provide consistency with state law and regulations

a) Stream flow monitoring requirement: CEMAR (2014) concludes that the complex geology and surface water-groundwater interaction of the upper Mark West Creek watershed render standard County "hydrogeologic investigations" insufficient to evaluate the impacts of groundwater pumping on creek flow. This scenario likely exists in many other County watersheds. CEMAR recommends that coordinated well operation (pumping) observations and creek flow monitoring is required to

[9] The Santa Rosa Plain groundwater sub-basin (defined in DWR's Bulletin 118) is currently identified as a medium priority basin/subbasin and is, therefore, subject to the requirements of SGMA. In May 2018, DWR proposed elevating the Santa Rosa Plain basin to a high priority basin. Public comment is open until August 20th, 2018 with final prioritization in mid-October. The proposed change is not expected to have any immediate impact on the development of the Groundwater Sustainability Plan or other GSA activities, as medium and high priority basins are subject to identical requirements and timelines under SGMA.

identify and quantify groundwater-surface water interaction. The Counties Cannabis Ordinance [Sec. 26-88-254, (g), (10)] includes the requirement for the preparation of a hydro-geologic report to certify that operation of an onsite groundwater supply does not exacerbate an overdraft condition in basin or aquifer or result in reduction of critical flow in nearby streams. However, the following section of the ordinance [Sec. 26-88-254, (g), (11)] only discusses groundwater monitoring and reporting protocols. As indicated above, stream flow monitoring is also required to definitively assess potential impacts on instream flows from groundwater withdrawals. Therefore, I recommend that an additional stream flow monitoring requirement be added to the ordinance for sites located within Groundwater Availability Zone 3 or 4, consistent with surface water flow monitoring requirements contained in the RWQCB Cannabis Cultivation Policy.

b) <u>Instream flow requirements:</u> A stated purpose of the County's ordinance amendment is to "harmonize" and "align" the ordinance with state law. Numerous requirements under the RWQCB Cannabis Cultivation Policy are triggers and/or mitigations in response to impacts on water and aquatic resources that are clearly anticipated (and articulated) from increased cannabis cultivation (e.g., minimum instream flow requirements). The State regulations clearly identify/anticipate and address potential adverse impacts from the legalization of cannabis cultivation. The County's ordinance should do likewise.

Please feel free to contact me with any questions regarding the material and conclusions contained in this letter.

Sincerely,

Greg Kamman, PG, CHG
Principal Hydrologist

REGISTERED GEOLOGIST
GREGORY R. KAMMAN
NO. 360
CERTIFIED HYDROGEOLOGIST
12/31/18
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Principal Hydrologist

EDUCATION	1989	M.S. Geology - Sedimentology and Hydrogeology Miami University, Oxford, OH
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	1991 - 1994	Project Geologist/Hydrogeologist Geomatrix Consultants, Inc., San Francisco, CA
	1989 - 1991	Senior Staff Geologist/Hydrogeologist Environ International Corporation, Princeton, NJ
	1986 - 1989	Instructor and Research/Teaching Assistant Miami University, Oxford, OH

SKILLS AND EXPERIENCE

As a Principal Hydrologist with over 25 of technical and consulting experience in the fields of geology, hydrology, and hydrogeology, Mr. Kamman routinely manages projects in the areas of surface- and ground-water hydrology, stream and wetland habitat restoration, water supply, water quality assessments, water resources management, and geomorphology. Areas of expertise include: stream and wetland habitat restoration; characterizing and modeling basin-scale hydrologic and geologic processes; assessing hydraulic and geomorphic responses to land-use changes in watersheds and causes of stream channel instability; evaluating surface- and ground-water resources and their interaction; and designing and implementing field investigations characterizing surface and subsurface conditions; and stream and wetland habitat restoration feasibility assessments and design. In addition, Mr. Kamman commonly works on projects that revolve around sensitive fishery, wetland, wildlife and/or riparian habitat enhancement. Mr. Kamman performs many of these projects in response to local, state (CEQA) and federal statutes (NEPA, ESA), and other regulatory frameworks. Thus, Mr. Kamman is accustomed to working within a multi-disciplined team and maintains close collaborative relationships with biologists, engineers, planners, architects, lawyers, and resource and regulatory agency staff. Mr. Kamman is a prime or contributing author to over 80 technical publications and reports in the discipline of hydrology – the majority pertaining to ecological restoration. Mr. Kamman routinely teaches courses on stream and wetland restoration through U.C. Berkeley Extension and San Francisco State University's Romberg Tiburon Center.

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APPENDIX B

Report on the Hydrologic Characteristics of Mark West Creek

November 14, 2014 (updated January 28, 2015)

ABSTRACT

Mark West Creek is an important stream for the recovery of salmon in the Russian River watershed. One of the principal challenges to recovering these fishes is maintaining sufficient flowing water through the summer dry season, when human water demands can result in reduced flow during a time when it is naturally very low. Analyses of rainfall dynamics, streamflow dynamics, and human development indicate that there is sufficient water on an annual scale to meet existing human and environmental water needs; but diverting water from aquifers, springs, and streams has likely contributed to less water in upper portions of Mark West Creek than would be present naturally. Agricultural needs and residential needs are similar in magnitude, and if water is stored in winter to meet these needs rather than obtained during the dry season, these management changes could have a meaningful benefit on streamflow during the dry season.

Center for Ecosystem Management and Restoration

Cover photo: Mark West Creek downstream of Neal Creek, Summer 2013.

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Report on the Hydrologic Characteristics of Mark West Creek

Center for Ecosystem Management and Restoration

November 14, 2014

1. Introduction

Mark West Creek is one of the largest tributaries to the Russian River, draining a catchment of 51 square miles before its confluence with the Laguna de Santa Rosa southwest of Windsor. NOAA Fisheries regards the Mark West Creek watershed as having high potential for supporting anadromous salmonids, ranking it as critical habitat for steelhead and coho salmon, and assigning it as a Phase 1 stream for coho recovery in its CCC ESU Coho Salmon Recovery Plan (Figure 1). Anecdotal reports from stakeholders in the Mark West Creek watershed and fish-monitoring groups also indicate that Mark West Creek and its tributaries currently support salmonids (mostly steelhead trout), though in lower numbers than were present in the recent past.

Like many parts of rural Sonoma County, the Mark West Creek watershed has undergone land use changes that are believed to alter the dynamics of the hydrologic regime (NMFS 2012). In recent decades, vineyards have expanded to join the many rural residences in the Mark West Creek watershed; concerns have arisen about proposed industrial facilities (namely, wineries) as well. Depending on how water is obtained, each of these human developments may alter the flow regime: data from across the county indicate that a number of water uses, ranging from agricultural to recreational to domestic, all have potential to influence streamflow during the summer dry season, in part because streamflow is naturally very low. Concerns have also arisen that water storage in winter could reduce winter flows during salmon migration periods, though studies have indicated that these impacts are variable through the Russian River watershed (Deitch et al. 2013).

This report describes the hydrologic characteristics and factors that influence the water balance of the upper Mark West Creek watershed (Figure 2). Much of this report focuses specifically on the area upstream of the confluence of Humbug Creek with Mark West Creek (near the west end

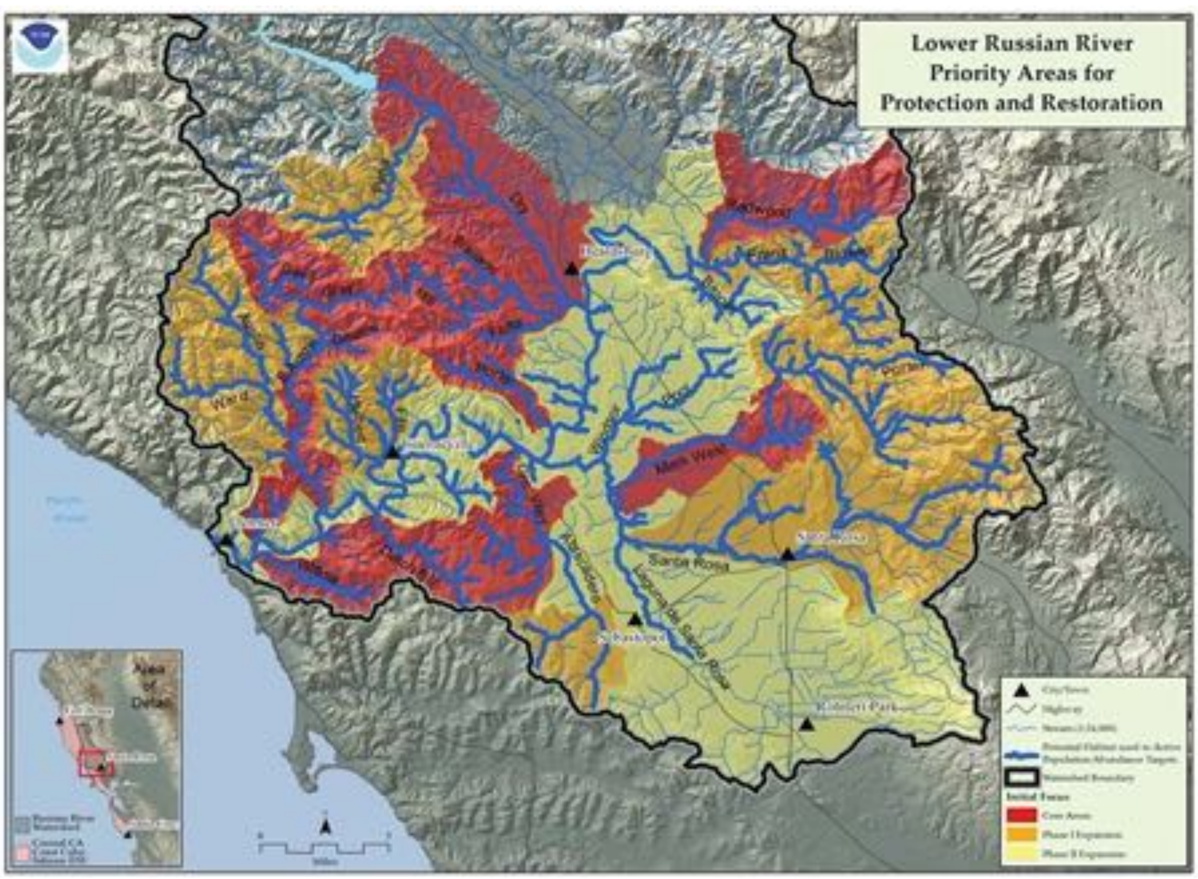


Figure 1. Areas in the lower Russian River watershed in the NMFS CCC Coho Recovery Plan, by priority (NMFS 2012).

of St. Helena Road), referred to henceforth as *Upper Mark West Creek*. In particular, this report focuses on characteristics of land cover and human development, rainfall and runoff, geology, and channel geomorphology as they pertain to the hydrology of the upper Mark West Creek watershed. Based on the information presented, we conclude the report by summarizing management tools that could be utilized to increase summer base flow in Mark West Creek.

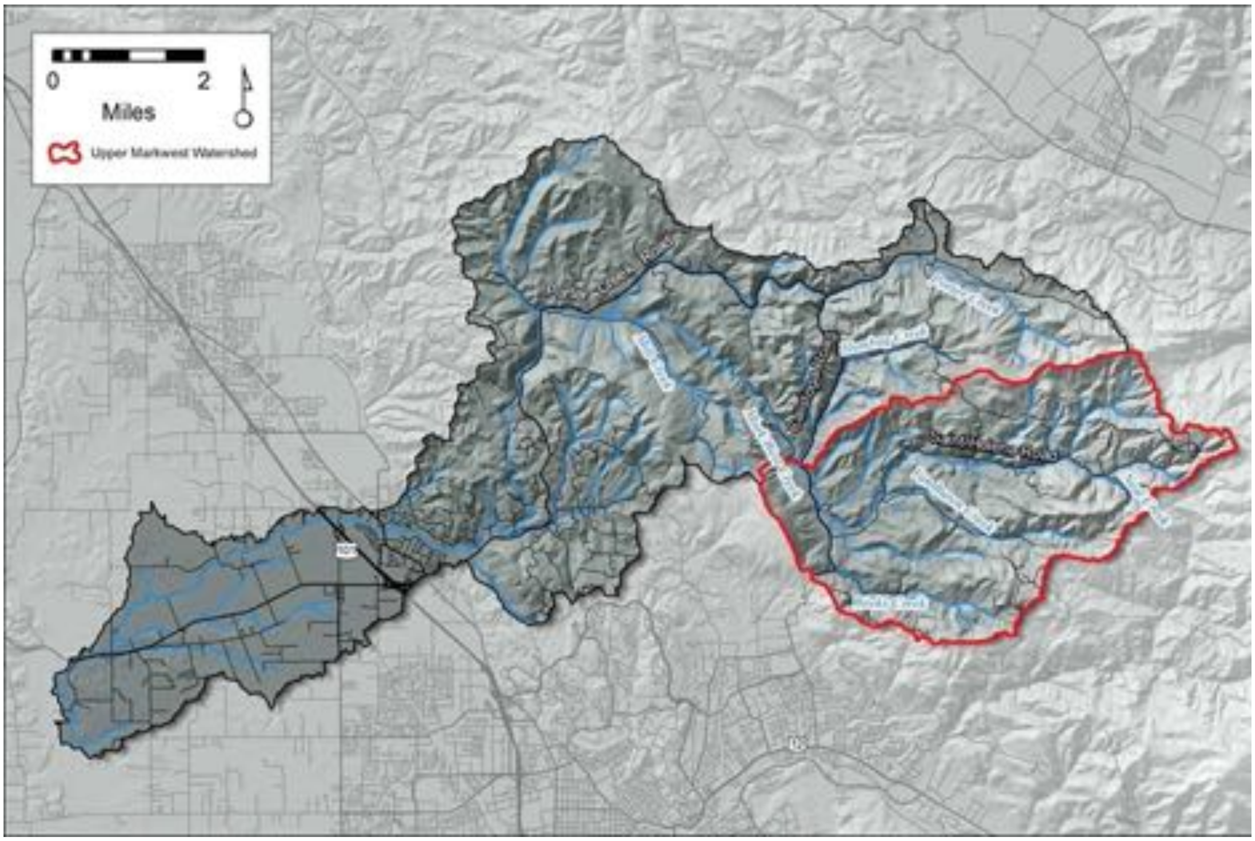


Figure 2. Mark West Creek watershed, with the upper Mark West watershed used in this study identified.

2. Rainfall

Rainfall is the principal driver of hydrologic processes in coastal California. Virtually all precipitation occurs as rainfall, and streams generally respond quickly to rainfall with elevated streamflow. When rainfall ends, streamflow gradually recedes until the following rainfall event (which, depending on the time of year, may occur several months later). In addition, streamflow in years with higher-than-average rainfall have appreciably different streamflow dynamics than in years with less-than-average rainfall (Deitch and Kondolf, 2012). These streamflow dynamics define instream conditions for anadromous salmonids through the year: fishes such as steelhead trout and coho salmon migrate upstream to spawn during and following high-flow pulses, and juvenile fishes rear in freshwater streams for at least one year before migrating to the ocean as smolts (coho spend one year as juveniles in freshwater streams, while steelhead may spend up to three). The purpose of this section is to quantify the amount of rain that falls on the Mark West Creek watershed, based on standard data sources; describe differences between these standard sources and measured data within the watershed; and estimate the differences between rainfall in a "normal-type" versus "dry-type" year.

Annual-scale rainfall

On an annual scale, the Mark West Creek watershed receives a considerable amount of rainfall. Reports on the Mark West Creek watershed frequently cite an average annual precipitation of 50 inches of rain in the upper portion of the watershed (e.g., ESA 2012, Todd Engineers 2006). Our analysis of spatial rainfall data based on the PRISM data set (Parameter-elevation Regressions on Independent Slopes Model, developed by researchers at Oregon State University, which is frequently cited as the standard for rainfall estimation in California) provides a slightly lower estimate of 42.5 inches in an average year for the entire watershed, including the lower portion in the Santa Rosa Plain (Figure 3). Orography influences the spatial variability of rainfall: whereas PRISM estimates the low-relief downstream portion of the watershed receives 35 inches in an average year, the upper high-relief portion receives more than 50 inches on average. This underestimates local rainfall measurements taken at the Mark West headwaters: local measurements indicate an average of approximately 65 inches through the year, recorded from 1965-2011 (Doerksen, unpublished data).

Based on the PRISM average annual rainfall data set (which, as described above, provides a low estimate of rainfall in the headwaters), 42.5 inches of rainfall over the 51 square mile watershed. This corresponds to 117,000 acre-ft, or 38.2 billion gallons, of water as rainfall to the Mark West watershed in an average year (Table 1). As discussed above, upper Mark West Creek is the wettest portion of the Mark West watershed: PRISM estimates that it receives approximately

46.4 inches of rain over its 14 square mile catchment (34,500 acre-ft, or 11.2 billion gallons) in an average year. Though this is likely an underestimate based on locally collected data described above, the PRISM rainfall data provide a conservative estimate from a water resource perspective.

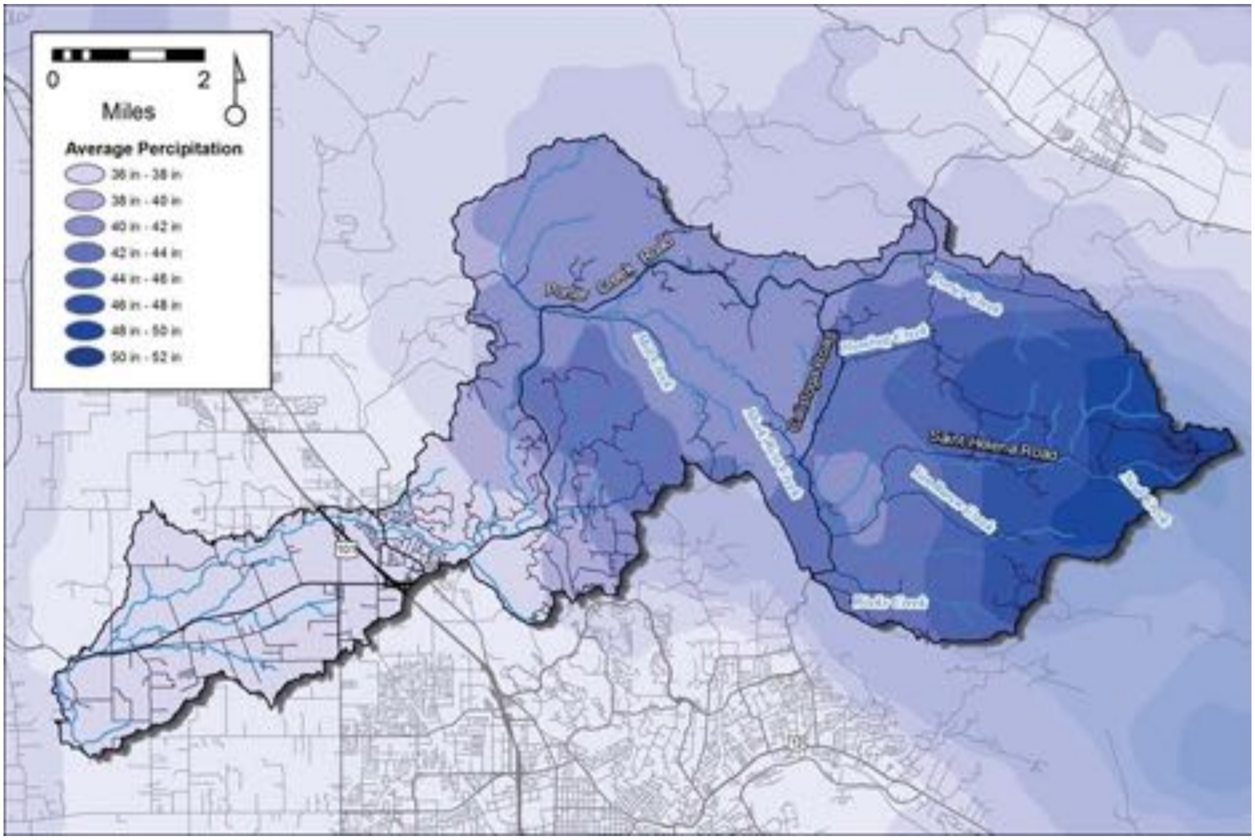


Figure 3. Average annual rainfall over the Mark West Creek watershed (PRISM data).

Table 1. Average and dry-year rainfall in the Mark West Creek watershed and upper Mark West watershed, in inches, acre-feet, and gallons.

		Average annual rainfall			Estimated dry-year rainfall		
Watershed	**Catchment area, mi^2**	**Rainfall, inches**	**Total precip, acre-ft**	**Total, gallons**	**Rainfall, inches**	**Total precip, acre-ft**	**Total, gallons**
Mark West Watershed	51.70	42.5	117,000	38,200,000,000	21.2	58,600	19,100,000,000
Upper Wark West watershed	14.0	46.3	34,500	11,300,000,000	23.1	17,300	5,600,000,000

Rainfall in coastal California can be highly variable from one year to the next; thus, multi-annual variability must be considered in any water resources analysis intended to evaluate water availability for human or ecological needs. Long-term data measured at nearby Healdsburg indicate that the rainfall in a very dry year is approximately half of the rainfall in an average year: rainfall in water year 1972, exceeded by 95% of 61 years from 1951 to 2011, was 21.4 inches (half of the average annual rainfall [42.9 inches] recorded at Healdsburg over the 61 year period of record; Figure 4). In a very wet year (e.g., 1995, exceeded by 5% of 61 years), rainfall is approximately two-thirds more than average (71 inches). These comparisons provide useful rules-of-thumb for what might be expected at the opposite ends of extreme rainfall years.

Evaluations that consider dry-year conditions are especially important because they depict water availability during times of scarcity. If rainfall in a very dry year is approximately half of the average, then water managers need to consider the implications of having half the rainfall that typically occurs for facilities such as water storage and water delivery systems. If a very dry year were to have half the rainfall of an average year, the Mark West watershed would receive approximately 58,600 acre-ft (19.1 billion gallons) of water as rainfall over the entire watershed in a very dry year (Table 1, above, with 17,300 acre-ft of rainfall in the upper Mark West watershed in a dry year).

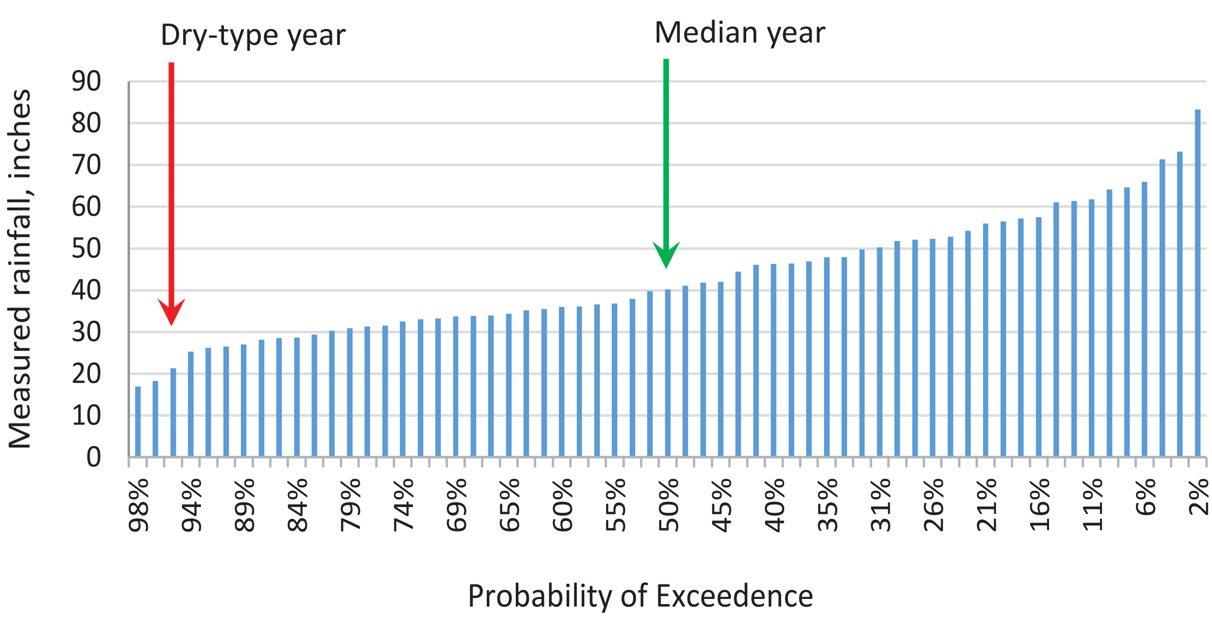


Figure 4. Probability of exceedence for annual rainfall recorded at Healdsburg, CA, 1951-2011 (by water year).

Seasonal variations in rainfall

Though dry-year and wet-year rainfall analyses in the Mark West watershed provide important insights into water resources that reach the watershed over the entire year, annual-scale analyses neglect important characteristics about the timing of water that influence the capacity for water to meet human and ecosystem needs within the year. Like most of coastal California, climate patterns in eastern Sonoma County are characteristically Mediterranean, resulting in a very wet season and a very dry season. The 61-year data set of rainfall at nearby Healdsburg, CA used in the above analysis also show that 90 percent of the average annual rainfall occurs during the wet half of the year November through April; less than 2 percent of the average annual rainfall occurs from June through August (Figure 5). While the total amount of rainfall may be variable from one year to the next, the seasonality of precipitation is consistent among all years (Deitch and Kondolf, 2015).

This seasonal variation has profound implications for people living and working in the Mark West watershed and across coastal California. Rainfall will not provide water to meet agricultural, industrial, or domestic needs during the summer dry season, so water is instead typically obtained through sources such as wells and springs. If wells and springs provide an uncertain or unsteady supply of water, it may be advantageous to store water in reservoirs or water tanks in winter for use during summer. This seasonality also has implications for stream hydrology (further described below): streamflow begins to recede at the end of the rainy season toward intermittence through the dry season until rainfall occurs again the following water year.

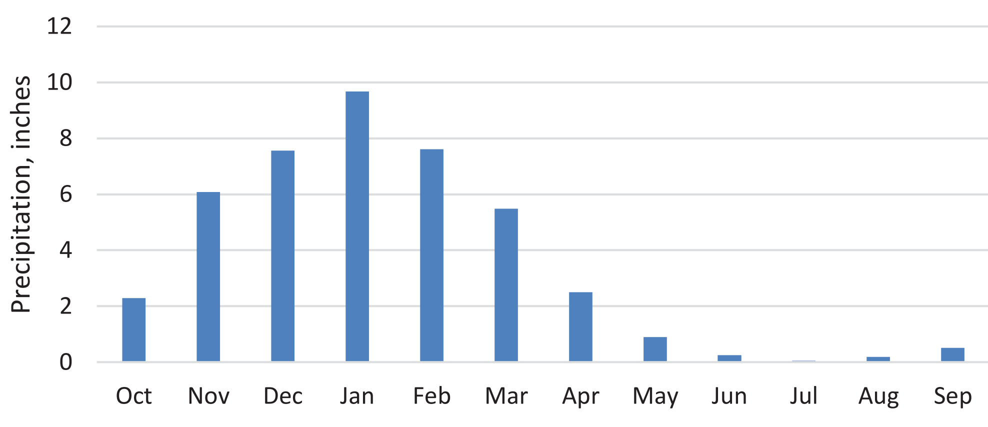


Figure 5. Average monthly rainfall recorded at Healdsburg, CA.

3. Land cover and land use

The term "land cover" classifies the features found on the surface of the earth. It usually focuses on vegetation cover, including types of forest (deciduous, riparian, evergreen, mixed), or other vegetation (*e.g.*, shrub/scrub, grassland), but also may include features such as barren land (*e.g.*, exposed rock), and various types of human development (classified as either developed or cultivated crops). Variations in land cover help to understand the extent of human footprint in a watershed, as well as how features such as geology, soil type, and climate influence the types of plants that grow in an area. In addition, land cover can influence watershed hydrology (described further in subsequent sections). In this section, we use existing land cover data sets to explore the spatial distribution of the human footprint in the Mark West watershed, and develop an estimate of human water need in the upper portion of the study area.

Land Cover by Percentage

Like the rest of the Russian River watershed, the land cover of the Mark West watershed is diverse. We used the 2011 National Land Cover Database (Jin et al. 2011, a US Geological Survey product available through the Multi-Resolution Land Characteristics Consortium, mrlc.gov) to identify the variations in land cover in the Mark West Creek watershed; we further refined the cultivated crop data to reflect an agricultural crop data set prepared by researchers at UC Berkeley and the University of California Cooperative Extension in 2004 and updated by CEMAR in 2014, to more accurately reflect the actual agricultural coverage in the watershed (this was necessary because much of the agricultural coverage, especially in the upper portions of the watershed, were not included in the Land Cover Database).

As summarized below (Table 2), the majority of the Mark West Creek watershed is covered in either forest (43.8 percent) or shrub/scrub (22.2%). The additional 33% of land cover includes grassland/pasture (11.3%), cultivated crops (12.6%), and developed (9.8%, including urban and open space such as parks). Most of the Upper Mark West watershed is evergreen forest, with some portions as grassland, mixed forest, shrub/scrub, developed, and cultivated crop (Figure 6B).

Table 2. Percentage of the Mark West Creek watershed by land cover type (based on 2011 National Land Cover Database and CEMAR agricultural crop GIS data).

	Evergreen	Deciduous/ Mixed forest	Grass-land	Shrub/ scrub	Developed	Cultivated crop	Reservoirs	Barren land
Lower (Santa Rosa Plain, 5,700 ac)	0.03	1.2	11.5	1.1	22.6	63.5	0.13	0.06
Middle (18,460 acres)	32.8	16.7	12.4	27.2	8.9	1.9	0.06	0.13
Upper (8.960 acres)	51.6	7.9	9.6	25.5	3.5	1.8	0.02	0.04
Total (33,120 ac)	**32.3**	**11.6**	**11.3**	**22.2**	**9.8**	**12.6**	**0.06**	**0.10**

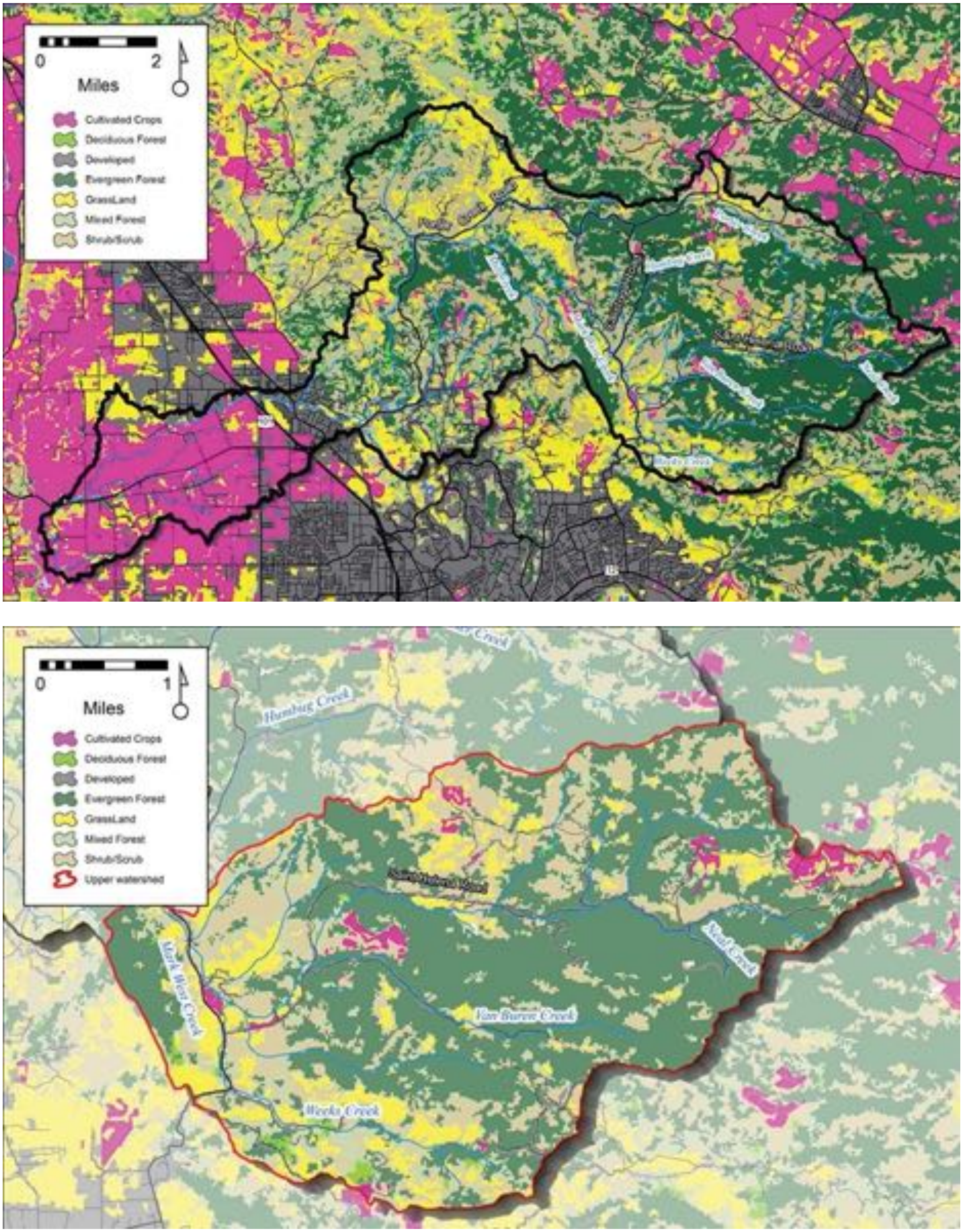


Figure 6A-B. Land cover in the Mark West Creek watershed and surrounding area (top), and land cover in Upper Mark West watershed (bottom).

Ninety-seven percent of cultivated crop (i.e., vineyard) coverage is in the lower region of the Mark West watershed (the Santa Rosa Plain), but cultivated crops are found elsewhere as well: based on compiled aerial imagery by CEMAR (updated in 2014), 3,620 acres of vineyard are located in the Santa Rosa Plain (lower Mark West Creek), 338 acres of vineyard are located between the Santa Rosa Plain and the confluence with Humbug Creek, and 158 acres of vineyard are located upstream of the Humbug Creek confluence (where vineyards straddle drainage divides, this only includes portions of vineyards that are within the Mark West watershed).

In some parts of the Mark West watershed, agricultural and domestic water needs are met through storing water in small reservoirs. Overall, reservoirs cover approximately 113 acres of the Mark West Creek watershed (0.34%). In the lower Mark West watershed, reservoirs cover approximately 38 acres; in middle Mark West, approximately 61 acres; and in upper Mark West, approximately 14 acres. Based on a relationship correlating surface area storage volume described by Deitch *et al.* (2013), this corresponds to approximately 180 acre-ft stored in the upper Mark West watershed in reservoirs (though this is likely an overestimate of stored water because the relationship used is more accurate for larger reservoirs than smaller ones).

Other development in upper Mark West Creek

In addition to reservoirs and agricultural development, many buildings have been constructed in the Mark West watershed. These include residences, residential storage structures, agricultural structures (*e.g.*, barns), water tanks, and commercial/industrial facilities (*e.g.*, supermarkets, wineries). Sonoma County has made available a GIS shapefile of building structures throughout the county, identifying the footprint of each structure as a polygon, but did not distinguish among types of structure. After reviewing the data set, we determined that the shapefile did not capture all of the structures in the watershed. For this project, we created a new shapefile of building structures in the upper Mark West Creek watershed (identified as points, rather than polygons), based on aerial imagery in an ArcMap GIS project. We then closely reviewed each structure to identify each as a residence, garage/storage building, industrial/commercial building, agricultural structure, water tank, or unknown/other structure (*e.g.*, Figure 8).

In the upper Mark West watershed (the portion of the watershed above the Humbug Creek confluence), we identified 222 houses among 457 structures (Figure 9).

Figure 8. Example of structures identified on aerial photographs near Mark West Creek.

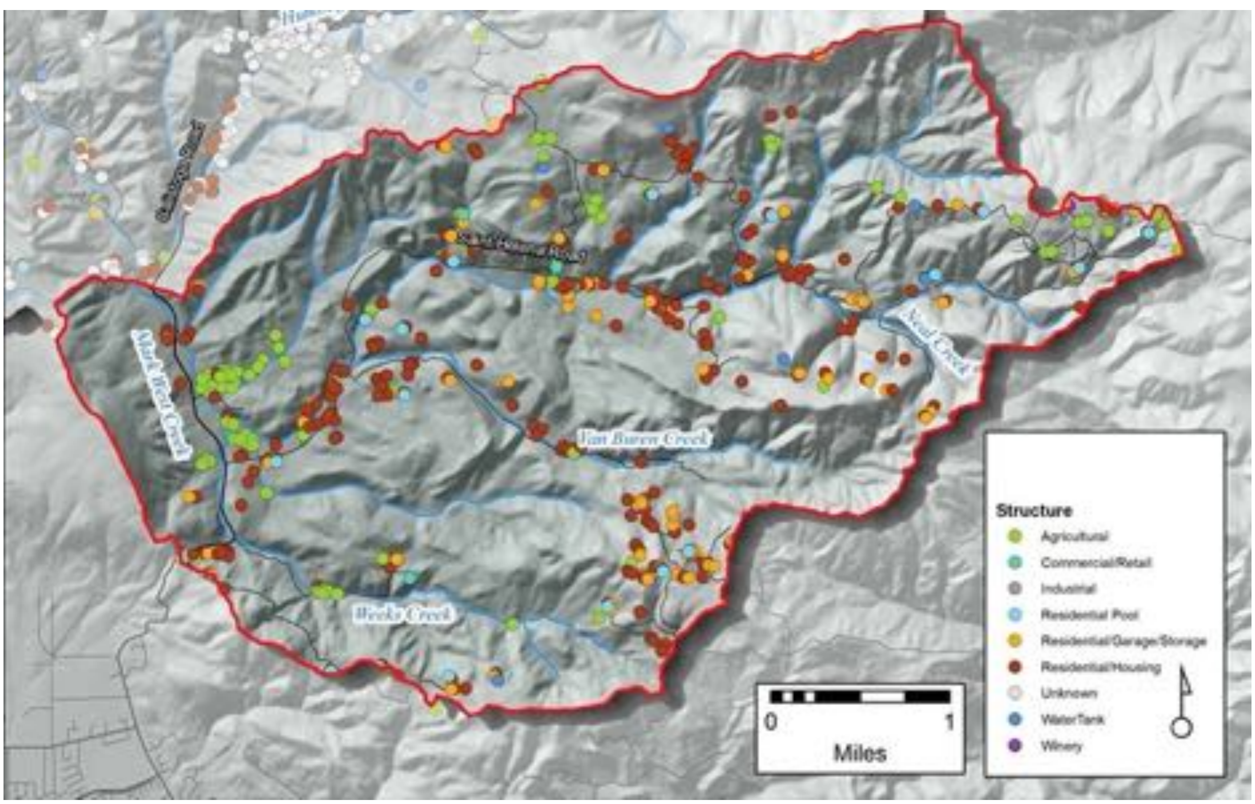


Figure 9. Building structures by type in the upper Mark West Creek watershed.

Details about building structures can provide insights into impacts of hydromodification due to accelerated runoff (off of impervious rooftops), as well as opportunities for rainwater catchment and impacts that rainwater catchment could cause on winter streamflow. We estimated the total area footprint of building structures by first calculating the average area of buildings in the Mark West watershed based on the Sonoma County buildings polygon shapefile described above (representing approximately half the buildings in the watershed), which was 1,660 square feet (Figure 10). We then multiplied the average footprint area by the total number of structures in the study area. Based on this method, the total footprint of buildings in the upper Mark West watershed is approximately 2.94 acres (128,100 square feet, or 0.033% of the land area).

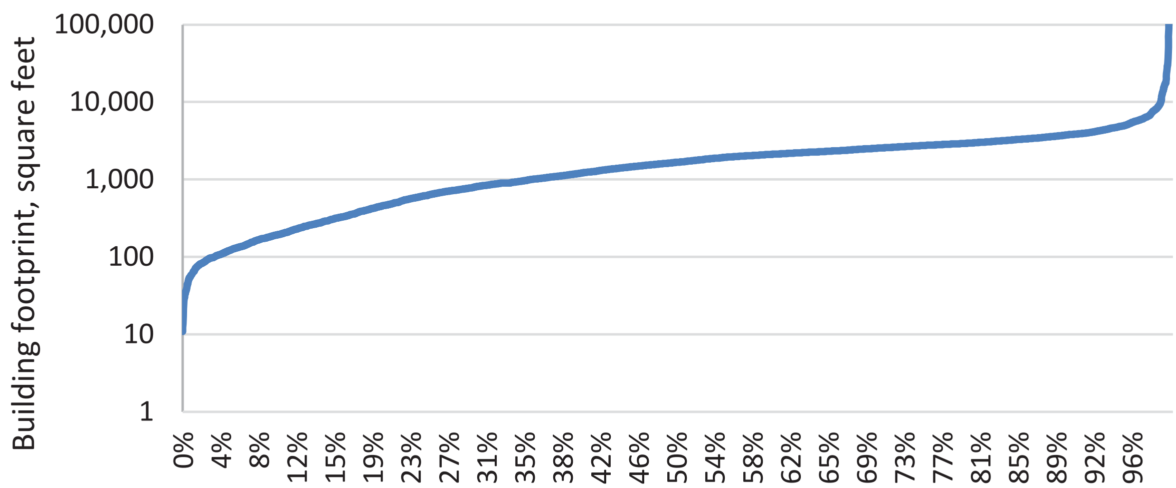


Figure 10. Probability distribution of building footprint in the Mark West Creek watershed (based on a total of 5,821 buildings with known surface area).

For this analysis, we did not digitize additional agricultural (namely, marijuana) development. A few of the buildings identified in the upper Mark West watershed were clearly greenhouses; they were classified as agricultural structures.

Characterizing Human Water Needs

As described above, a goal of this project is to develop quantitative comparisons of human development and associated water uses to characteristics of watershed hydrology. In the Mark West Creek watershed irrigated agriculture and rural residences are the two most evident forms of water use. In addition, wineries and other commercial industries within the region contribute to the human water need. Irrigated agriculture can have varying water needs depending on the type of crop grown. Vineyards are the most prevalent agricultural cover type in watershed, and depending on location and local conditions, may require water for both irrigation and frost protection. Domestic water needs typically include requirements for landscaping and household use. Wineries require water for barrel and equipment cleaning, and for dish washing in tasting rooms.

Within the Upper Mark West region, we compiled agricultural and building structure datasets derived using aerial imagery to construct a model of the human development footprint in the watershed (Figure 11). We used these data to estimate dry-season water need by each water use type through the course of the year.

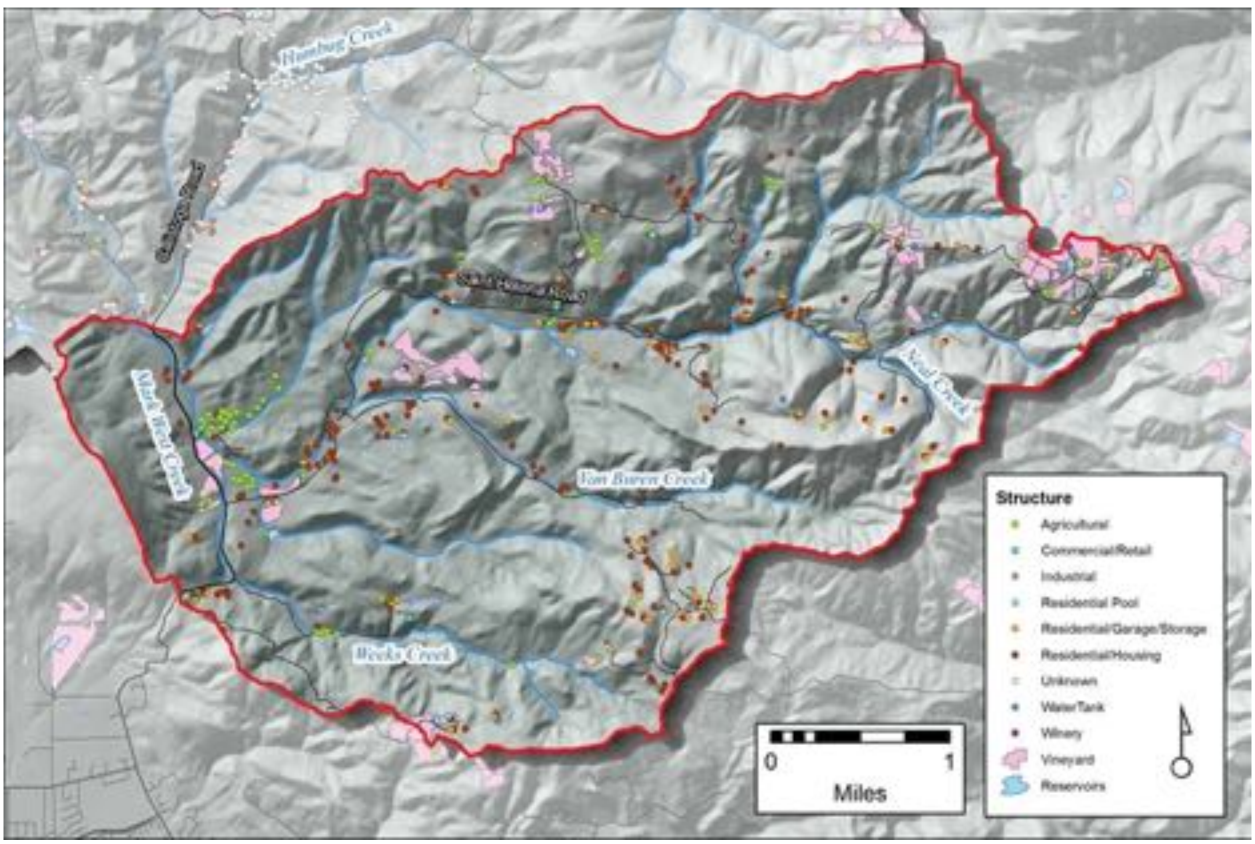


Figure 11. Structures, agricultural fields, and reservoirs in the Upper Mark West Creek watershed.

Agricultural. We used digitized agricultural coverage to estimate the total acreage of land as vineyards in each project watershed, and then calculated total agricultural water need based on regional per-area estimates of water use. However, vineyard water use is not uniform; we describe some of the variation in irrigation water needs here.

Vineyard specialists estimate that new vineyards in coastal Northern California may need up to 0.6 acre-feet of water annually (Smith et al. 2004). Water needs for more established vineyards vary over a range of factors, including climate, antecedent soil moisture, and vine characteristics. For example, UC Cooperative Extension describes survey data from grape growers in the Navarro River watershed that estimate average water use is 0.2 acre-ft per acre (UCCE 2013). Growers on Grape Creek, tributary to Dry Creek in Sonoma County, estimate needing 0.25 acre-ft of water per acre of grapes (Trout Unlimited and CEMAR 2012). Grape growers on valley floors of Napa and the Russian River may continue to need 0.6 acre-ft per acre of vines after the vineyards are established. Growers in hillside vineyards producing premium wines in Santa Clara County (on the eastern side of the Santa Cruz Mountains) do not irrigate during summer after the vines are five years old (Trout Unlimited and CEMAR 2014).

Within the Mark West watershed, the Cornell Winery Draft Environmental Impact Report (ESA 2012) provides an estimate of irrigation water use at the Cornell Farms vineyard to be up to 600,000 gallons per year in a hot dry year (and 300,000 gallons per year in a cool year) for the 19 acres of grapes on the property. This corresponds to 0.1 acre-ft per acre of grapevines under high-need conditions. This low water use is attributed to a system of sensors that measure moisture in the plants and soil, which are used to tell vineyard managers when water should be applied to maximize berry quality (ESA, 2012). Other growers in the region have begun to experiment with similar methods to reduce water use; the other reported benefit of reduced water use under these types of systems is improved wine quality.

There are many uncertainties in estimating average vineyard irrigation water use in the Mark West watershed. The 158 acres of vineyards in the region cover ten different parcel owners, four broad geological types (alluvium, volcanic ash tuff, volcanic flow rock, and Franciscan geologies) and 35 different soil types. Based on the above description of different water use volumes, the average water use in the area is likely somewhere between 0.1 and 0.6 acre-ft per acre of vines. For the purpose of this study, we estimate average water use is 0.3 acre-ft per acre of vines: most grapes in the area are produced on wet hillsides and are used to make expensive wines, so they likely use less water than other vineyards in Sonoma County. (Because of this uncertainty, subsequent analyses also show an upper estimate of water use of 0.6 acre-ft per acre, though this likely overestimates total irrigation need. These calculations can be refined with improved information.)

In addition to irrigation needs, wine grape growers also may need water for frost protection. Frosts that occur in the spring after buds have emerged can cause an entire loss of a year's crop. To protect against frost, water is commonly sprayed over the vines by overhead sprinklers; much larger volumes are required at a given time than is needed for irrigation (as much as 1 cubic foot per second for ten acres of grapes), though water is typically needed for only a fraction of the day (e.g., from 1:00 AM to 9:00 AM). Two additional factors influence the amount of water needed for frost protection. First, only those vineyards in valleys tend to be frost-prone because cold air that causes freezes tends to result from the settling of cold air (hillside and hilltop vineyards frequently don't have infrastructure for frost protection). Second, some years have more frosty spring mornings than others. The past few years have had relatively few frost events: for example, in spring 2014, many growers in Sonoma County required no water for frost protection (RRPOA, 2014), while growers in other regions required water for between 2 and 6 events. In 2008, many growers needed water more than 20 days for frost protection.

Residential. Residential water use estimates in coastal northern California vary considerably. Estimates of residential water use in the upper Mattole River are, on average, 708 gallons of water per day (TU and CEMAR [2012], based on unpublished data from Sanctuary Forest). Other areas, such as the towns of Willits and Ukiah, estimate that the average person uses approximately 160 gallons per day, so a household of 4 people would require 480 gallons per day. The Valley of the Moon Water District cites that the average Sonoma County household of four uses 200,000 gallons for indoor and outdoor uses annually; the Sonoma County Water Agency estimates that the average family in Santa Rosa uses 99,000 gallons annually for household uses (though it does not state whether this includes indoor and outdoor uses; if it omits outdoor uses, and outdoor landscaping commonly accounts for 50% of household use [DWR, 2011], then the SCWA and Valley of the Moon water use estimates are similar).

Only one of these estimates, from the Upper Mattole River in Humboldt and Mendocino Counties, is from a rural residential area; and many factors distinguish water use patterns in that region from the patterns in the upper Mark West Creek watershed (namely, less amounts of alternative cash crops). To develop a more realistic estimate of household water use in the upper Mark West watershed, we started with the four-person household water use estimate for Santa Rosa of 99,000 gallons per year; this equates to 270 gallons per day, or 68 gallons per person per day. We then estimated the average household to be 2 people per house, based on conversations and meetings with landowners in the area. This results in a household (indoors only) water use estimate of approximately 136 gallons per day.

Based on the above data for Santa Rosa, if the average outdoor household landscaping water use is 100,000 gallons annually (half of the total annual residential water use and equal to the total indoor water use), and that water is used during the dry half of the year (183 days), the average daily landscaping water use is approximately 546 gallons per day per residence through the dry half of the year. This accounts for lawn watering, tree and garden irrigation, and other landscaping needs. A careful review of residences in the Mark West watershed, however, indicates that approximately 4 in 5 residences do not have a lawn, visible garden, or other irrigated landscaping. This may be a reflection of generally low water availability: as described further below, the majority of the watershed is composed of Franciscan assemblages, which provides poor aquifer characteristics. A fraction of residences have green lawns observed in recent NAIP aerial imagery; some have landscaping distributed over a dry cleared space; and a few have small gardens of plants spaced closely in a rectangle and surrounded by a fence.

If 80 percent of the 136 houses use 136 gallons per day, and 20% of the houses use 682 gallons per day (136 indoor and 546 outdoor), then the *average* domestic water use is 245 gallons per day per residence from May through October. This rate was applied to the number of residences within each watershed to estimate the annual residential water need, though this number is more reflective of water needs in summer for landscaping purposes.

As in the case for agricultural water needs, the value used here for household water use rests on several assumptions. These assumptions can be validated or modified with additional information from the area. Analyses that follow will use this household value for most of the discussion, but also will present results of a higher and lower water use estimate.

Industrial. As of 2013, we identified only one winery in the upper Mark West Creek watershed; another is tentatively planned for construction in the near future. To estimate total water need for wine production, we can use water use estimates from reports and studies to develop a total volume of water needed to produce wine from an acre of grapes. Winery water use is a function of production: UCD researchers estimate that, on average, 6 gallons of water are used to make one gallon of wine (Oberholster 2011). To estimate water use for the winery in the Mark West headwaters, we used an average per-acre wine production estimate based on the nearby Napa appellation: an economic impact report of Napa County's wine and vineyards indicated that a total of 19,961,500 gallons of wine were produced from Napa appellation grapes in 2011, from a total of 43,580 acres of land as vineyards (Stonebridge Research Group 2011). The Napa appellation thus produces, on average, 460 gallons of wine per acre of vineyards. If six gallons of water are used to make a gallon of wine, then wineries require approximately 2,750 gallons of water to make wine from an acre of grapes.

Results. Using the moderate water need estimates described above, approximately 140 acre-feet of water is need on an annual basis for all human water uses in the upper Mark West Creek watershed (Table 3). Approximately 48 acre-feet of water is needed vineyard irrigation. A total of 73 acre-feet of water is needed for annual residential water use, divided among 20 acre-feet needed for the 25 residential houses with landscaping, and 53 acre-feet is need for the 197 residential houses without landscaping. Lastly, we estimate that if all grapes grown in the upper Mark West watershed are turned into wine within the watershed, then 1.83 acre-feet (594,000 gallons) of water is needed for winery water use.

Table 3. Annual water needs for human uses in the Upper Mark West watershed, in acre-feet per year (AF/yr).

Water User	Number of Units	Annual Water Need (AF/yr)	Annual Water Need (AF/y, high estimate)
Vineyards	158 acres	47.4	94.8
Orchards	0.7 acres	1.4	1.4
Other Crop	7.7 acres	0.0	0.0
Fallow Fields	0.0 acres	0.0	0.0
Residential houses with landscaping	25 houses	19.8	19.8
Residential houses, no landscaping	197 houses	53	53
Winery	1 winery	1.83	1.83
Total Water Needed		**123.4**	**170.8**

Comparing the human water needs in the upper Mark West Creek watershed to the rainfall volume available in both average and dry years allows us to estimate whether human water needs can be met through the water resources available on site on an annual scale. Our analysis indicates that human water need represents 0.6 percent of the total rainfall that reaches the Upper Mark West watershed in an average year and 1.2 percent of the rainfall in a dry year (Figure 12).

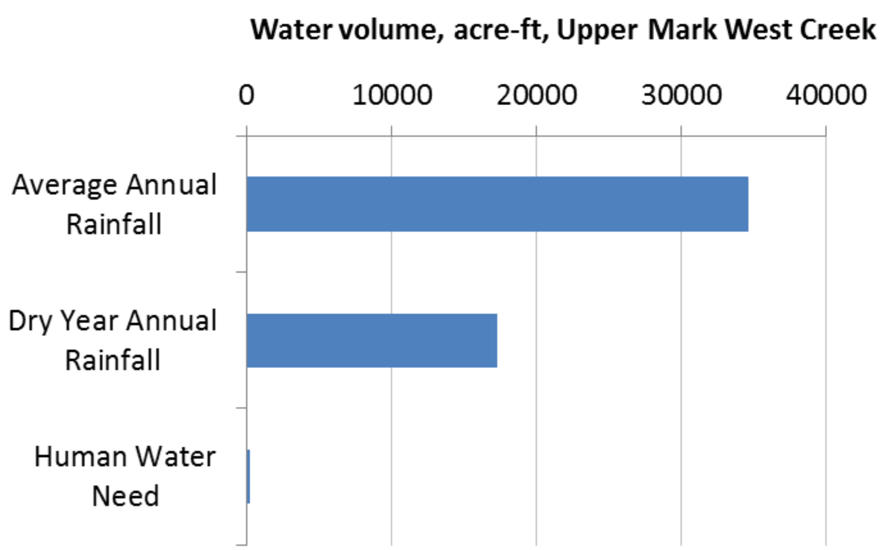


Figure 12. Comparison of rainfall in average and dry years to human water need in the upper Mark West Creek watershed.

4. Streamflow

Streamflow is an essential subject of reference for understanding the interaction between humans and the surrounding ecosystem in a watershed. These data provide the foundation for many applications, such as helping to identify reaches that are impaired by human water uses, and quantifying the magnitude of the existing impairments that water use may cause on streamflow. Streamflow data have also been used in other watersheds to identify reaches that may benefit most from projects to restore streamflow and the types of projects that could achieve tangible outcomes. Streamflow data also are important for determining the means by which water can be obtained and stored in winter to minimize the impacts to environmental resources such as salmonid habitat (as stipulated in the SWRCB North Coast Instream Flow Policy; SWRCB 2010).

Streamflow Data, Summer 2013

Six pressure transducers were installed in the Mark West Creek watershed to serve as streamflow gauges between April and November 2013. Three were installed as part of the Russian River Coho Partnership, and three others were installed by NOAA Fisheries. Each pressure transducer was set to record water level at 15-minute intervals. Streamflow was measured by CEMAR and/or NOAA staff at approximately monthly intervals following protocols outlined in CEMAR's Protocols for Measuring Streamflow in Wadeable Streams (CEMAR 2014) and the CDFW Standard Operating Procedures for Discharge Measurements in Wadeable Streams (CDFW 2013), using a Price Mini current meter. Using the measured streamflow values we created rating curves to correlate streamflow with discharge and developed 15-minute streamflow records for each site.

Our streamflow gauge network design can be described as measuring flow from three headwater tributaries, and then measuring flow at three mainstem sites below. The three tributaries are the mainstem Mark West Creek, Neal Creek, and the North Fork of Mark West Creek (an unnamed tributary on USGS topographic maps, but with similar catchment area as the mainstem Mark West Creek at its confluence). Our two farthest-upstream gauges on Mark West Creek were within 300 ft of each other: one was upstream of Neal Creek and the other was immediately below.

Streamflow data from summer 2013 show important variations among tributaries (Figure 13). The mainstem Mark West Creek above Neal Creek was intermittent by mid-May and the North Fork was intermittent shortly after in early June; but Neal Creek (and thus, Mark West Creek below Neal Creek) continued to flow throughout summer 2013. The dry conditions in the North Fork and mainstem above Neal Creek may be due to a number of factors described in more detail below, but the data presented here indicate a critical point for the hydrology of Mark West Creek: Neal Creek maintains flow even in a dry year such as 2013, and is critical for the persistence of flow in Mark West Creek below.

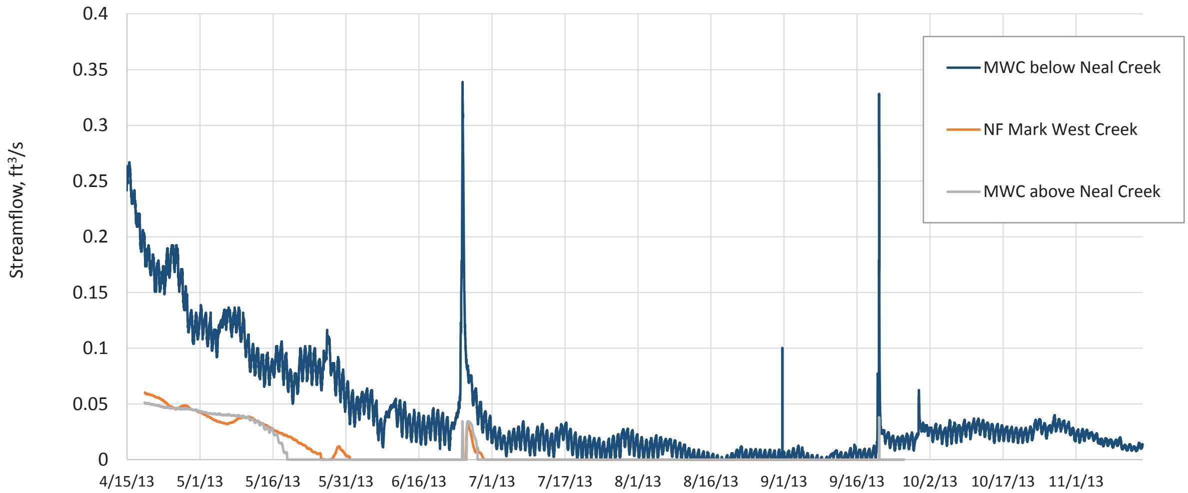


Figure 13. Streamflow recorded at the three "headwater streams"—North Fork Mark West Creek, Mark West Creek above and Mark West Creek below Neal Creek—spring to fall 2013.

Streamflow on the mainstem Mark West Creek from Neal Creek to the Tarwater Road gauge show a few other important trends in catchment hydrology farther downstream (Figure 14). Mark West Creek accrues streamflow from Neal Creek to the Puff Lane gauge throughout summer, though flow at both sites is less than 1 gallon per second (or 0.13 ft^3/s) from mid-May through mid-November. Streamflow downstream at the Tarwater Road gauge is approximately double the flow at Puff Lane in April, 3 to 4 times the flow in May, and as much as 10 times the flow at Puff Lane by September. Similar to the variations in the headwater tributaries, these mainstem variations may be attributed to a number of factors described below; but the differences in flow indicate that the reach of Mark West Creek between Puff Lane and Tarwater Road provides a substantial amount of base flow even in a year as dry as 2013.

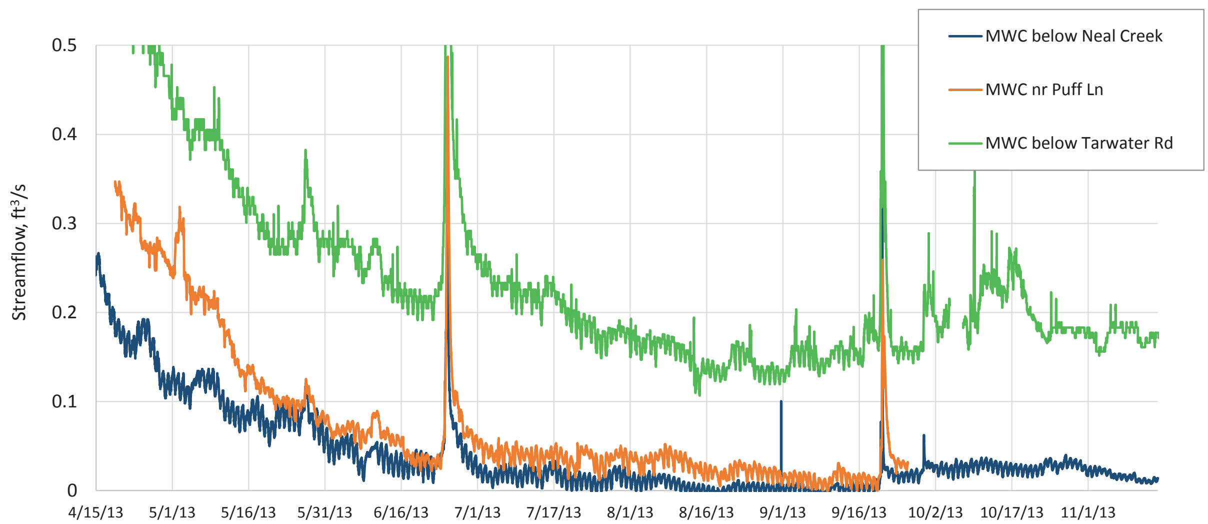


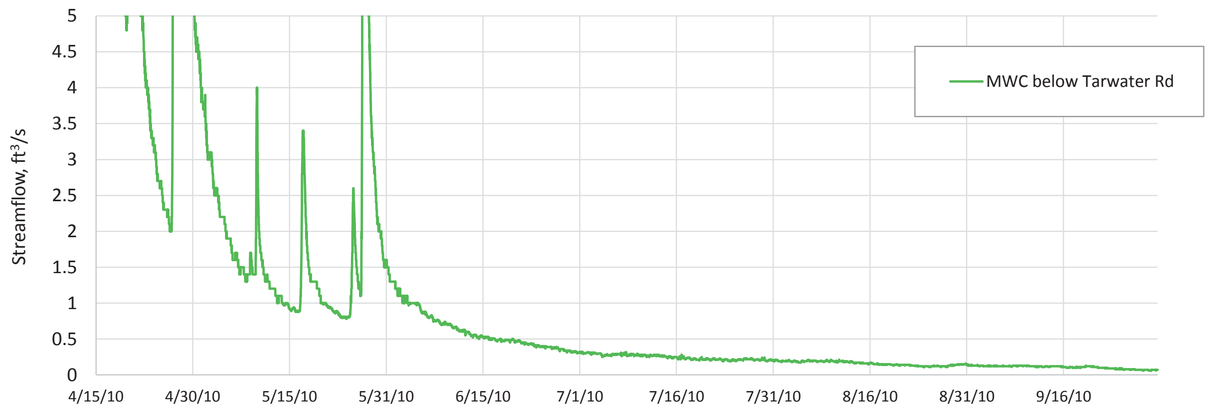
Figure 14. Streamflow data at three locations on the mainstem Mark West Creek, from Neal Creek to below Tarwater Road, dry season 2013.

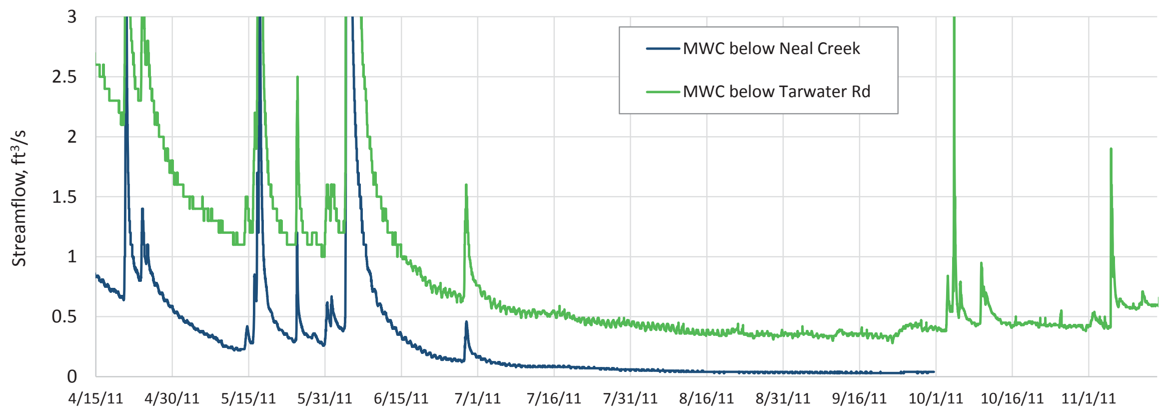
Comparisons with Summer Streamflow Data, 2010 – 2012

The streamflow data from the mainstem Mark West Creek gauges show relatively stable and consistent flow throughout summer 2013. Daily fluctuations (commonly attributed to watershed evapotranspiration) are on the order of 0.03 ft^3/s, comprising as much as 100 percent of flow at upper gauges but approximately 10 to 20% of flow at the downstream Tarwater Road gauge. Similar patterns of stable base flow occurred at the Tarwater Road and Neal Creek gauges in 2010, 2011, and 2012 (Figure 15).

There appear to be no sudden large changes in flow that could be attributed to instream diversions in our Mark West Creek streamflow data sets. Streamflow at the Upper Mark West Creek gauges exhibit more consistent stable flow through summer months, compared to gauges on other Russian River tributaries in Sonoma County such as Austin Creek and Maacama Creek (both available through USGS), Mill Creek, Dutch Bill Creek, and Green Valley Creek (Deitch et al., in review).

While the data here show relatively stable flow through the dry summer, they also indicate persistent low flow, especially in the headwaters. Combined with the water needs assessment above, which indicates that residential and agricultural water needs exceed discharge throughout the dry season May-October, these results suggest that changes in water management practices among grape growers and residents in the upper Mark West watershed toward reducing dependence on water from wells and springs in summer could have meaningful benefits to summer streamflow in Mark West Creek.





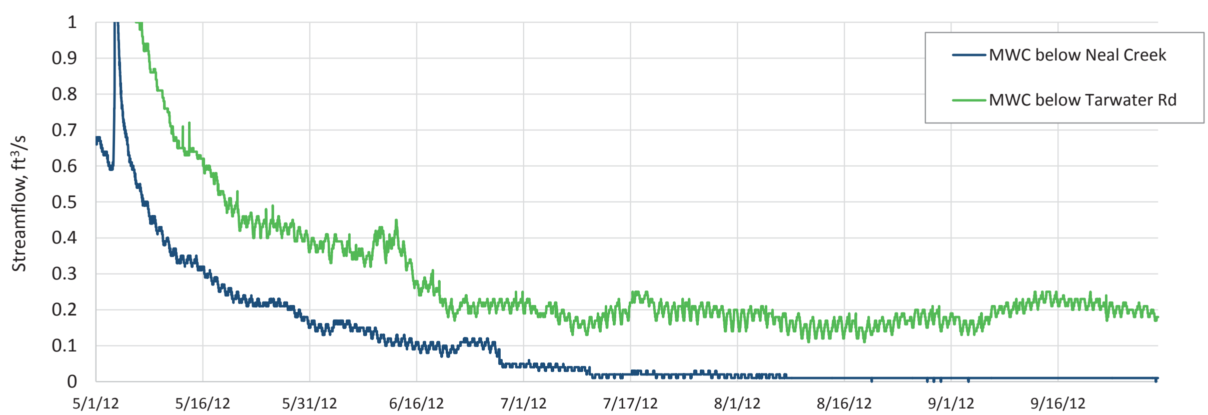


Figure 15. Mark West Creek streamflow below Tarwater Road and below Neal Creek, summer 2010 (top), 2011 (middle), and 2013 (bottom; the "below Neal Creek" gauge was not installed until 2011).

Figure 16. Mark West Creek below Tarwater Road, where the creek flows through an ash-tuff channel with volcanic-derived boulders and cobble.

Synthesis

While the comparison of human water needs and rainfall in Figure 12 above paints an optimistic picture about annual water availability for human and ecological needs, examining measured streamflow against demand on a monthly scale highlights potential conflicts between human water uses and instream resources. In particular, water need during the dry season when agricultural and residential needs are greatest may constitute a large proportion (or even exceed) streamflow quantities.

We used data from a gauge operated on Mark West below Tarwater Road to calculate the average monthly discharge from May through October, historically the driest months of the year with the lowest streamflow levels. We then estimated water need during the same timespan to compare water need to discharge, assuming that dry-season water need is consistent among months. We calculated two water need estimates, one using the low water need numbers, and the other using the high water need numbers (described above). We used the following approach to calculate human water need: agricultural water needs were divided evenly over five months, and residential water needs were divided over twelve months. The results indicate that water need in summer months exceeds the discharge in Mark West Creek (Figure 13). The higher water need estimates are at least two times the dry-year discharge in late summer, and the lower water need estimates are on the order of dry season discharge even in a wet year.

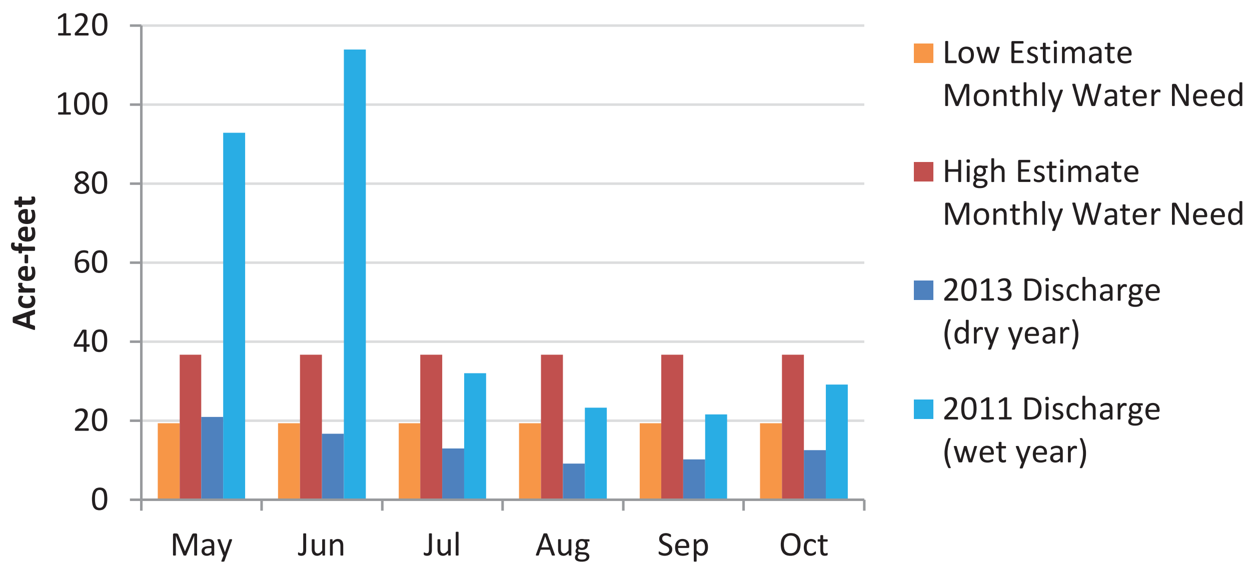


Figure 13. Monthly discharge in a wet and dry year, compared to monthly water need, in the Upper Mark West Creek watershed.

The results of this water needs analysis indicate that dry-season discharge in Mark West Creek cannot meet all the agricultural and residential needs in the watershed. Though there may be very few existing “straws” in Mark West Creek itself, water needs satisfied through pumping groundwater or from spring boxes likely remove water that would otherwise become base flow. The amount of rainfall that falls on Mark West Creek suggests that there is ample water available overall in the watershed to meet all current human water needs (for example, rainfall in a dry year is approximately 80 times greater than human water need) while maintaining ecological processes, so long as water is stored in winter at appropriate times and through appropriate methods. The results also suggest that base flow in late summer could increase substantially if human water needs met through pumping groundwater or diverting from streams during the dry season were reduced.

5. Geology

The Mark West Creek watershed is among the most geologically and topographically diverse in Sonoma County. Geological surveys indicate that, overall, the majority of the watershed has a surface geology derived from volcanic activity dating back to the Tertiary (now referred to as the Neogene) Period, to an age of approximately 2.9 million years (Figure 17). Frequently referred to as Sonoma Volcanic geology, this is most commonly represented in the watershed by settled and hardened ash, called tuff; and also includes harder flow rock (in particular, andesite and basalt). In addition to the Sonoma Volcanic geology, a large portion of the watershed has surface geology characterized as Franciscan Complex; the Franciscan assemblage in the Mark West watershed is referred to as Central Belt (Graymer et al. 2007), referring to a combination of mélange and greywacke (pressurized sedimentary rock, often resulting in minerals like quartz, feldspar, and other minerals formed within the pressurized sedimentary matrix), formed originally as ocean floor during the Jurassic and Cretaceous Period (to an age of 60 to 200 MY) and pressurized through tectonic uplift. Portions of the watershed also have surface geology of the Glen Ellen formation, which is considered soft sedimentary rock (including clay and silt; DWR 1982) of late Pliocene and Pleistocene age (which covers a range of approximately 12,000 to 5M years).

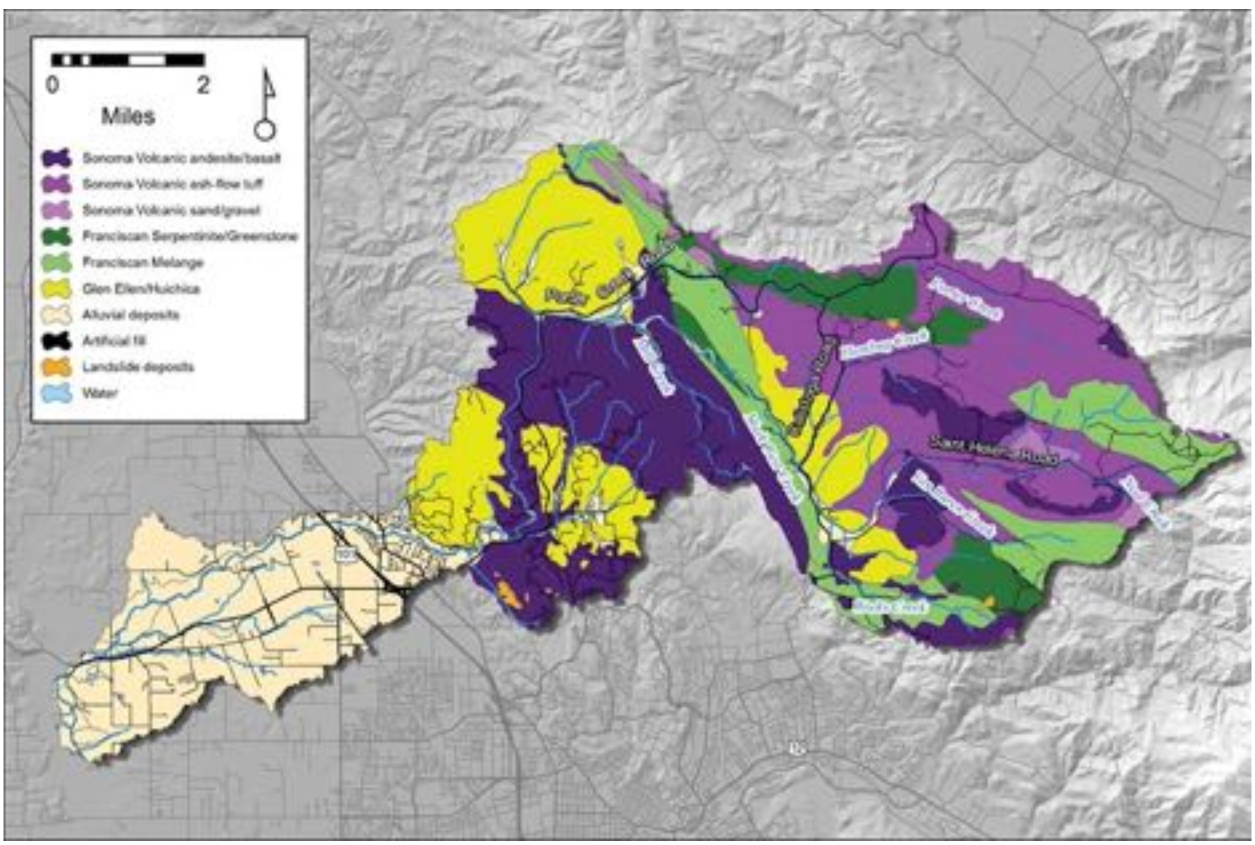


Figure 17. Surface geology of the Mark West Creek watershed.

Each of these geological formations has markedly different geohydrological properties. The purpose of this section is to characterize the geology, topology, and geomorphology of the Mark West Creek watershed, especially as it pertains to surface water-groundwater interactions in the upper portion of the watershed. In particular, we present two analyses: (1) groundwater, wells, and summer base flow; and (2) runoff, infiltration, and influence of land cover modifications.

Groundwater, summer base flow, and influence of wells

During summer, streamflow in Mark West Creek is comprised of base flow: rainfall that gets stored in soil and bedrock during winter slowly moves downward through its solid matrix to become streamflow months, sometimes years, later (Rodgers et al., 2005, Soulsby and Tetzlaff 2008). In addition to supplying base flow, water stored below the surface also provides a resource for meeting human water needs in the form of springs and wells: conversations with landowners in the area indicate that many people rely on springs and wells to meet agricultural and residential water needs through the dry season. Water removed for various uses likely depletes base flow, but it is difficult to discern the precise effects of pumping groundwater or diverting from springs on hydrologic conditions without detailed information describing how the systems operate and what happens in nearby streams when systems operate. However, several factors influence the capacity for wells and springs to affect base flow, and those factors are described here.

The most fundamental property that influences the potential for a type of rock to supply base flow is the capacity for water to move through it. Barlow and Leake (2012) describe a number of terms geologists use to describe the capacity for water to move through a solid matrix, including hydraulic conductivity ("K", which characterizes the rate of groundwater flow, in distance per time) and transmissivity ("T", which characterizes the rate of groundwater flow per area, in distance squared per time, calculated as K times vertical aquifer thickness "b"). They also describe Specific Yield, "S_y", which describes the potential for a type of rock to serve as an aquifer (defined as a ratio of the volume of water that can be drained by gravity from an aquifer material to the total volume of the material). Each of these is individually useful to characterize potential interactions between surface water and groundwater; together, Barlow and Leake (2012) also use these terms to characterize the influence of wells in different types of geology to affect the timing of streamflow depletion (described further below).

Geohydrologic differences: Hydraulic conductivity, transmissivity, and specific yield

The difference in geohydrological properties between the most common types of surface geology in the Upper Mark West watershed are substantial. In a Memorandum on aquifer storage and recovery feasibility, Pueblo Water Resources (2012) reported hydraulic conductivity data from four of the City of Santa Rosa's test wells in Sonoma Volcanic geology as 3.0, 22.3, 24.9 and

79.9 ft per day. These are similar to estimates of hydraulic conductivity for volcanic ash tuff (similar to some of the Sonoma Volcanic geology; see Figure 17, above) reported by Belcher et al. (2001) from a different location, on average, 5 meters per day. The Pueblo Water Resources (2012) Memorandum also reports hydraulic conductivity for Glen Ellen formations approximately 4 ft per day. In contrast, the North Coast Regional Water Quality Control Board (SWRCB 2011) and Palmer (2001) both report hydraulic conductivity through Franciscan bedrock as approximately 0.001 ft per day, approximately *one-ten thousandth* of the values reported for Sonoma Volcanic geology.

Additionally, a report on groundwater in Sonoma County by the Department of Water Resources (DWR 1982) describes Specific Yield, directly related to the ability for a rock to serve as an aquifer, for geologic types in Sonoma County:

- Sonoma Volcanic types have variable S_y ranging from 0 to 15%, with flow rock (andesite and basalt) at the lower of the range and ash tuff/ sand-gravel (described as a "good water producer") at the upper end. Corroborating this range, Kleinfelder (2003), summarizing data from Ford (1975), states that wells in the ash tuff of Sonoma Volcanics are highly productive; whereas the hard flow rock tends to yield very little water.
- Franciscan complex (including mélange, greenstone, metamorphosed sandstone, and serpentinite) is described as having "very low" S_y (less than 3%), and likely not being suitable as an aquifer. (The DWR report uses the word impermeable.) DWR (1982) reports that Franciscan mélange has very low porosity (resulting from shearing). However, the Franciscan mélange tends to be highly fractured (a result of uplift) and many residents who live in areas of the Mark West watershed in Franciscan geology describe springs and sufficiently productive wells in the landscape. (This point is revisited below.)
- Glen Ellen formation has a low S_y, ranging from 3 to 7 percent, likely due to high clay and silt content (which results in moderate porosity but poor hydraulic conductivity) and cementation of alluvial deposits.

Each of these factors has important implications for interactions between surface water and groundwater under different geological formations. For example, hydraulic conductivity can be used to estimate the linear velocity of water through a bedrock. Average linear velocity (ALV) can be estimated via Darcy's Law by first calculating Darcy velocity, *v*

$$v = -K\left(\frac{dh}{dl}\right)$$

where K is hydraulic conductivity and dh/dl is the hydraulic gradient (*i.e.*, the difference in elevation of the aquifer from one point to another divided by distance between the two points). ALV[1] can be calculated as Darcy velocity divided by the porosity of the bedrock material:

$$ALV = \frac{v}{porosity}$$

These equations show that linear velocity is directly related to hydraulic conductivity, which means that, under conditions of similar hydraulic gradient (e.g., 0.1) and porosity (e.g., 0.1), average linear velocity through Franciscan bedrock is approximately *four orders of magnitude* less than average linear velocity through Sonoma Volcanic ash tuff. (Porosity is inversely related to average linear velocity, so that if porosity of Franciscan bedrock is ten times less than porosity of Sonoma Volcanic ash tuff, average linear velocity through an aquifer of Franciscan bedrock with similar hydraulic gradient would still be *three orders of magnitude* less than ash tuff.)

Transmissivity, which describes the rate of groundwater flow through an aquifer under a unit hydraulic gradient, is also *directly related* to hydraulic conductivity as

$$T = K \times b$$

where b is vertical aquifer thickness. Thus the flow through an aquifer composed of Sonoma Volcanic ash tuff with similar aquifer thickness and hydraulic gradient will be four orders of magnitude greater than if it were composed of Franciscan bedrock. Overall, the substantial difference in hydraulic conductivity suggests that Sonoma Volcanic ash tuff can provide much more base flow than unfractured Franciscan bedrock, even if the Franciscan aquifer is a hundred times thicker than that of the ash tuff. (A discussion of fractured Franciscan bedrock is below.)

Hydraulic diffusivity and streamflow depletion

The two factors that most influence the timing and rate of streamflow depletion are the distance from a well to the stream and the aquifer's hydraulic diffusivity (Barlow and Leake 2012). For an unconfined aquifer (i.e., an aquifer without a confining layer above), hydraulic diffusivity (D) can be calculated as

[1] Porosity is a component of calculating the average linear velocity of water through a subsurface matrix because it takes into account the circuitous movement of water through the interstices of the matrix, rather than the direct movement of the water along the hydraulic gradient.

$$D = \frac{Transmissivity}{Specific\ Yield}$$

Barlow and Leake (2012) use the hydraulic diffusivity and distance to a well to define a term they call the Stream Depletion Factor (SDF), which is a relative measure of how rapidly streamflow depletion occurs from groundwater pumping:

$$SDF = \frac{d^2}{D}$$

The SDF (which Barlow and Leake [2012] speculate could more specifically be called "streamflow depletion response-time factor") is in units of time. A low SDF indicates that streamflow depletion will occur relatively quickly, while a high SDF indicates that streamflow depletion will occur relatively slowly (based on the work of Jenkins [1968]).Table 4 shows how differences in hydraulic parameters influence the potential for groundwater pumping to affect the stream. The parameters used for these calculations, such as aquifer thickness and distance from the well to the stream, are hypothetical and are intended to show how changes influence the SDF.

Table 4. Streamflow depletion Factors for Sonoma Volcanic ash tuff and Franciscan bedrock under varying aquifer thickness and distance from a well to the stream.

Condition	Sonoma Volcanic ash tuff, 100 ft thick	Franciscan bedrock, 100 ft thick	Franciscan bedrock, 1000 ft thick	Sonoma Volcanic ash tuff, 100 ft thick	Franciscan bedrock, 100 ft thick	Franciscan bedrock, 1000 ft thick
Hydraulic conductivity, ft/day	10	0.001	0.001	10	0.001	0.001
Aquifer thickness, ft	100	100	1000	100	100	1000
Calculated transmissivity, ft^2/day	1,000	0.1	1.0	1,000	0.1	1.0
Specific yield	0.15	0.03	0.03	0.15	0.03	0.03
Calculated D	6,700	3.3	33	6,700	3.3	33
Dist. from well to stream (ft)	1000	1000	1000	200	200	200
Calculated SDF	150	300,000	30,000	6.0	12,000	1,200

The calculations presented in Table 4 are hypothetical but inputs such as proximity to the stream and aquifer depth are on the order of the conditions encountered in upper Mark West Creek watershed. The goal of the above analysis is to show how the differences among the hydrologic properties of the two most prevalent types of surface geology affect the potential for wells within them to deplete streamflow. These calculations indicate that the potential for groundwater pumping to deplete streamflow is much greater for Sonoma Volcanic geology than Franciscan bedrock, even if the Franciscan bedrock is thicker and closer in proximity to the stream. Additionally, the calculations in Table 4 indicate the importance of Sonoma Volcanic ash tuff in providing base flow to Mark West Creek in summer and the potential for near-stream groundwater pumping in ash tuff to deplete base flow.

Realities of the Upper Mark West Creek region: Franciscan geology, and well locations

The above characterization of upper Mark West Creek geohydrology is an oversimplification of the Franciscan geology, neglecting an important feature: the uplift that created the Mayacamas Mountains and other mountain ranges in coastal California resulted in many fractures in the bedrock. These fractures allow water to move much more easily through Franciscan formations than it can through the bedrock itself; local geohydrologists attribute these fractures, which have greater porosity, permeability, and hydraulic conductivity, as the reason why springs are common and wells can provide adequate yield for domestic and some agricultural uses in Franciscan geology (*e.g.*, Phillips 2012).

While these features are common in the landscape, characterizing their overall influence on streamflow in nearby streams is difficult. This type of evaluation would require (1) a delineation of the abundance and extent of subsurface fractured bedrock, and their hydrologic properties, over a large portion of the region; and (2) a more detailed stream gauging operation to determine where streams are gaining and losing from groundwater as streams flow through Franciscan geology. Conversely, however, an evaluation of the impacts of groundwater pumping on streamflow could be accomplished through a simpler evaluation: detailed streamflow gauging at a few strategically chosen locations near the well during its period of operation could determine how streamflow varies near a groundwater well and how those variations change over time. Because these fractured bedrock aquifers are so variable, conclusions of groundwater pumping effects on streamflow are likely not possible without this type of specific cause-effect evaluation.

Because fractured bedrock can more efficiently convey groundwater, pumping groundwater from fractured bedrock aquifers could potentially reduce the amount of base flow in a stream: fractures in Franciscan bedrock will likely provide base flow at a much faster rate than non-fractured bedrock. However, the extent of base flow depletion is likely not uniform among all fractures and instead will be related to the size and hydrologic properties of the fracture. A large fracture containing a large volume of water could be an important source of base flow through spring and summer; a small fracture containing less water may not be sufficient to provide base flow past early summer. Additionally, as Darcy velocity is directly proportional to hydraulic gradient and hydraulic conductivity, a steep fracture filled with material that can easily convey water could discharge most of its water volume early in the dry season and convey little water later in the dry season. Given the range of possible scenarios for describing surface water-groundwater relationships in fractured bedrock, it is not possible to know how pumping groundwater from fractured bedrock may affect streamflow without conducting a test of well operation and streamflow response to see whether and how streamflow patterns deviate from baseline conditions when water is pumped.

Characteristics of wells in the upper Mark West Creek watershed can help to further understand the potential for groundwater pumping to affect streamflow. For this project, NOAA obtained well completion reports from the Department of Water Resources (DWR) for the region of the Mark West watershed outlined in blue rectangle in Figure 18, below.[2] Data from well completion reports were used in accordance with DWR requirements of confidentiality. The presence of a well completion report on file with DWR does not necessarily mean the well is in use today.

Analysis of the data within these well completion reports indicates two important findings about wells and their potential influence on streamflow in the region:

- There were 102 wells with completion reports on file with DWR within the blue rectangle in Figure 18, and of these, 72 had adequate information to determine approximate locations of the wells (based on features such as parcel number, location addresses, hand-drawn maps, or coordinates). Of the 72 wells with adequate geographic information to give approximate location, 46 (nearly two-thirds) were located in the area near Mark West Creek outlined in yellow. This corresponds to a region with a high number of relatively small parcels (indicating rural residential development) along Mark West Creek. As described above, these wells may not all be in use; but the proximity of several wells near the stream in a geological formation with a high potential streamflow depletion factor (ash-flow tuff and sand/gravel) suggests that wells operating in this region could individually or cumulatively have adverse effects on streamflow in Mark West Creek during the dry season.

[2] DWR requires that well drillers submit a well completion report for the drilled well describing (among other features) the location of the well, its depth, the composition of the material with depth, depth to water, and initial pump rate and drawdown. Newer wells, such as those drilled since the 1980s, tend to have more detailed and complete information about all of these characteristics, while older wells frequently have incomplete information and poor descriptions of well locations.

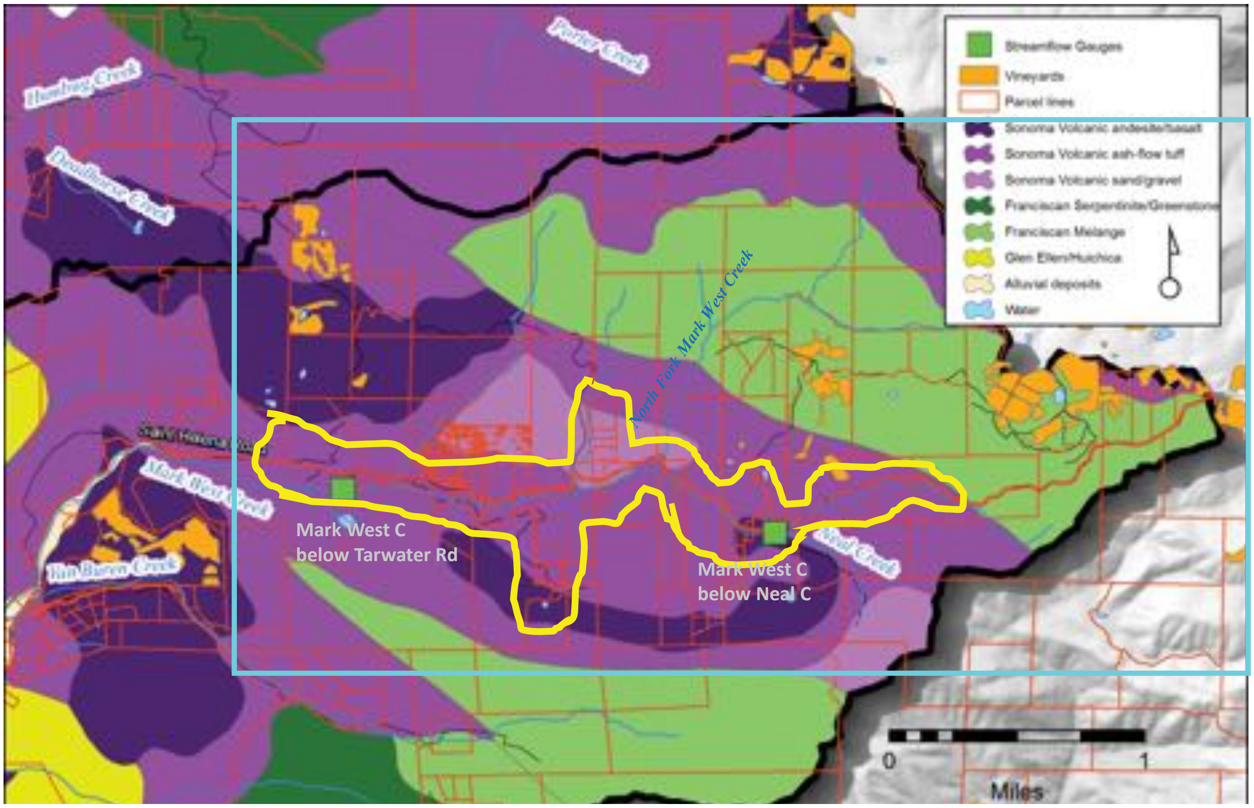


Figure 18. Portion of the Mark West Creek region for which DWR well records were obtained by NOAA.

- Of the 72 wells described above with adequate information to give an approximate location, 52 had a value given for an initial onsite well yield test performed by the driller. This preliminary test does not necessarily correspond to the yield of the well over the long term, but it provides a relative value for comparing the initial ability for the well to provide water at the time of drilling. Initial pumping rates were compared based on differences in geology as indicated in surface geology GIS maps (Figure 19). These pumping rates indicated that wells in Franciscan Complex often provide among the lowest yields, but can provide relatively high yields as well. Wells in Sonoma Volcanic geology, which represent 85% of the wells with adequate information to determine approximate location and initial pump rate, also provide varying yield. However, they tend to be the most productive: half provide an initial yield greater than 20 gallons per minute, and three-quarters provide more than 15 gallons per minute.

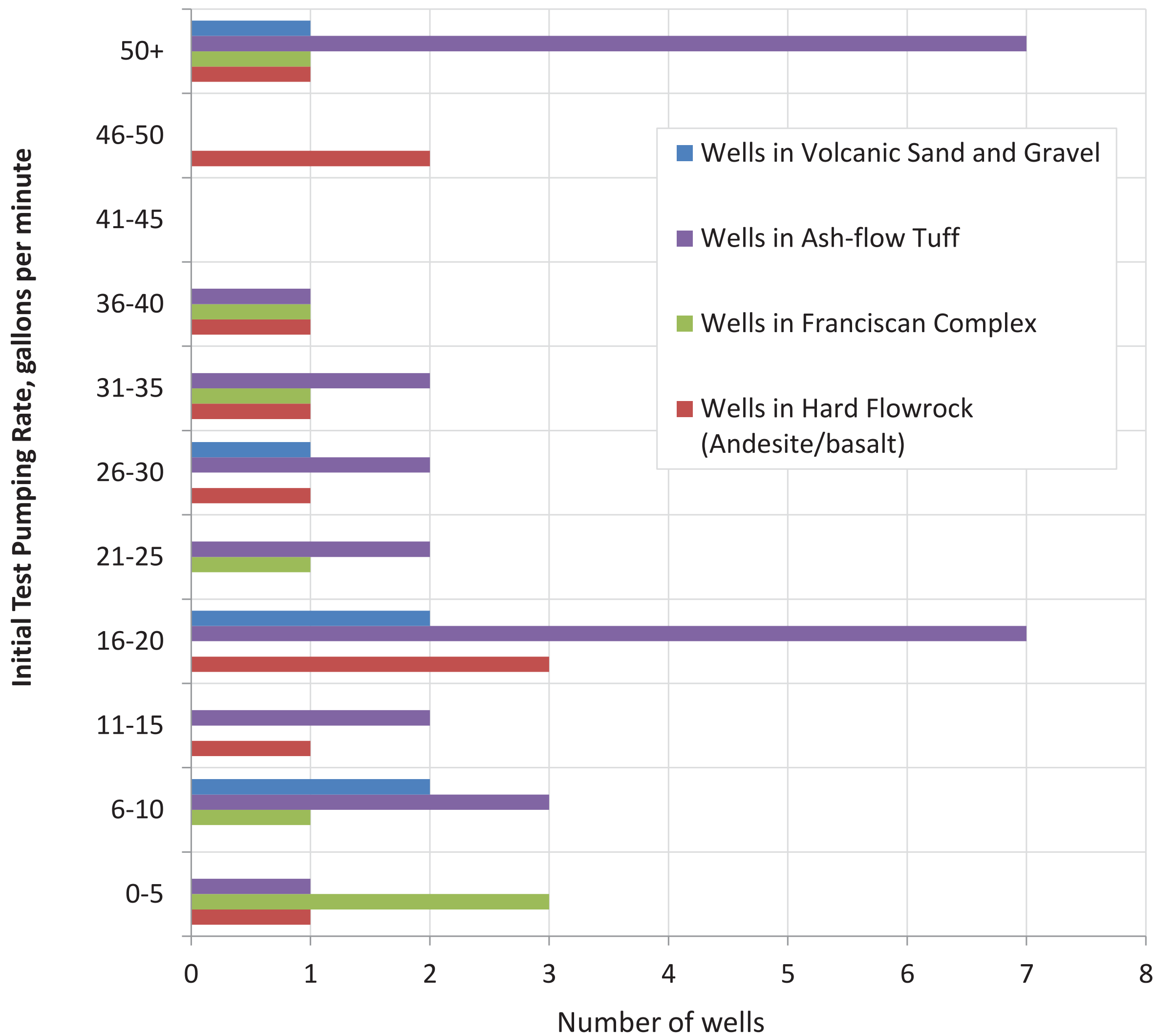
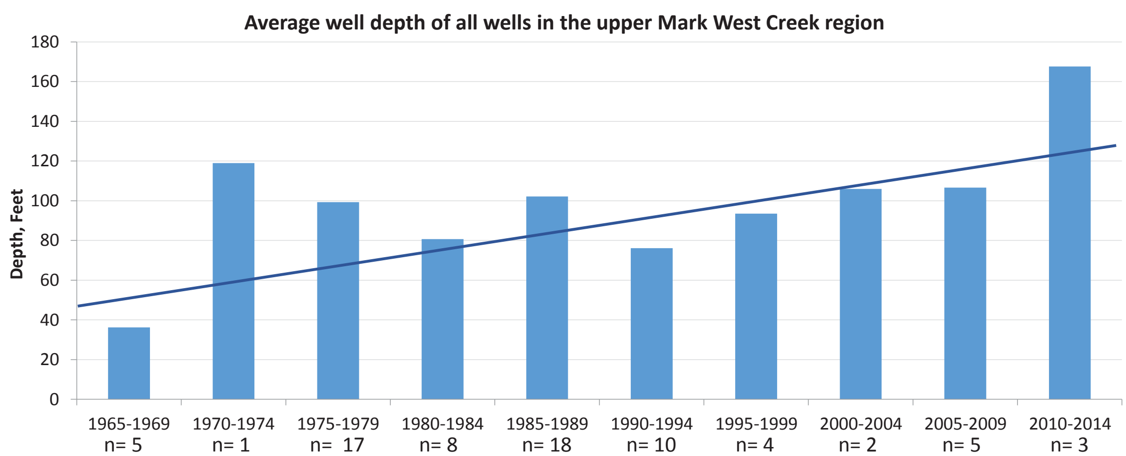


Figure 19. Number of wells plotted against initial well yield (based on pump test performed by driller) for wells with geographic information sufficient to estimate location in the upper Mark West Creek watershed, along with differences in surface geology.

The above comparisons are intended to provide a general description of well locations and yields for the upper Mark West Creek watershed, rather than specific features about particular wells or wells in certain regions. Many of the data sets used above have uncertainties that should be acknowledged. First, well completion reports are often incomplete. The data are skewed to reflect reports for newer wells because newer well reports tend to have more complete information than older reports. Second, the analyses of geological type are based on surface geology GIS data. While the GIS geology data set used in this analysis is the most recent and highest-resolution data set available for the region (created in 2013), it does not likely include all the geological variations that are in the region. Additionally, it only shows the surface geology: well completion reports indicate that surface geology layers such as ash tuff or volcanic sand/gravel may only be tens of feet deep, overlaying Franciscan bedrock hundreds of feet below. Finally, well completion reports only indicate conditions when a well was drilled and do not indicate the long-term well yield or if the well is still used today.

In addition to the pump test rates, well completion reports also describe the depth to water at the time when the well was drilled. We compared depth to water over time for two sets of wells: those wells that are within one-quarter mile of Mark West Creek (corresponding to approximately the area outlined in yellow, Figure 18) and those in the entire region from which data was requested. The data describing depth to water in the well completion reports indicate an overall trend of greater depth to water among those wells over the entire region, as well as those wells within one-quarter mile of Mark West Creek (Figure 20).



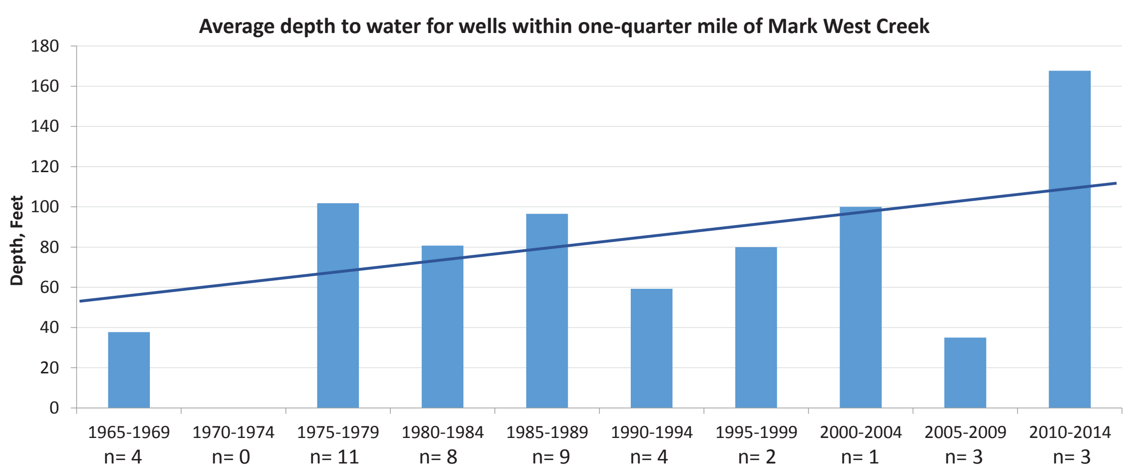


Figure 20. Average depth to water for wells in the Upper MW region, every five years; and average depth to water for wells within a quarter-mile of Mark West Creek; and overall trendlines. Trend lines indicate deeper water over time, but data are skewed by one very deep well drilled in 2010.

We performed an additional analysis of initial depth to water (as reported in driller logs) over time in the upper Mark West Creek region. Wells tended to be clustered in groups along the creek, indicating relatively dense development. We examined initial depth to water over time in five clusters of wells (Figure 21), with number of wells ranging from six to 8 per cluster, covering a period of the 1970s to 2014 (total of 35 wells). The purpose of this analysis was to assess if the initial depth to water in wells has changed over time; if depth to water among wells in the same aquifer is greater today than it was 40 years ago, that would suggest the aquifer is lower than it was in recent decades. This analysis assumes that all wells in each cluster are in the same aquifer; given the heterogeneity of geologic conditions in the region, this assumption may not be valid.

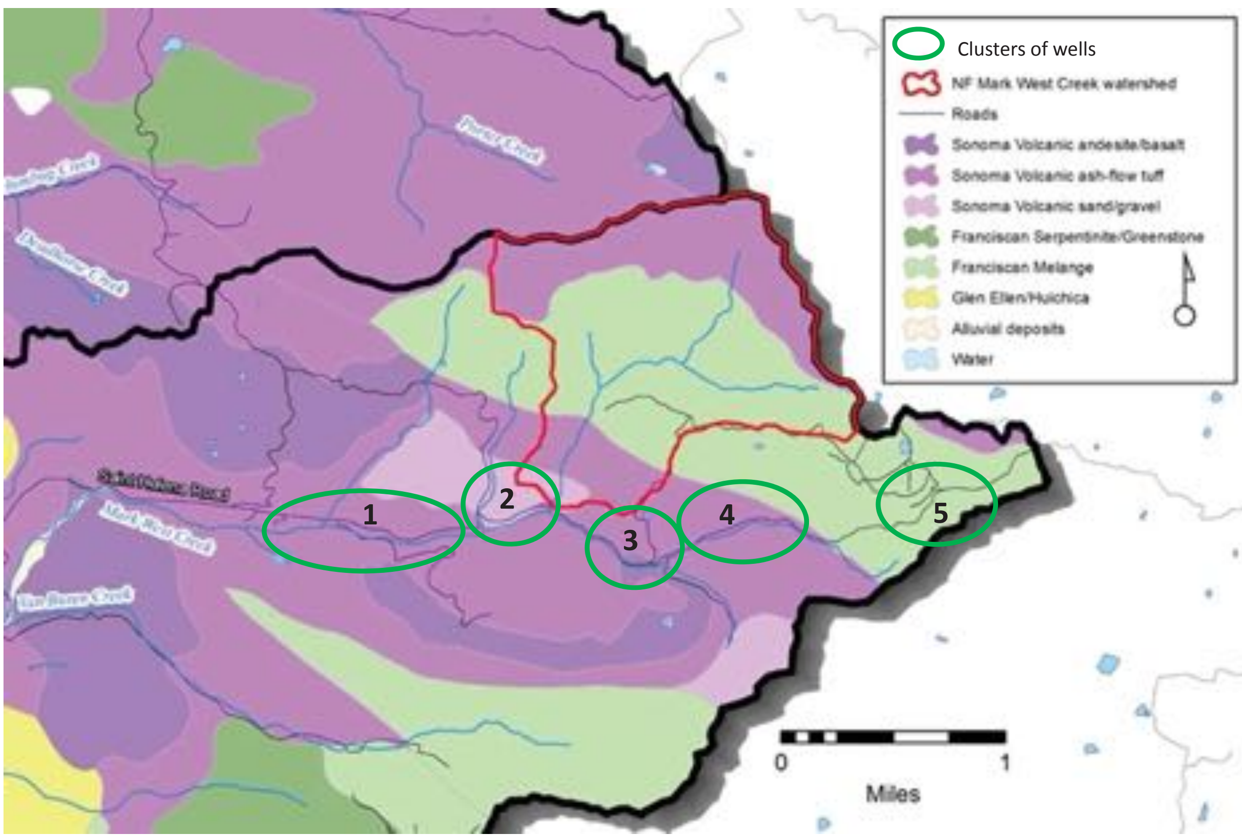


Figure 21. The majority of wells in the upper Mark West Creek region tended to be clustered in five areas, circled and numbered one through 5. Analysis of initial depth to water over time in each of these circles appears in Figure 22.

Overall, the initial depth to water in the well clusters does not appear to have consistently changed over time (Figure 22). Group 1 and Group 4 show greater initial depth to water, through the trendline in Group 1 is skewed by one particular well (and otherwise would show a decreasing trendline); the other three show a weak trend of less depth to water over time.

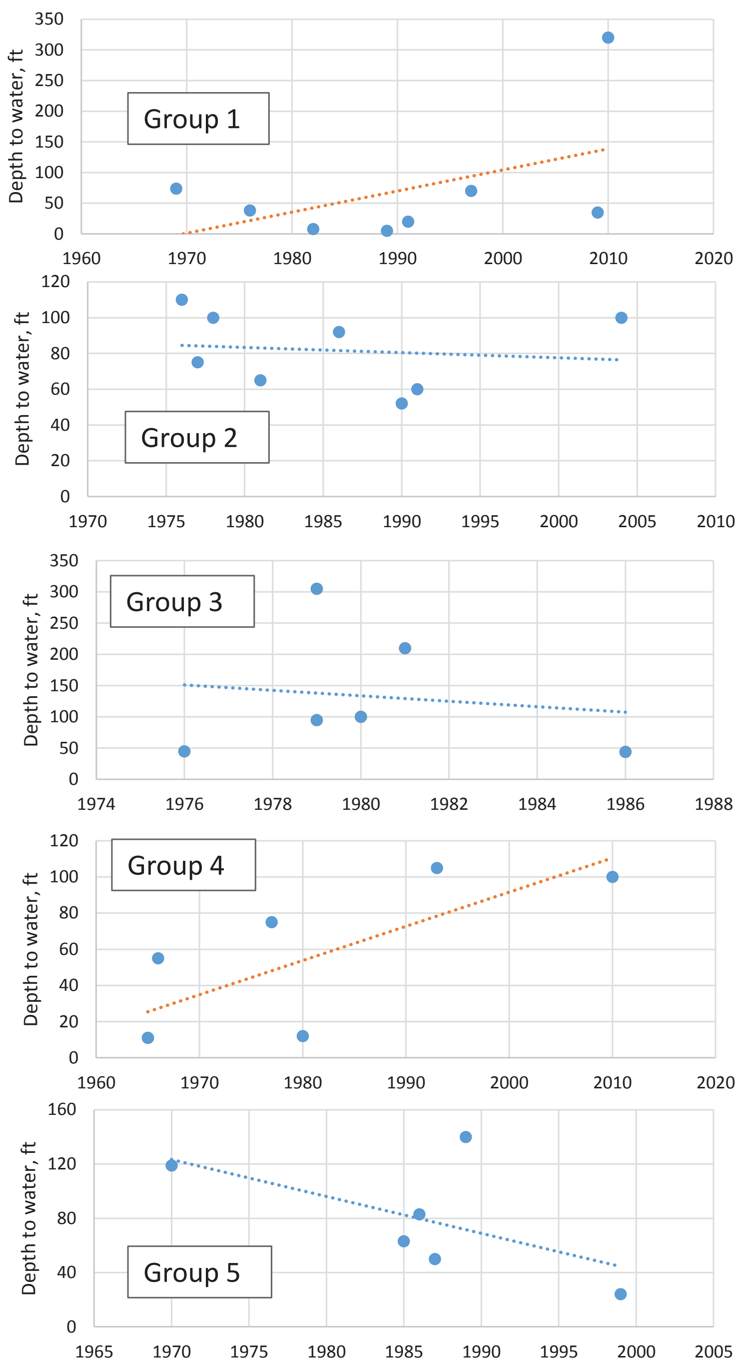


Figure 22. Initial depth to water over time among wells in each of the five clusters of wells in the upper Mark West Creek region (as identified in Figure 21).

Additional field observations and measurements, summer 2013

The importance of Sonoma Volcanic geology in sustaining Mark West Creek base flow was evident in observations made in the field in summer 2013. As described in the previous Hydrology discussion (Section 4), streamflow in the North Fork and mainstem Mark West above Neal Creek ended in late spring 2013, while flow immediately below Neal Creek and subsequent mainstem gauges downstream continued to flow through summer. Figure 17, above, shows that the surface geology of the North Fork watershed and upper mainstem Mark West watershed is mostly Franciscan bedrock, while the Neal Creek watershed and subsequent lower Mark West gauged watersheds had larger portions of Sonoma Volcanic geology.

NOAA and/or CEMAR staff visited Mark West Creek approximately monthly through summer 2013 and regularly observed springs and seeps from the bedrock alongside Mark West Creek. The creek was accessed to make observations at three locations between Neal Creek and Tarwater Road: at the St. Helena Road crossing just below Neal Creek; at a private residence on St. Helena Road near Puff Lane; and at a private residence downstream of Tarwater Road. At each visit, water was observed seeping from the Sonoma Volcanic bedrock (e.g., Figure 23); water was often observed seeping from bedrock on both sides of the channel. Additionally, in early summer 2013, NOAA walked from where the North Fork Mark West Creek flows beneath St. Helena Road, downstream to the confluence with Mark West Creek, then downstream to a private residence on St. Helena Road near Puff Lane (where permission had been granted to exit the creek). During that half-mile walk, many springs and seeps were noted on both sides of Mark West Creek.

NOAA staff also walked along the North Fork Mark West Creek upstream from the St. Helena Road crossing to a boulder cascade possibly marking the upper limit of anadromy on the North Fork Mark West Creek (assuming salmonids could get past the St. Helena Road culvert). No springs and seeps were observed through this reach. Though this reach was identified in surface geology GIS data sets as volcanic sand and gravel, the bedrock at creek level was Franciscan (Figure 24).

Figure 23. Water seeping out of bedrock, Mark West Creek below Neal Creek (at St. Helena Rd crossing), May 2011 (wet year, upper photo) and July 2013 (very dry year, lower photo). Seeping groundwater is not limited to fractures in bedrock, and it was observed in many places along Mark West Creek between Neal Creek and Tarwater Road in summer 2013, on both sides of the creek.

Figure 24. Stream channel, North Fork Mark West Creek, upstream from St. Helena Road (July 2013).

Additionally, CEMAR and NOAA Staff walked alongside Mark West Creek on St. Helena Road in summer 2013; no springs or seeps were observed through this reach and the stream channel was completely dry over the observable portion of the creek from Neal Creek upstream (a total distance of 0.8 miles). Whereas Mark West Creek below Neal Creek has a narrow active channel with boulders, gravel, and bedrock-bottomed (albeit shallow) pools (Figure 25A), the channel above Neal Creek was broader and covered with finer gravel and cobble to the tops of boulders (Figure 25B).

Many factors may contribute to the dry conditions of the mainstem Mark West Creek above Neal Creek. Wells on the hilltops of the watershed divide, where most of the watershed's vineyard development is located, could be affecting summer base flow; the majority of the watershed is Franciscan formation, which correlates with poor base flow; and much gravel and cobble has accumulated in this reach of Mark West Creek, likely elevating the level of the channel bed while still allowing hyporheic flow through the coarse alluvial matrix. At this point, it is not possible to distinguish between correlation and causation. However, the accumulation of gravel, especially above the undersized culverts along St. Helena Road, is substantial (e.g., Figure 26 A-B). This gravel accumulation fills pools throughout Mark West Creek, and disproportionately affects the creek upstream of road culverts (where deposits are especially large).

Figure 25A (top) – B (bottom). Mark West Creek immediately below Neal Creek at the St. Helena Road Crossing (top), and immediately above Neal Creek (bottom).

Figure 26 A-B. Accumulation of coarse material in Mark West Creek above Neal Creek, along St. Helena Road, upstream of St. Helena Road culvert--facing downstream (top) and upstream (bottom).

North Fork Mark West Creek

The North Fork of Mark West Creek (NF MWC) has been a subject of much attention in recent years, focusing on concern over the effects of vineyard development in a portion of the watershed on summer base flow. Nearby stakeholder groups have noted that NF MWC becomes intermittent earlier than in the past and that it has become dry in most recent years where it had not in the past. The purpose of this section is to describe the features that could be contributing to reduced base flow in NF MWC.

The majority of the NF MWC watershed is covered by surface geology of Franciscan mélange (Figure 27), indicating that much of it is unlikely to directly produce consistent base flow through summer. However, as described above, fractures in Franciscan bedrock of suitable characteristics (e.g., large enough, with adequate hydraulic conductivity) may provide base flow in summer. The upper and lower portions of the watershed are covered in Sonoma Volcanic surface geology, implying a greater capacity for providing base flow during summer, but no seeps or springs were observed along the NF MWC near the St. Helena Road crossing. Additionally, California Geological Survey maps illustrate an unnamed fault running through the NF MWC watershed; ESA (2012) provides additional speculation as to the origin of this fault and its relationship to other nearby faults.

Specific concerns have been raised that a well providing irrigation water for the vineyard on the ridge separating the North Fork watershed from the mainstem watershed may be reducing summer base flow. Consultants for the vineyard report that the well pumps ten gallons per minute for irrigation through summer totaling 0.1 acre-ft per acre of grapes, for a total of 2.0 acre-ft of water annually (ESA 2012). The consultants describe the location of the well as being on the ridgetop dividing the mainstem and North Fork watersheds, between the two large blocks of vineyards shown in Figure 27.

Given the high stream depletion factor described for Franciscan bedrock above, water is probably not directly losing from NF MWC to the adjacent bedrock. The fairly productive well pumping rate of 10 gallons per minute suggests that part of the well is in a bedrock fracture capable of providing adequate yield for irrigation needs, and its location suggests it is in proximity to the unnamed fault that also crosses NF MWC. If the fracture supplying the irrigation well is hydrologically connected to NF MWC, then removing water would likely reduce flow in NF MWC. However, reducing flow from the well-influenced bedrock fracture to NF MWC would not affect inputs from other fractures: other fractures that provide flow to NF MWC elsewhere in the NF MWC watershed would likely not be affected by groundwater pumping at the vineyard site. While conditions could be imagined whereby water could move from NF MWC toward the vineyard well via bedrock fractures, that movement would: (1) require the potentiometric water surface within the fracture to be below the level of the stream; (2) the fracture would need to have sufficient transmissivity to accommodate water from the stream into the fracture; and (3) the size of the fracture would need to be sufficient to remove water from the NF MWC.

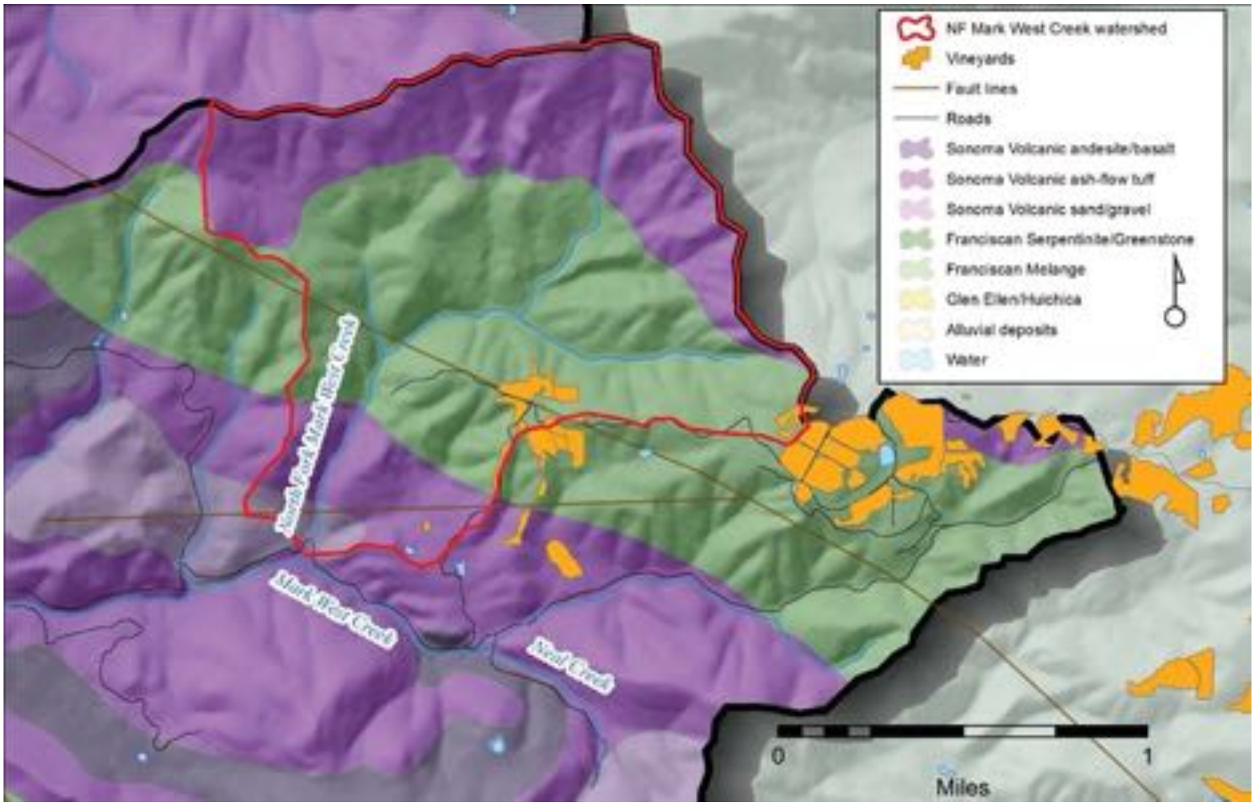


Figure 27. North Fork and mainstem Mark West Creek, with surface geology, roads, and fault lines.

The complexities of groundwater flow in Franciscan bedrock and limited flow data undermine our ability to know for certain how the well providing irrigation water for the vineyard in the NF MWC watershed affects streamflow below without systematic measurements to ascertain baseline conditions and conditions upon pumping. The nature of the geologic material suggests that the effects of groundwater pumping would reduce flow only by proportion of flow the particular fracture provides; other fractures elsewhere in the watershed would continue to provide base flow independent of groundwater pumping at the vineyard well site. The seasonal impact of base flow depletion due to groundwater pumping can also be calculated. If the total amount of water obtained by groundwater pumping is 2 acre-ft annually, and the effects of groundwater pumping are attenuated over the year, it corresponds to an average of 0.003 ft^3/s through the year. Assuming the effects are attenuated evenly over the year, this represents the maximum impact the well can have; it also would assume all the water pumped by the well would otherwise become streamflow in NF MWC. If the effects are attenuated evenly over the two-month period when water is used, and all the water that is pumped from the groundwater well would otherwise become streamflow in NF MWC, the maximum impact would be a reduction of up to 0.016 ft^3/s. Further confounding this evaluation, the North Fork Mark West Creek was dry in June 2013, earlier in the dry season than when water is usually used for irrigation.

Two other factors have likely played a role in the decline of summer base flow in the North Fork of Mark West Creek and the mainstem Mark West Creek above Neal Creek. The first is the nature of hydrologic conditions over the period 2007 to 2014. While two of the past eight years were wetter than average, six of the eight were much drier than average. These multi-annual drought conditions may compound the impacts of drought, resulting in sequentially less base flow from one drought year to the next. From a mechanistic perspective, the cracks and fractures in the bedrock that support base flow through summer do not re-charge sufficiently, resulting in a declining supply of water over multiple years to provide summer flow. The other factor that likely contributes to less summer surface flow is the accumulation of coarse gravel in the channel. Anthropogenic and naturally-caused landslides and channel erosion have caused stream channels to aggrade through much of the upper portion of the watershed. Gravel accumulation is so great in some reaches that the channel has become braided, a common feature of streams with an excessively high sediment load. Studies from elsewhere in the western United States indicate that low rates of discharge, such as those typical in Mark West Creek (ranging from 0.1 to 0.3 ft^3/s) could easily percolate and pass subsurface through coarse gravel that accumulates in channels as a result of erosion upstream in the catchment (May and Lee, 2004).

The streamflow dynamics of the North Fork Mark West Creek is likely affected by such sediment accumulation, especially on the upstream side of the St. Helena Road culvert crossing. Like the mainstem Mark West Creek above Neal Creek, the sediment regime of NF MWC is affected by an undersized culvert. The culvert on the 1.3 square mile North Fork Mark West Creek has a diameter of 6 ft; this has led to an accumulation of coarse gravel and cobble on the upstream side of the culvert (Figure 28; this accumulation is likely exacerbated by upslope landslides to the NF MWC described by Li and Parkinson, 2008).

Figure 28. Sediment accumulation, North Fork Mark West Creek above culvert at the St. Helena Road crossing (May 2013).

On the other end of the culvert, the water level in the stream bed as surveyed on May 20, 2014 was 6.5 ft below the bottom of the culvert (Figure 29). Beyond presenting major challenges to salmonids migrating upstream in NF MWC, this undersized culvert has led to an unnatural channel slope upstream of the culvert as coarse gravel and cobble has accumulated upstream. A survey of the NF MWC from a boulder cascade 400 ft upstream of the St. Helena Road crossing to the confluence with Mark West Creek shows that the overall channel gradient is consistently approximately 1% except immediately above the culvert (Figure 30). Surface flow was observed below the boulder cascade and again below the culvert, but not through the reach where the slope was affected by sediment accumulation.

Figure 29. Downstream end of the culvert on the North Fork Mark West Creek at St. Helena Road.

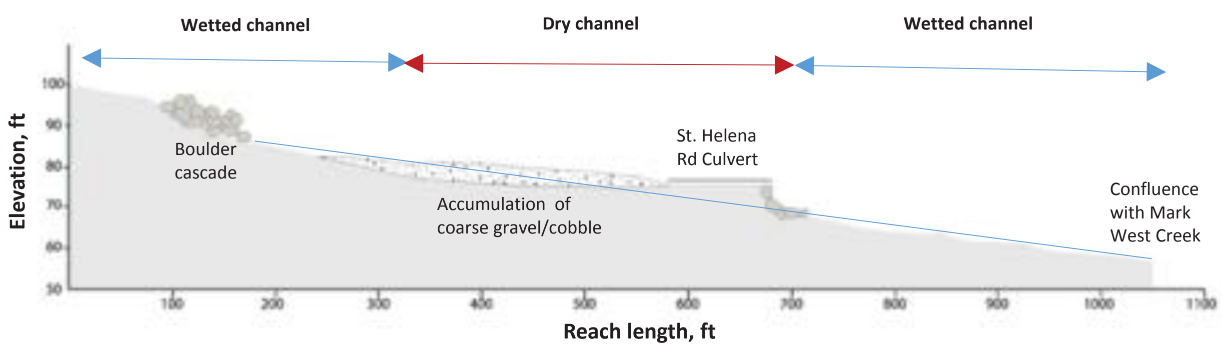


Figure 30. Longitudinal profile of the north Fork Mark West Creek from boulder cascade upstream of St. Helena Road to the confluence with Mark West Creek, indicating the portions of the channel that were wetted and dry during survey (5/20/2013). The continuous line from the boulder cascade down to the confluence with Mark West Creek illustrates a continuous slope through the reach that could correspond with the saturated water level above and below the surface of the channel bed.

The presence of water at the top of the survey and again below the culvert suggests that there could be surface flow throughout NF MWC in the absence of the culvert. The slope of the channel surface has changed upstream of the culvert with the accumulation of gravel and cobble, but the water table gradient through the accumulated gravel and cobble is approximately the same upstream and downstream of the accumulated material. While this points to a benefit of increasing potential salmonid spawning and rearing habitat by replacing the NF MWC culvert with a bridge, the amount of increased habitat is small: the boulder cascade at the upper end of the long profile survey likely limits adult migration, so the amount of increased habitat would only be five hundred feet (the distance from the downstream end of the St. Helena Road culvert to the base of the boulder cascade).

Runoff, infiltration, and influence of land cover modifications

Runoff is water that flows on Earth's surface and in streams during and directly after a rain event (Dunne and Leopold 1978). A number of factors influence how much rainfall is converted to streamflow, including infiltration capacity of the soil, vegetation cover, landscape gradient, and rainfall intensity. The amount of water that gets converted from rainfall to runoff can be altered by human development; for example, addition of impervious surface can reduce infiltration capacity and conversion from forest to grassland can reduce leaf interception. The purpose of this section is to describe some of the characteristics that influence runoff in the Mark West watershed, and how development in the watershed have altered runoff processes.

Estimating runoff

A straightforward and commonly used way to estimate runoff in a watershed is to calculate runoff as a function of rainfall intensity, drainage area, and a term called the runoff coefficient according to the Rational Equation:

$$Q = C \times i \times A$$

In the original Rational Method, Q is defined as peak flow in cubic feet per second, C is the runoff coefficient reflecting the ratio of rainfall to surface runoff, i is the rainfall intensity in inches per hour (in/hr), and A is drainage area in acres. Runoff coefficient values that commonly appear in tables (e.g., Dunne and Leopold 1978) are based on empirical data where rainfall and runoff were measured from small watersheds, where C could be estimated with reasonable accuracy (the Rational Method was designed to apply to watersheds less than 200 acres in size). The runoff coefficient is a function of how quickly water can flow off of a surface, on a scale of 0 to 1, where a low runoff coefficient indicates a low volume of water converted into flow (*e.g.*, a forested understory with soils having high infiltration capacity), and a high coefficient indicates a large volume of water converted to flow (*e.g.*, an impervious surface). Because of the simplicity and clarity of the Rational Method, it is often applied to watersheds much larger than 200 acres and over broader intervals such as seasonal or annual runoff (CalTrans 2001).

Despite these limitations, the runoff coefficient C provides a useful method of comparison for considering how different landscape characteristics influence runoff. The runoff coefficient describes the fraction of total rainfall that appears as a runoff volume, after a portion of it has been infiltrated, and stored in the groundwater table. In addition, runoff coefficients can describe a site's infiltration characteristics, providing useful insights to which areas in a watershed contribute most to recharging groundwater aquifers, and contribute most to base flow later in the year.

To conceptualize runoff variability, we calculated the runoff coefficient across space for the Mark West Creek watershed. Dunne and Leopold (1978) list runoff coefficients according to soil type and land cover; we added runoff coefficient data to include a value for ponds (1.0, implying a full reservoir whereby all water that falls as rain becomes runoff), and for hillside vineyards from 0.45 (as Dunne and Leopold report for cultivated land on shallow soils) to 0.9 (reflecting shallow soils, steep slopes, and often drainage tiles on vineyards). In GIS, we spatially joined the soil and vegetation/ land cover data to correspond with categories for assigned C values based described by Dunne and Leopold (1978). Table 5 describes the runoff coefficient values used in this study, based on soil and land cover.

We conducted this analysis under two conditions. In the first, we used land cover data from a 2002 USGS data set that included no agriculture or reservoirs in the watershed above the Santa Rosa Plain. In the second, we used land cover from a modified 2011 data set that incorporated the vineyards and reservoirs we mapped in the watershed upstream of the Santa Rosa Plain. These two different conditions allowed us to compare how the development of vineyards and ponds in the watershed affects runoff.

Table 5. Runoff coefficients in the Mark West Creek watershed (adapted from Dunne and Leopold [1978]; red text shows modifications based on local conditions).

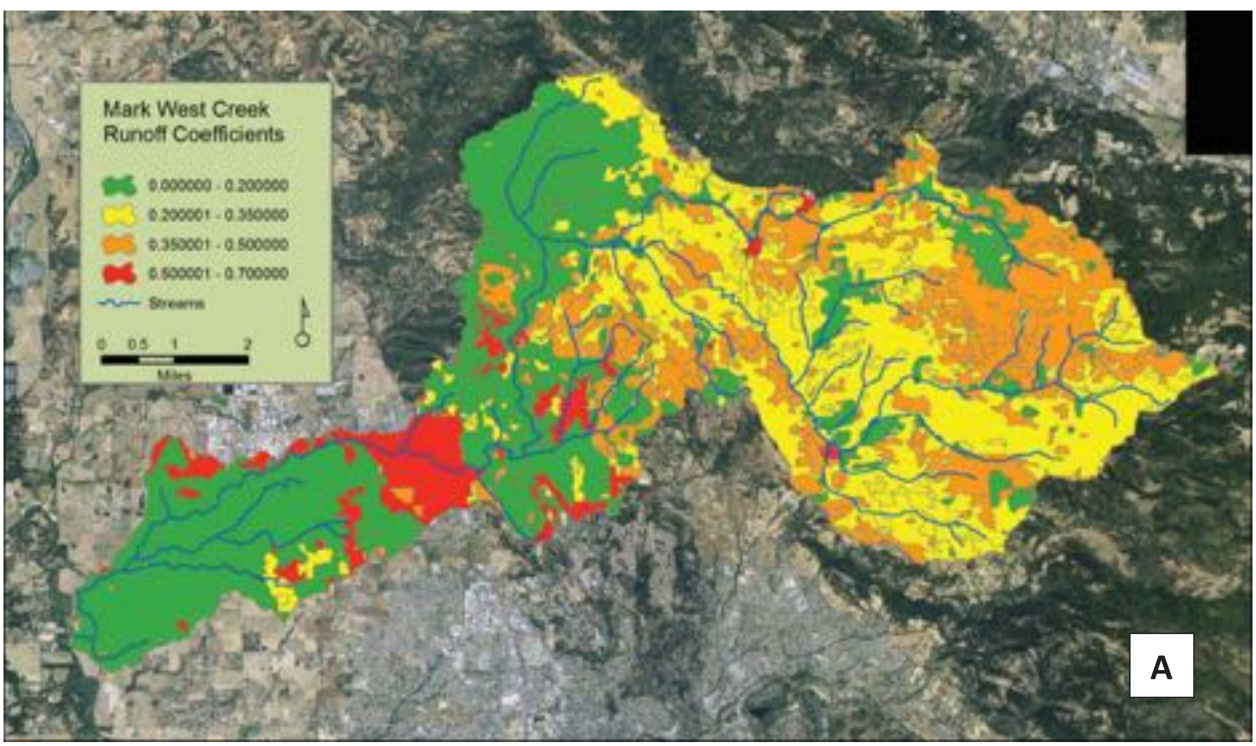
Urban and Rural Single Family Residential	
Urban areas (lower in watershed)	0.7
Residential on sandy and gravelly soils	0.2
Residential on loams	0.3
Residential on clay soils	0.4
Open water	1.0

Sandy and gravelly soils:	
Cultivated (vineyards, etc.)	0.2
Pasture, grasslands	0.15
Woodland, forest	0.1
Open water	1.0

Loams and similar soils with impeding horizons	
Cultivated (vineyards, etc.)	0.4
Pasture, grasslands	0.35
Woodland, forest	0.3
Open water	1.0

Heavy clay soils or those with a shallow impeding horizon (shallow soils over bedrock)	
Cultivated (vineyards, etc.)	0.9
Pasture, grasslands	0.45
Woodland, forest	0.4
Open water	1.0

Overall, the results of this analysis indicate the variation in runoff and infiltration throughout the watershed (Figure 31A). The lower part of the watershed, with soil categorized as "riverwash" and land cover mostly as cultivated crops, has low runoff (and thus high infiltration). Urban areas (e.g., Larkfield/Wikiup) have the highest runoff and lowest infiltration. The areas with low runoff coefficients upstream of Larkfield/Wikiup correspond with sandy soils and forest. Soils upstream in the more mountainous areas have higher clay content (derived from Franciscan and Sonoma Volcanic bedrock) and mixed land cover (as indicated above in Figure 6A). If runoff coefficients are summed to create an average value over the entire watershed, the average runoff coefficient in the Mark West watershed is 0.31.



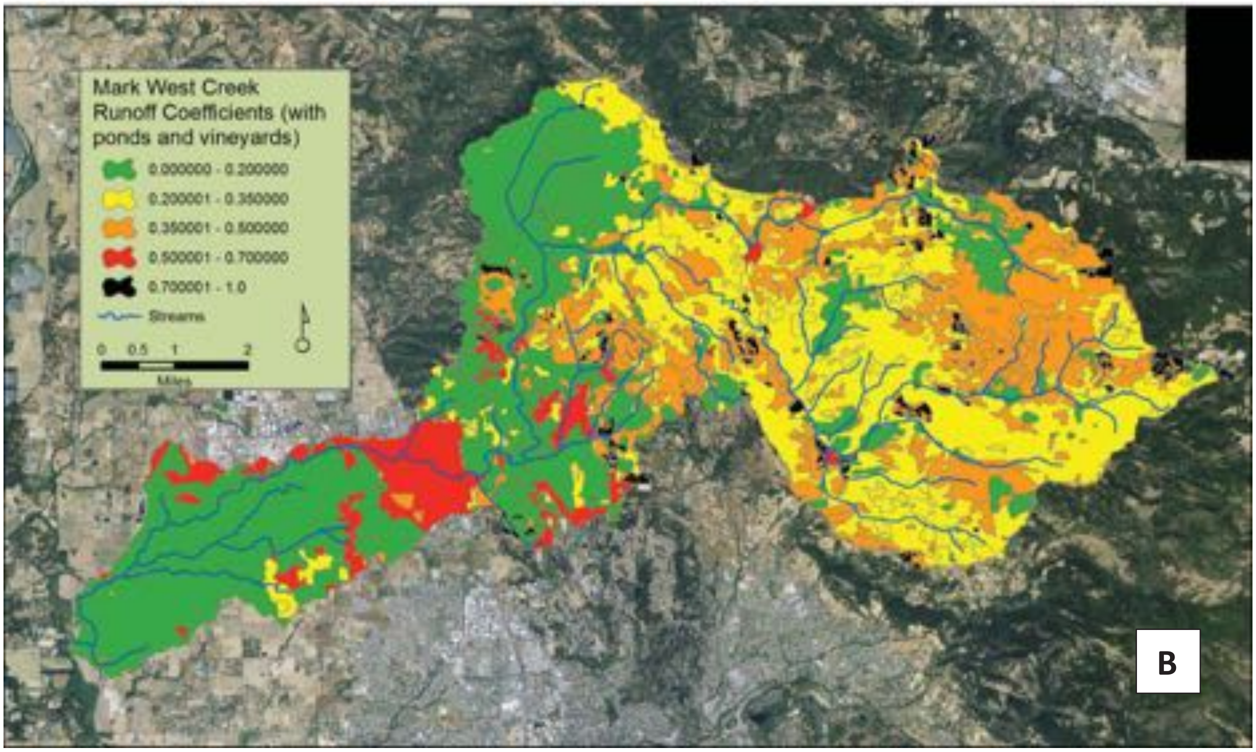


Figure 31A-B. Runoff coefficient values in the Mark West Creek watershed in the absence of ponds and vineyards (A, above) and with ponds and vineyards (B, below).

Because vineyards and small reservoirs represent a small fraction of the overall watershed (Figure 31B), their influence on the overall watershed runoff coefficient is small. The amount of land upstream of the Santa Rosa Plain as either vineyards or reservoirs is approximately 730 acres; when we replaced the runoff coefficients of these areas from initial values to either 0.9 and 1.0 (for vineyards and ponds, respectively), the overall runoff coefficient changes to 0.32 (Table 6).

Table 6. Runoff coefficients for portions of the Mark West Creek watershed based on data sets with and without vineyards in the upper portion of the watershed (i.e., based on data shown in Figures 28A and 28B).

Region	total area, acres	Average runoff coefficient	Middle/upper watershed as vineyard or reservoirs	New average runoff coefficient
Mark West watershed	33160	0.31	730	0.32
Upper Mark West C	8960	0.33	281	0.35
North Fork Mark West C	920	0.36	13	0.37
Mark West C ab Neal C	794	0.32	78	0.38

Given the concerns about development in the upper portion of the watershed, we repeated the comparison of runoff coefficients with and without agricultural development in three other locations: the upper Mark West Creek watershed (above Humbug Creek), the North Fork Mark West Creek watershed, and the Mark West Creek watershed above the MW06 ("below Neal Creek") gauge (Figure 32). Because the amount of agricultural coverage represents a small fraction of the overall watershed area, the new runoff coefficients (including agricultural development) change only slightly. The greatest change occurs in the portion of the watershed above the MW06 gauge, where 10% of the watershed is covered by either ponds or vineyards (Table 6). The change from 0.32 to 0.38 means that a rainfall event may convert 38% of its rainfall into runoff, where previously it would have converted only 32% to runoff.

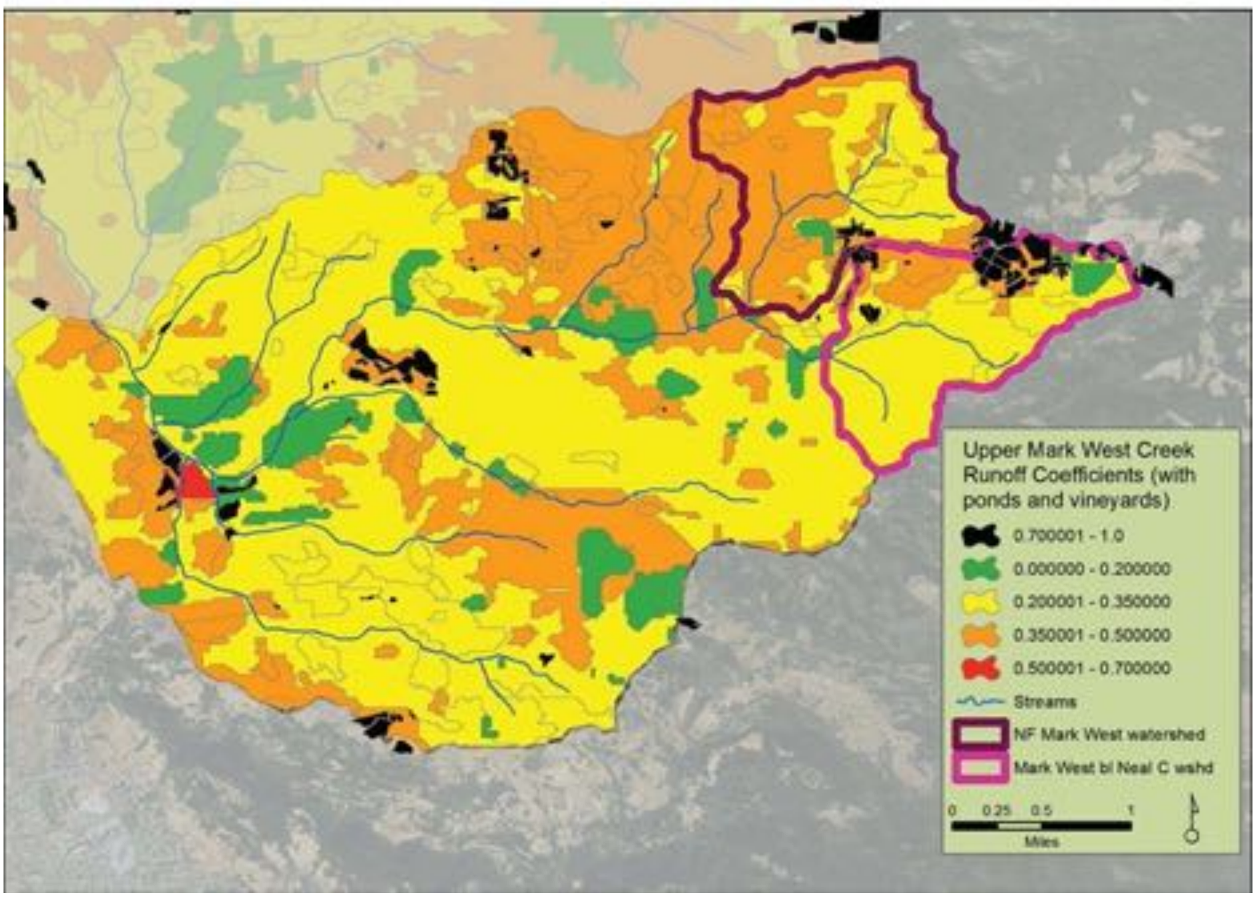


Figure 32. Runoff coefficients in the upper Mark West Creek watershed area, given current agricultural development.

6. Conclusions

Characterizing the interactions between humans, our development, and the natural flow regime is a complex task. Streamflow varies over time (*e.g.,* within the year and among years), and development patterns vary across space (*e.g.,* in the lower watershed compared to the upper watershed). We have attempted to describe some of these complexities in four related discussions (Rainfall, Land Cover/Land use, Hydrology, and Geology) to provide some insights into how streamflow in Mark West Creek has been affected by human development in the watershed.

Overall, our study suggests that streamflow is low in Mark West Creek but does not show many of the characteristic fluctuations associated with streamflow diversions to meet human water needs, even in a dry year. The Sonoma Volcanic surface geology in much of the watershed has capacity to produce base flow through summer, which is likely one of the main reasons why Mark West Creek maintained consistent flow even through the dry year 2013. Also, while there is some development along the upper reaches of Mark West Creek (as shown through locations of houses and wells), groundwater pumping to meet residential needs attenuates the impacts compared to direct instream diversions. Instead, groundwater pumping likely results in reduced base flow. Groundwater pumping to meet agricultural needs may also affect base flow, especially if wells are located in bedrock fractures that would otherwise provide base flow in summer.

Our analyses also show that the amount of water that falls as rain and leaves as streamflow greatly exceeds the amount of water needed for human uses. Normal-year rainfall is more than 150 times our estimate of human water need in the watershed, on an annual scale. Normal-year discharge is likely also much greater than human water need. For example, Rantz (1972) reviewed rainfall and streamflow records from watersheds in northern California and found that approximately 50 percent of the water that falls as rain is converted to streamflow. If this estimate is applied to Mark West Creek, then a discharge value can be added to the water use/rainfall comparisons in Section 2. If typical normal-year rainfall over the upper Mark West watershed is 34,500 acre-ft, discharge can be estimated as approximately 17,300 acre-ft. Our estimate of 260 acre-ft of water needed for human uses comprises approximately 1.5 percent of the discharge from the Upper Mark West Creek watershed under normal-year conditions (Figure 33), and approximately 3 percent of discharge from Upper Mark West Creek in a dry-type year (Based on dry-year rainfall, Figure 12).

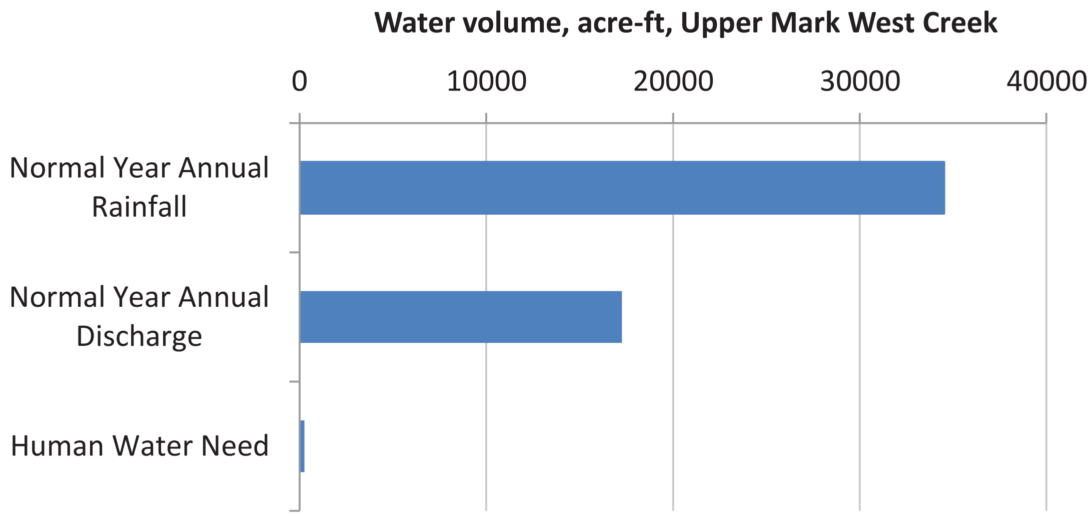


Figure 33. Estimated normal-year rainfall, discharge, and human water need in upper Mark West Creek.

These results suggest that it should be possible to meet all the water needs of the upper Mark West watershed with minimal effects to hydrology if water is obtained through appropriate methods at appropriate times. As indicated above in Figure 13, this cannot occur in summer: the characteristically low discharge through the dry season is not sufficient to support human needs in the basin. The abundance of rainfall and streamflow in normal and in dry years suggests that Methods such as rainwater catchment and reservoir storage could be suitable to meet human needs if operated correctly. Rainwater catchment may be the least hydrologically invasive because it only stores water when it rains in proportion with rainfall intensity, and only affects stream hydrology in proportion to the area of catchment (e.g., house or barn roof, relative to a stream catchment). For example, if one residence stores water off of a 1,000 square foot area, 48 inches of rain would produce approximately 30,000 gallons of water. Based on our estimates, this would be sufficient to meet the needs of the majority of houses in the Mark West watershed through the dry season. If 80 houses in the Mark West Creek watershed above Tarwater Road (total watershed area 2,960 acres) store rainfall off of a 1,000 square foot area, it would result in storage of 0.062% of the total rainfall (storing water that falls on 80,000 square feet over a 129,000,000 square foot watershed). Rainwater catchment has the greatest potential to meet human water needs in the Mark West Creek watershed while minimizing impacts to hydrology, though it may be limited by roof space: it can only store as much water as falls on the roof, and rainwater catchment design should consider total water needs and rainfall in a dry year to ensure needs will be met.

Reservoirs also provide storage from winter to summer. Reservoirs may be located on headwater streams, thus collecting inflow from the upstream channel; or offstream, receiving water pumped from groundwater or from a nearby stream. Onstream reservoirs that collect water from upstream typically fill at some point in winter and begin to spill over and reconnect with the drainage network, but until they do, they are designed to prevent water from flowing downstream. Reservoirs on small streams are now required to have a mechanism that allows some water to bypass the dam and provide water downstream (SWRCB 2010), but whether the bypass flow is sufficient to meet ecological needs or operates correctly is unknown. Equally important, the cumulative effects of many headwater reservoirs could impede flow if they all are storing water in the rainy season. In examining the impacts of headwater "fill-and-spill" reservoirs on streamflow in Sonoma County (including the Mark West watershed), Deitch et al. (2013) found that streamflow in streams that support salmonids can be impaired especially early in the water year, though results are variable: drainage networks with more reservoirs are more impaired than those with few reservoirs. Also, because reservoirs tend to fill through the year, their impacts on salmon streams are often small in a normal-type year (though they can persist longer in a dry-type year). The potential effects of onstream reservoirs should be carefully considered, but they could (with appropriate bypass mechanisms) provide adequate water storage in a way that has low impacts to streamflow below. Given topographic limitations through much of the watershed, offstream reservoirs may not be feasible. However, where they are, they also may provide an opportunity to store water with low impacts to streamflow, so long as water is obtained when there is sufficient flow in the stream and the proportion of water taken for storage is small relative to streamflow.

Overall, the results above indicate that there is enough water on an annual scale to meet all existing human water needs, but diverting water from aquifers, springs, and streams has likely contributed to less water in upper portions of Mark West Creek than would be present naturally. Agricultural needs and residential needs are similar in magnitude, and if water is stored in winter to meet these needs rather than obtained during the dry season, streamflow in Mark West Creek could more than double.

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APPENDIX C

State of California
Natural Resources Agency
California Department of Fish and Wildlife

STUDY PLAN
Habitat and Instream Flow Evaluation for Anadromous Steelhead and Coho Salmon in UPPER MARK WEST CREEK, Sonoma County

STUDY PLAN

June 2018

Cover photo: Mark West Creek, view upstream.

Approvals

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____________________________________ Date 6/21/18

PREFACE

This study plan outlines the approaches that may be used by the California Department of Fish and Wildlife (Department) to evaluate instream flow needs for anadromous steelhead and Coho Salmon in upper Mark West Creek, Sonoma County. The California Water Action Plan[1] (CWAP) outlines ten actions and associated sub-actions to address water management challenges and promote reliability, restoration, and resilience in the management of California's water resources. Action Four of the CWAP, to protect and restore important ecosystems, directs the Department and the State Water Resources Control Board (State Water Board) to implement a suite of actions to enhance instream flows within at least five priority stream systems. Mark West Creek, a tributary to the lower Russian River, is among these first five priority streams. The Department plans to begin work on the upper Mark West Creek study in 2018 as part of the suite of actions to address instream flow enhancement for anadromous salmonid species present within upper Mark West Creek.

The Department is the Trustee Agency for California's fish and wildlife resources and a Responsible Agency under CEQA §21000 *et seq*. Fish and wildlife resources are held in trust for the people of the State of California under FGC §711.7. As Trustee Agency, the Department seeks to maintain natural communities and native fish, wildlife, and plant species for their intrinsic ecological values and for their benefits to all citizens in the State. This includes habitat protection and maintenance of habitat of sufficient amount and quality to ensure the survival of all native species and natural communities. The results of the study may be used to assist with flow enhancement activities in upper Mark West Creek through the CWAP and other salmonid restoration and recovery efforts.

[1] More information about Proposition 1 and the California Water Action Plan can be found at http://resources.ca.gov/california_water_action_plan/

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ABBREVIATIONS

°F	degrees Fahrenheit
1D	one-dimensional (physical habitat simulation model)
2D	two-dimensional (physical habitat simulation model)
BMI	benthic macroinvertebrate
CC	California Coastal
CCC	Central California Coast
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife (previously CDFG)
CEMAR	Center for Ecosystem Management and Restoration
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CNFD	California Natural Flows Database
CWAP	California Water Action Plan
cfs	cubic feet per second
DPS	distinct population segment
DWR	Department of Water Resources
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FGC	Fish and Game Code
FN	Froude number
FR	Federal Register
FRAP	Fire Resource Assessment Program
ft	foot/feet
ft/s	feet per second
GIS	geographic information system
GPS	Global Positioning System
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HRM	Habitat Retention Method
HSC	habitat suitability criteria
HTS	habitat time series
HUC12	12-digit hydrologic unit code
IFP	Instream Flow Program
LiDAR	Light Detection and Ranging
MANSQ	Manning's stage discharge
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
PACT	Priority Action Coho Team
PHABSIM	Physical Habitat Simulation Model
PRISM	Parameter-elevation Regressions on Independent Slopes Model
RCD	Resource Conservation District
RIVER2D	River2D Model
RRCWRP	Russian River Coho Water Resources Partnership
RRISRP	Russian River Independent Science Review Panel

RTK	real time kinematic
SCWA	Sonoma County Water Agency
SEFA	System for Environmental Flow Analysis
SOP	standard operating procedure
SRPBAP	Santa Rosa Plain Basin Advisory Panel
SRPHM	Santa Rosa Plain Hydrologic Model
SWRCB	State Water Resources Control Board
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WPM	Wetted Perimeter Method
WSEL	water surface elevation
WY	water year
WSP	water surface profile
VAF	velocity adjustment factor
VDI	Voluntary Drought Initiative

CONVERSIONS

1 cubic foot per second ≈ 2.83 × 10^{-2} cubic meters per second
1 inch = 2.54 centimeters
1 foot ≈ 30.48 centimeters
1 square mile ≈ 2.59 square kilometers
1 mile ≈ 1.61 kilometers
1 foot ≈ 0.31 meters
°C = (°F - 32) ÷ 1.8

1.0 INTRODUCTION

The Russian River watershed, to which Mark West Creek is a tributary, currently supports several species of anadromous salmonids, including anadromous Rainbow Trout (commonly known as steelhead; *Oncorhynchus mykiss*), Chinook Salmon (*O. tshawytscha*), and Coho Salmon (*O. kisutch*). Salmon and steelhead populations within coastal California watersheds, including those found within the Russian River watershed have declined significantly due to habitat modification, overfishing, and environmental stressors (Steiner 1996; CDFG 2004; NMFS 2008; NMFS 2012; CDFW 2015b; NMFS 2016). The National Marine Fisheries Service (NMFS) has consequently made several listing determinations pursuant to the federal Endangered Species Act (ESA) for the Distinct Population Segments (DPS)/ Environmentally Significant Units (ESU) of the respective species. These determinations cover all anadromous salmonid species found within the Mark West Creek subwatershed: Central California Coast (CCC) steelhead, listed as threatened in 1997 (62 FR 43937); California Coastal (CC) Chinook Salmon, listed as threatened in 1999 (64 FR 50394); and CCC Coho Salmon, listed as endangered in 2005 (70 FR 37160). CCC Coho Salmon north of San Francisco Bay were also listed as endangered under the California Endangered Species Act (CESA) in 2005.

Despite the CESA/ESA listings, populations of anadromous salmonid species continue to decline in the Russian River watershed and throughout their ranges. The Russian River population of Coho Salmon was nearly extirpated in the late 1990s (CDFG 2004; NMFS 2008). In response to the decline, county, state, and federal agencies formed the Russian River Coho Salmon Captive Broodstock Program (Broodstock Program) in hopes of preventing imminent extirpation. This collaborative effort has been supporting species recovery by breeding Coho Salmon from local genetic stocks and releasing juveniles into streams historically inhabited within the Russian River watershed, including Mark West Creek.

The degradation and loss of freshwater habitat, caused by a decrease in water quality and insufficient water quantity, is one of the leading causes of salmonid decline (CDFG 2004; NMFS 2012). Water diversions, modifications to riparian vegetation, and sediment delivery to streams that provide critical habitat to salmonid species in the Russian River watershed have contributed to the degradation and loss of habitat (NMFS 2008; Sonoma RCD 2015). This instream flow study conducted by the Department of Fish and Wildlife (Department) will provide information to help support the recovery of anadromous species within upper Mark West Creek by identifying the flow regimes necessary to support salmonids and the habitats upon which they depend.

2.0 PROJECT BACKGROUND

The Mark West Creek subwatershed provides habitat for listed anadromous salmonid species including CCC steelhead, CC Chinook Salmon, and CCC Coho Salmon as well as various other aquatic species of special concern such as the California Roach (*Lavinia symmetricus*), Northwestern Pond Turtle (*Actinemys marmorata*), and Foothill Yellow-Legged Frog (*Rana boylii*). One of the primary motivations for this flow study is the California Water Action Plan (CWAP). Released by Governor Brown in 2014, the CWAP directs the Department and State Water Resources Control Board (State Water Board) to initiate a suite of actions to enhance water flows in at least five stream systems that support critical habitat for anadromous fish species. Mark West Creek was established as a priority CWAP stream. In addition to being a CWAP priority stream, limiting factors and recovery actions identified in recovery plans for the listed salmonid species inhabiting Mark West Creek (CDFG 2004; NMFS 2012; NMFS 2016) provide contextual background for this instream flow study.

Prior assessments (e.g., NMFS 2008; Grantham et al. 2012; Obedzinski et al. 2016) have indicated that impaired streamflow is a factor affecting steelhead and Coho Salmon survival in the Russian River watershed. The State's Steelhead Restoration and Management Plan (CDFG 1996) suggests that water diversions have led to insufficient flow conditions within the Russian River watershed, contributing to the decline of steelhead populations. Part of the difficulty in managing the impacts of water diversions, the plan stated, stems from the lack of studies to determine the instream flow requirements for salmon and steelhead within the Russian River and its tributaries (CDFG 1996). The Department's Coho Salmon Recovery Strategy (CDFG 2004) suggested that altered flow regimes were likely presenting an obstacle to Coho Salmon recovery within the Russian River watershed. Finally, both the CCC Coho Salmon Recovery Plan (NMFS 2012) and Coastal Multispecies Recovery Plan (NMFS 2016) identified insufficient baseflow conditions as a limiting factor facing rearing juveniles within the Russian River and Mark West Creek focus populations, respectively. To aid in the prioritization of recovery actions from the Coho Salmon recovery plans, the Department and NMFS formed the Priority Action Coho Team (PACT). The PACT identified Mark West Creek as one of the top ten streams north of San Francisco Bay in which flow enhancements could benefit the recovery of the species.

In 2014, prolonged drought conditions and the likelihood of significant impacts to listed salmonid species prompted the Department and NMFS to develop the Voluntary Drought Initiative (VDI) Program[2]. Mark West was identified as a priority watershed in which to implement the VDI Program, one of four within the entire CCC steelhead DPS and CCC Coho Salmon ESU. In 2015, as poor conditions persisted, the State Water

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[2] Governor Brown declared a State of Emergency in 2014 due to ongoing drought conditions and subsequently issued an Executive Order directing the Department to coordinate with other agencies and landowners to minimize the combined impacts of the drought on listed species within priority watersheds. The VDI Program aimed to incentivize landowners to reduce water use and "prevent unreasonable impacts to fishery resources."

Board adopted an emergency regulation titled “Enhanced Water Conservation and Additional Water User Information for the Protection of Specific Fisheries in Tributaries to the Russian River” (CCR Title 23 Section 876). This regulation applied to the four Russian River subwatersheds identified in the VDI effort (i.e., Dutch Bill, Green Valley, Mill, and Mark West creeks), and mandated that landowners reduce water use and provide water use information on surface and subsurface diversions.

The Russian River Coho Water Resources Partnership (RRCWRP) identified Mark West Creek as one of five critical subwatersheds within the Russian River basin where important water management strategies could help restore the Coho Salmon population (RRCWRP 2017). In order to help address the low-flow limiting factor, developing an understanding of flow regimes and the relationship between streamflow and available salmonid habitat within upper Mark West Creek is required. This study will develop these habitat-flow relationships and identify the flows necessary to provide suitable habitat to support species recovery and guide future management decisions.

3.0 PROJECT DESCRIPTION

Department staff will conduct the instream flow study within upper Mark West Creek. Department Water Branch staff will coordinate and carry out data collection, data analysis, and generate a technical report (Table 1). Given the diverse nature of interests within the watershed, stakeholder coordination and outreach will be a vital component of the project. Bay-Delta Region staff will identify key outreach opportunities and will be supported by Water Branch staff participation. Bay-Delta Region, Conservation Engineering, and the Fisheries Branch will review the study plan, technical project components, and reports produced by the Water Branch.

Table 1. Roles and responsibilities in the Department's Mark West Creek study.

Department Lead	Role
Water Branch	Technical Study Project Coordination Study Planning Field Data Collection Engineering Data Management and Analysis Data Reporting
Bay-Delta Region	Project Context and Objectives Study Plan Review Field Data Collection (resources permitting) Project Review
Shared (Water Branch and Region)	Study Design Stakeholder Identification, Coordination, and Outreach Landowner Access
Conservation Engineering	Study Plan Review Project Consultation and Review
Fisheries Branch	Study Plan Review Project Review

3.1 Study Goals and Objectives

The goal of this study is to develop relationships between streamflow and salmonid habitat in upper Mark West Creek. Information developed will identify important flow thresholds for the protection and maintenance of anadromous steelhead and Coho Salmon juvenile rearing, and may be used to generate Department flow recommendations.

The objectives of this study are to:

- Identify and develop relationships between streamflow and available salmonid habitat using a combination of empirical approaches and hydraulic habitat modeling.
- Determine flows needed to maintain rearing habitat and connectivity for juvenile salmonids.
- Identify flows that support productive riffle habitats for benthic macroinvertebrates, an important food source for juvenile salmonids.
- Monitor water quality conditions, including temperature and dissolved oxygen.

3.2 General Approach

Relationships between streamflow and habitat within upper Mark West Creek will be developed using a combination of scientifically defensible methods, which may include hydraulic habitat modeling and empirical approaches described by the Instream Flow Council in *Instream Flows for Riverine Research Stewardship* (Annear et al. 2004). The resulting relationships will serve as a basis to help identify important flow thresholds for the conservation, restoration, and protection of salmonids and other aquatic resources within the watershed. Study components include assessing rearing habitat, riffle productivity and connectivity flows in upper Mark West Creek. In addition, monitoring of temperature and dissolved oxygen will be conducted to evaluate water quality conditions.

4.0 WATERSHED DESCRIPTION

Depending on the source of information, the boundary of the Mark West Creek subwatershed can vary. The U.S. Geological Survey (USGS) National Hydrologic Dataset and the Sonoma County Water Agency (SCWA) define Mark West Creek as a tributary to the Russian River (Nishikawa 2013). However, several other sources identify Mark West Creek as a tributary to the Laguna de Santa Rosa, which then flows into the Russian River (Sloop et al. 2007; Baumgarten et al. 2014; CEMAR 2015). The discrepancy stems in part from the complex lower reaches of the creek. Lower Mark West Creek's channel has undergone natural course migrations across its alluvial fan, but has also been subject to substantial anthropogenic modifications since the late 1800s (Baumgarten et al. 2014). For the purposes of this study, we are defining the Mark West Creek subwatershed using a modified USGS 12-digit hydrologic unit code (HUC12) boundary[3] and Mark West Creek as a tributary to the Russian River. Mark West Creek enters the Russian River near river mile 24 (Figure 1).

[3] Quantum Spatial developed these hydrologic data products for the Sonoma County Vegetation Mapping and LiDAR Program based on high-resolution LiDAR data collected in 2013.

Figure 1. Mark West Creek HUC12 subwatershed.

Situated about five miles north of the City of Santa Rosa along the eastern boundary of Sonoma County, the Mark West Creek HUC12 subwatershed is the second largest in the Russian River basin, draining an area of approximately 59 square miles. Mark West Creek stretches roughly 34 miles from its confluence with the Russian River to its headwaters in the Mayacamas Mountains. The three main tributaries to Mark West Creek are Windsor and Porter creeks, and the Laguna de Santa Rosa. Smaller significant tributaries include Mill, Humbug, Weeks, Van Buren, North Fork Mark West, and Neal creeks.

With a maximum elevation of approximately 2,350 feet, the watershed drains a portion of the Mayacamas Mountain Range in a general westward direction towards its confluence with the Russian River, which occurs at an elevation of roughly 30 feet. Longitudinally, the watershed's topography varies greatly. Towards its western boundary, the watershed encompasses a low relief valley area. The Rodgers Creek fault that runs northwest and lies approximately mid-watershed marks a noticeable topographic boundary at the foot of the Mayacamas Mountain Range (Figure 1; Sloop et al. 2007). From this point, the watershed begins to climb into rolling foothills and ultimately terminates in the steep-walled, narrow valleys of the mountainous headwater region along its eastern boundary (Honton and Sears 2006).

The watershed's land uses and land cover differ between the lower valley and upper mountainous region. Around the mid-19th century, the lower watershed underwent a conversion from a landscape dominated by oak savannah, seasonal and perennial wetlands, to a landscape structured around grazing and ranching; this later shifted to dairy farming, orchards, hay fields, and row crops (Honton and Sears 2006; Sloop et al. 2007). In the mid-20th century, rapid urbanization began to shift land use from agriculture (Sloop et al. 2007). Today, most of the lower watershed's land cover is dominated by urbanized land and irrigated cropland (predominantly vineyards), and to a lesser extent native hardwood forests, riparian forests, and grassland (CEMAR 2015).

Ranching and timber harvest were the major early land uses in the eastern mountainous region of the watershed (i.e., the upper watershed; Sonoma RCD 2015). Mirroring population growth and changes in the lower watershed, land use in the upper watershed began to shift in the mid-20th century when parcels were subdivided, allowing for the expansion of rural residential development (Sotoyome RCD 2008). Like the lower watershed, vineyards emerged as a dominant crop towards the end of the 20th century (Sonoma RCD 2015), although vineyard land cover by percentage area is far smaller in the upper watershed as compared to the lower watershed with approximately 2% and 37%, respectively[4]. Coniferous forest, hardwood forest, grassland, and shrubs presently dominate land cover in the upper watershed (CEMAR 2015; Sonoma RCD 2015). Approximately 90% of the land within the Mark West Creek subwatershed is privately owned.[5]

4.1 Target Species and Life Stages

Collectively, CCC steelhead, CC Chinook Salmon, and CCC Coho Salmon utilize the Mark West Creek subwatershed year-round to carry out the freshwater stages of their life histories. CCC steelhead and CC Chinook Salmon are both listed as threatened under the federal ESA, while CCC Coho Salmon are listed as endangered under both the ESA and CESA. Bjorkstedt et al. (2005) and Moyle et al. (2008) concluded that CCC steelhead within Mark West Creek exist as an essential, potentially independent population within the steelhead DPS. CCC Coho Salmon in lower Russian River tributaries, including Mark West Creek, exist as part of a single, functionally independent population that is at high risk of extirpation (NMFS 2008). NMFS (2008) suggests that, historically, CCC Coho Salmon populations in the lower Russian River were the most abundant population source for other streams within the CCC ESU. Accordingly, the persistence of CCC steelhead and CCC Coho Salmon populations in

[4] Vineyard land cover estimate from GIS analysis using the fine-scale vegetation and habitat map data from the Sonoma County Vegetation Mapping and LiDAR Program.
[5] Land ownership estimate from GIS analysis using data from the California Department of Forestry and Fire Protection, Fire Resource and Assessment Program (FRAP).

the Russian River is necessary to support the recovery of the species within their respective DPS/ESU (NMFS 2008). The Department identified the juvenile life stages of steelhead and Coho Salmon as the focus for this instream flow and habitat assessment project. Because the juvenile life stages of these species rear in the creek throughout the summer and fall months (Table 2), maintaining adequate streamflow conditions during this period is essential to support the species' recovery (NMFS 2008).

Table 2. Generalized seasonal periodicities of target salmonid species in upper Mark West Creek.

Species and Life Stages	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec
CCC steelhead												
Adult												
Juvenile												
CCC Coho Salmon												
Adult												
Juvenile												

Legend:	
	Present

Sources: Steiner (1996); R2 Resource Consultants, Inc. and Stetson Engineers, Inc. (2007); NMFS (2012); NMFS (2016).

Long-term systematic fish surveys are lacking within the Mark West Creek subwatershed (NMFS 2016). Several short-term studies have been conducted and observations have been noted during periodic habitat analyses conducted by the Department and other entities. Historically, steelhead were observed over a wide range of Mark West Creek where habitat remained wetted through the summer and fall seasons (CDFG 1953, 1966, 1969, 1971), though current densities are thought to be significantly reduced from observations noted through the 1950s to 1970s (NMFS 2016). Information on the historical presence and distribution of Coho Salmon within the Russian River watershed, and Mark West Creek, specifically, is much more limited (Spence et al. 2005; NMFS 2008). Nonetheless, both Brown and Moyle (1991) and Spence et al. (2005) found evidence from past stream surveys to conclude that Coho Salmon populations historically existed in Mark West Creek.

In the early 2000s, the Broodstock Program conducted surveys in the lower Russian River and found limited numbers of wild juvenile Coho Salmon in only five creeks, including Mark West (Conrad 2006). A study conducted by Merritt Smith Consulting (2003) during the summer and fall months from 1993-2002 observed small numbers of Coho Salmon across their three Mark West Creek study reaches in 2001 only. Steelhead were observed in moderate numbers in each of the study reaches in most years, with greater abundances in the upper watershed (Merritt Smith Consulting 2003). The SCWA also conducted electrofishing distribution/abundance surveys in Mark West

Creek to detect steelhead and Coho Salmon in 2001 and found only steelhead throughout the creek, with numbers increasing from the most downstream to upstream survey sites (Cook and Manning 2002).

4.2 Habitat Suitability and Biological Criteria

Accurate representation of available habitat in relation to discharge requires linking stream channel hydraulics, over a range of flows, with known habitat suitability criteria (HSC) for the target species and life stages (CDFG 2008). The target species and life stage for this project have been identified as juvenile CCC steelhead and juvenile CCC Coho Salmon. Appropriate HSC are a critical element of hydraulic habitat modeling. No site-specific HSC have been developed for the above listed species in the Russian River watershed.

The creation of suitable HSC requires a minimum sample size of fish observations (typically greater than 150 per life stage/species, mesohabitat category, and microhabitat component) while also accounting for the influence of habitat availability on observed habitat use (Bovee 1986). HSC are developed by associating fish observations with water depth, velocity, cover, and other important site-specific microhabitat components, ideally in systems that have a minimally altered flow regime. To accomplish this, field-based techniques including fish snorkel surveys and measurements/classification of physical habitat attributes are employed based on methods described by Holmes et al. (2014). General guidelines for HSC development can be found in Bovee (1986), Bovee and Zuboy (1988), and CDFG (2008).

Obtaining representative and unbiased information is an important step in developing HSC. There are two factors that make the development of HSC uncertain in Mark West Creek. First, Mark West Creek has an impaired hydrograph and can be subject to sustained low flow conditions. Because of this, hydraulic habitat availability and associated fish behavior observed in a HSC study may not be representative of ideal conditions since fish are unable to utilize preferred habitat. Second, estimates of current Coho Salmon populations within Mark West Creek have been very low and it would likely be difficult to observe the required sample size. Instead, HSC from two coastal California watersheds will likely be used to support the habitat analysis of juvenile CCC steelhead and CCC Coho Salmon life stages in Mark West Creek: the Big Sur River (Holmes et al. 2014) and the South Fork Eel River (to be completed in 2018/2019).

4.3 Hydrology

The watershed's Mediterranean climate is characterized by arid to semi-arid summers and punctuated storm events during the winter and spring months. Long-term meteorological data coverage in the Mark West Creek subwatershed is limited and records from existing monitoring stations often have short periods of record, contain significant data gaps, or are situated in the lower elevations of the watershed making it difficult to characterize precipitation patterns in the mountainous upper watershed (Woolfenden and Nishikawa 2014). Because precipitation within the watershed is strongly influenced by topography (Nishikawa 2013), many analyses rely upon PRISM (Parameter-elevation Regressions on Independent Slopes Model) datasets, which use elevation and nearby meteorological stations to interpolate precipitation values for ungaged locations. Average yearly precipitation values vary from about 30 inches in the valley floor to about 47 inches in the Mayacamas Mountains, with a watershed average of approximately 40 inches[6] (800m PRISM 30-year normal, 1981-2010). In a 2015 report, the Center for Ecosystem Management and Restoration (CEMAR) presented information from a landowner in the upper watershed who recorded an annual average of approximately 65 inches (1965-2011), indicating that the PRISM normals are likely underestimates, at least in the upper watershed (CEMAR 2015). Although winter temperatures may be conducive to snow formation at the higher elevations, nearly all of the precipitation in the watershed falls as rain (Nishikawa 2013). Rantz (1972) analyzed streamflow and precipitation records (1931-1970) in relatively undeveloped watersheds including nearby Mill and Santa Rosa creeks, and found that roughly half of the precipitation that fell in those watersheds was converted into streamflow.

Springs and seeps such as those that contribute to Neal Creek, a small tributary in the headwater region of Mark West Creek, play an important role in maintaining water connectivity and perennial flows within the upper watershed (Nishikawa 2013; CEMAR 2015). Some of the tributaries to Mark West Creek also maintain minimal perennial flows through the dry season, though the majority undergo significant drying and generally lose surface connectivity with Mark West Creek (SRPBAP 2014). Baseflow, which comprises only a small portion of the hydrograph in Mark West Creek, is an extremely important component of flow during the dry season (Nishikawa 2013). Results from the USGS Santa Rosa Plain Hydrologic Model (SRPHM)[7] indicate that surface runoff is the main component of the hydrograph in Mark West Creek from November through April, while baseflow is dominant from May through October (Woolfenden and Nishikawa 2014). CEMAR (2015) indicated their multiyear streamflow monitoring conducted in upper Mark West Creek showed that, while consistently low, flows were relatively more stable over the course of each dry season compared to other Russian River tributaries in their monitoring network.

As with many streams subject to the seasonality of Mediterranean climates, the timing of higher streamflow in Mark West Creek and other Russian River tributaries in the late winter and spring does not coincide with the high demand in the summer and fall dry seasons (Deitch and Dolman 2017). CEMAR (2015) found that total annual rainfall and discharge generally surpass demand; however, demand in the summer and fall exceeds surface water availability leading to a reliance on wells and springs to meet dry season

[6] PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, accessed September 2017.

[7] The SRPHM is a groundwater-surface water model that was developed by the USGS. It is used to characterize a water balance including streamflow, groundwater recharge and storage, and the impacts of diversions on these hydrologic components. The model utilized information and data collected during a hydrologic characterization of the Santa Rosa Plain completed by the USGS in 2013 (Nishikawa 2013).

water needs (Deitch and Dolman 2017). This reliance upon wells and springs can have cumulative impacts on baseflow and likely contributes to the low flow conditions observed throughout the dry season, especially during extended periods of low rainfall (SRPBAP 2014; CEMAR 2015; Sonoma RCD 2015). Results from the 2015 informational order (see Section 2) show dense concentrations of groundwater wells along areas of Mark West Creek and its tributaries (Figure 2).

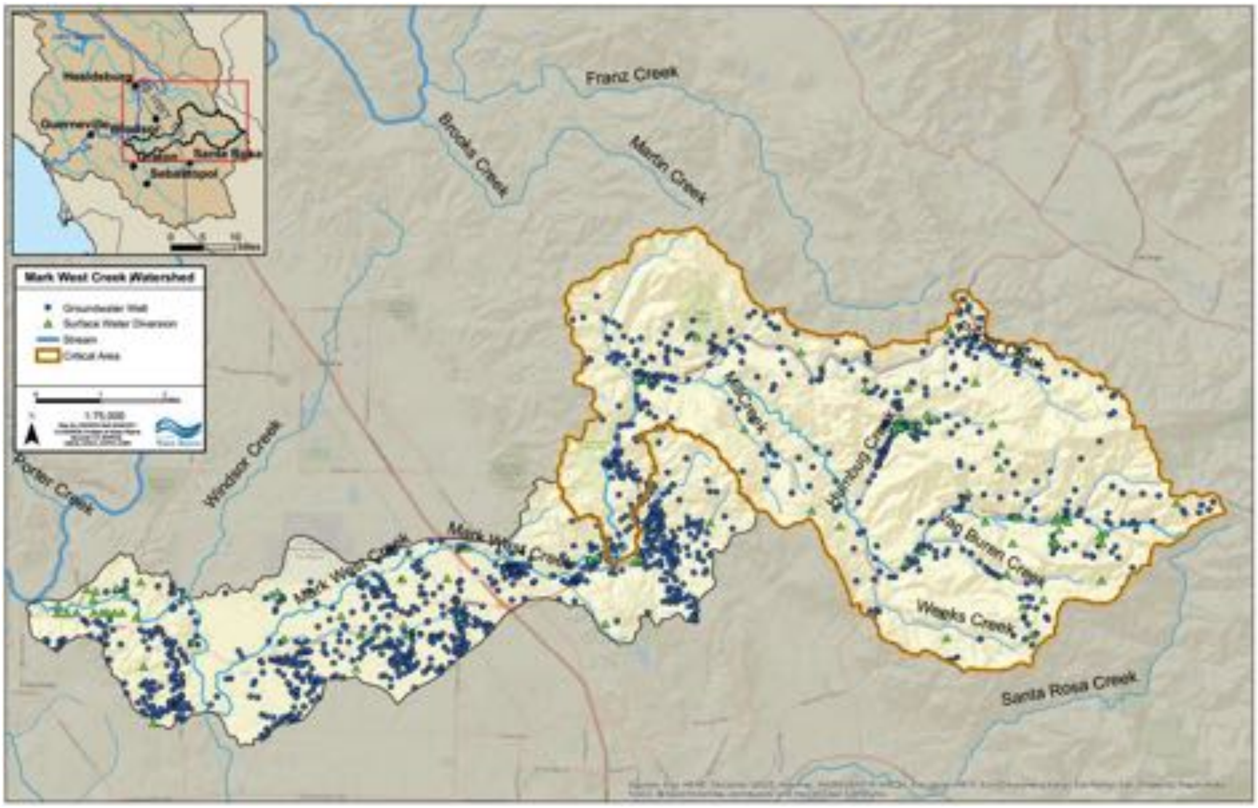

Figure 2. Diversions within the Mark West Creek subwatershed. Figure from SWRCB (2017).

Numerous streamflow gages have been operated across the Mark West Creek subwatershed (Figure 3 and Table 3), though meaningful hydrologic analysis is constrained by short periods of record, data gaps, and seasonal data collection (Sloop et al. 2007; Nishikawa 2013). A USGS gage near Mirabel Heights (USGS 11466800) has the longest period of record within the watershed, with approximately 12 years of data starting in the 2006 water year (WY). This gage is located downstream of Mark West Creek's confluence with two large tributaries, the Laguna de Santa Rosa and Windsor Creek. The lack of flow information for these contributing tributaries means the amount of flow originating from upper Mark West Creek cannot accurately be discerned. CEMAR has operated three gages to varying lengths during WY 2010-WY 2017. One of these gages, MW01, is located high in the watershed near Tarwater Road. This gage provides the best available indicator of conditions in the upper watershed during the dry season. Average daily streamflow at MW01 has generally dropped below 1 cubic foot per second (cfs) by May or June. The minimum and maximum average daily summer flows captured at MW01 over the period of record were 0.06 and 11.8 cfs, respectively. The mean and median average daily flows during the same period were 0.41 and 0.22 cfs, respectively. The lack of a long-term, year-round gage network throughout the watershed makes it difficult to assess flow regimes and to understand how the range of flows can affect biological processes and species recovery in the creek (Honton and Sears 2006).

Figure 3. Streamflow monitoring gages in the Mark West Creek subwatershed.

Table 3. Streamflow monitoring gages within the Mark West Creek subwatershed.

Operator	Gage Identifier	Period of Record	Notes
USGS	11466800 Mark West Creek near Mirabel Heights	October 2005-Present	Some small data gaps in record, and a large gap for most of WY 2010. Gage sometimes influenced by backwatering from Russian River during high flows.
NMFS	Mark West Creek at River Road	November 2011-Present	Significant data gaps.
USGS	11465500 Mark West Creek near Windsor	October 2006-April 2008	Significant data gap in second half of WY 2007.
USGS	11465450 Mark West Creek at Mark West Springs	1958-1962	Peak annual discharges only.
CEMAR	MW02 Mark West Creek above Porter Creek	May 2010-Present	Record covers mostly low flow periods. Significant recent data gaps.
NMFS	Mark West Creek at Calistoga Road	October 2011-Present	Discharge extrapolated above 30 cfs. Some data gaps.
CEMAR	MW01 Mark West Creek below Tarwater Road	March 2010-Present	Early records were mostly year-round with discharges estimated below 50 cfs only. Some small data gaps. Since WY 2015, only seasonal low flow measurements taken.
CEMAR	MW06 Mark West Creek at Neal Creek	June 2011-November 2014	Record covers mostly low flow periods. Some small data gaps.

Long-term unimpaired streamflow records are generally used by the Department IFP to aid in the determination of a range of representative target flows for field data collection. The lack of long-term gages in the Mark West Creek subwatershed, as well as the surrounding watersheds, complicates the unimpaired streamflow determination. Given this, to identify target flows for data collection in upper Mark West Creek the Department intends to select an appropriate range of flows based on unimpaired average monthly flow estimates (1950-2015) from the California Natural Flows Database[8] (CNFD; Zimmerman et al. 2017). The unimpaired average monthly flow estimates in the stream reach (COMID 8272495) located near the CEMAR MW01 gage will serve as the basis for a flow duration analysis, which estimates the likelihood of a particular discharge value being equaled or exceeded (referred to as an exceedance flow; CDFW 2013b; Searcy 1969). The unit of time used to calculate exceedance flows affects the utility of the flow duration curve (i.e., a shorter time unit will result in a greater representation of flow variability). The CNFD only provides average monthly unimpaired flow estimates. While exceedance calculations using the average monthly estimates may result in diminished flow variability, the CNFD provides the best available information for calculating target flows. Target flows for data collection on upper Mark West Creek will likely fall within the 20 to 80 percent exceedance flow range (CDFW 2013b). The 20, 50, and 80 percent exceedance flows estimated for this reach of upper Mark West Creek are 23.5, 2.9, and 0.5 cfs, respectively.

4.4 Groundwater Hydrology

The Mark West Creek subwatershed overlies three groundwater subbasins identified in the Department of Water Resources' (DWR) Bulletin 118 (DWR 2003), though the subbasins' areal extent within the watershed varies. The upper Mark West Creek subwatershed overlies small sections of both the Rincon Valley Subbasin (1-55.03) and the Alexander Subbasin (1-54.01). Most of the lower Mark West Creek subwatershed overlies the Santa Rosa Plain Subbasin (1-55.01). In addition to these named subbasins, small, localized aquifers likely exist within the alluvial deposits along the stream channels in the middle watershed (Nishikawa 2013). The Sonoma Volcanics, which comprise a significant portion of the Mayacamas Mountains in the upper watershed, can also contain disconnected aquifers within fractured or porous strata (Cardwell 1958; Nishikawa 2013). Groundwater that discharges from springs and seeps provides a significant source of baseflow in parts of Mark West Creek (Nishikawa 2013), especially within the Sonoma Volcanics (Cardwell 1958).

The geologic heterogeneity surrounding Mark West Creek, especially in the mountainous upper watershed, results from the numerous fault zones that traverse the area as well as the interaction between the North American and Pacific tectonic plates that formed the Mayacamas Mountains and northern California Coast Ranges (SRPBAP 2014; RRISRP 2016). The interactions that result from the juxtaposition and

[8] The California Natural Flows Database was a collaborative effort between the USGS and The Nature Conservancy to develop estimates of natural (unimpaired) flows for all of the streams in California from 1950-2015 (Zimmerman et al. 2017).

interfingering of these geologic units can affect groundwater flow and yields (Nishikawa 2013). For example, evidence suggests that Mark West Creek likely gains streamflow near the Rodgers Creek fault zone, where shallow groundwater originating in the mountainous upper watershed mounds and discharges to the creek as a result of the horizontal flow barrier (SRPBAP 2014).

Several surficial geologic units are present in the upper Mark West Creek subwatershed including Quaternary Alluvium, the Sonoma Volcanics, and the Franciscan Assemblage (Nishikawa 2013; CEMAR 2015); the Sonoma Volcanics are the dominant unit in terms of areal coverage (Nishikawa 2013). The Sonoma Volcanics are generally porous and can be highly fractured in areas, allowing for development of wells (RRISRP 2016), though their yield is highly variable and is dependent upon the extent of fracturing (Cardwell 1958; Nishikawa 2013). Due to the inconsistent fracturing within the Sonoma Volcanics, determining the direct impacts of groundwater pumping is difficult (CEMAR 2015). Although domestic wells have tapped into areas of fractured bedrock that underlie the Sonoma Volcanics, the existence of groundwater within the Franciscan complex is much more limited and the wells consistently have low yields (Nishikawa 2013). Where wells exist in the upper Mark West Creek subwatershed, the alluvial deposits generally consist of coarse material (Nishikawa 2013), which leads to higher streambed conductivities and a greater potential for groundwater-surface water interactions (SRPBAP 2014).

Lower in the watershed, both the Sonoma Volcanics and the Glen Ellen Formation outcrop in the area surrounding the Rodgers Creek fault zone (SRPBAP 2014). In the lower Mark West Creek subwatershed, the valley is comprised of quaternary alluvium and loosely consolidated alluvial deposits of the Glen Ellen Formation (SRPBAP 2014). Well pumping yields within the Glen Ellen Formation are highly variable (DWR 1975) and the alluvial deposits are generally comprised of finer material than those found in the upper Mark West Creek subwatershed, leading to lower conductivities and infiltrative capacity (SRPBAP 2014).

4.5 Connectivity

Low streamflow can limit the hydrologic connectivity of riverine habitats, impacting water quality, food production, and critical salmonid life history strategies. Salmonids have learned to survive in systems with long low flow periods by rearing in deep pools and runs throughout the summer and fall months (Moyle 2002; CDFG 2004). Disconnected stream segments can prevent juvenile salmonids from relocating to suitable over-summer holding habitat having adequate cover and water quality conditions. Due to various factors such as climate, water diversions, antecedent precipitation, and groundwater-surface water interactions, sections of Mark West Creek become disconnected during the dry season. Merritt Smith Consulting conducted seasonal fisheries surveys from 1993-2002 along three reaches of Mark West Creek and observed that the reach in the upper watershed downstream of Calistoga Road occasionally became intermittent in the late spring and summer months, forcing fish to rear in isolated pools (Merritt Smith Consulting 2003).

The watershed's Mediterranean climate and lack of precipitation during summer months is a significant factor contributing to seasonal low flows and intermittence in Mark West Creek (CEMAR 2015). Additionally, springs and seeps that help maintain stream connectivity in the upper watershed are frequently diverted during the dry season when streamflow is already naturally low. While unintentional, baseflow may be impacted by the cumulative impact of diversions, depending on the extent of groundwater-surface water interconnection (CEMAR 2015).

In 2013, the UC Cooperative Extension added Mark West Creek to their list of streams monitored for wetted habitat conditions (wet/dry mapping)[9] during the low flow period. The objective of the wet/dry mapping effort is to document the extent and location of wet, dry, and intermittent instream habitat during the driest period of the year, which usually occurs in September. The effort has indicated that Mark West Creek remains wetted through most of the middle and upper watershed, though streamflow remains low. In the alluvial reach near the Porter Creek confluence (middle watershed), Mark West Creek has experienced dry or intermittent conditions each year since 2013, with the exception of 2014.

4.6 Geomorphology

The Mark West Creek subwatershed is situated within the Northern Coast Range geomorphic province. The Mayacamas Mountain Range that comprises much of the terrain in the upper Mark West Creek subwatershed was formed as a result of complex tectonic interactions between the North American and Pacific plates. Mark West Creek and its tributaries have eroded the Mayacamas Mountains over time, transporting and depositing sediment into the mountain valleys and alluvial fan in the valley below. The northwest trending Rodgers Creek fault zone acts as a rough boundary between the sediment production zone of the upper watershed and the depositional zone in the valley floor (Sloop et al. 2007).

Hydrologic soil group classifications (NRCS 2007), which are based on soil properties such as permeability and soil thickness, can be a useful tool in understanding a watershed's response to precipitation. In general, soils in the lower portion of the watershed have low-moderate runoff potential, while soils in the mountainous upper watershed are thinner with a significant amount of exposed bedrock, leading to a moderate-high runoff potential (Nishikawa 2013). Landscape alteration and disturbance can also affect runoff, erosion processes, and sediment transport. Historical landscape changes in the Mark West Creek subwatershed such as road development, timber harvest, and rural subdivisions, as well as shifting land use practices (e.g., grazing and vineyard development), have contributed to higher rates of runoff and sedimentation (Sloop et al. 2007; Sonoma RCD 2015).

[9] Information on wet/dry mapping available at: https://caseagrant.ucsd.edu/project/coho-salmon-monitoring/flow-and-survival-study.

The upper and middle portions of the watershed are comprised of moderate gradient channels that drain steep hillsides (Nishikawa 2013). In the valley floor, as Mark West Creek traverses its alluvial fan, the channel assumes a more modified character with a relatively straight, channelized, and entrenched channel (RRISRP 2016). An analysis of generalized stream typologies presented in the 2016 RRISRP report, developed by Walls (2013), suggests that five different stream types exist within Mark West Creek: dissected alluvium, unconfined alluvial, alluvial fan, semiconfined alluvial, and bedrock canyon. The alluvial channel forms are dominant in the valley floor up to the transition zone near the Rodgers Creek Fault. With the exception of a dissected alluvium channel downstream of the Porter Creek confluence, bedrock canyons and semiconfined alluvial channels dominate the upper watershed (RRISRP 2016).

Few on-the-ground assessments of the stream channel have been completed in Mark West Creek; the most recent watershed-wide mainstem survey was conducted by the SCWA in 1996 (CDFG 2006). The surveyors identified six different reaches and channel types from the downstream extent up to the Neal Creek confluence: F4, F2, B2, B3, C3, and B1-2 (Table 4). Flatwater habitat was the dominant Level II habitat type and comprised approximately 50% of the stream length, followed by approximately 40% pool habitat, 8% riffle habitat, and 1% dry channel (CDFG 2006).

Table 4. Mark West Creek channel types, presented from downstream to upstream.

Channel Type	Description
F4	Entrenched, meandering riffle/pool channel with low gradient and high width/depth ratio; gravel-dominated substrate
F2	Entrenched, meandering riffle/pool channel with low gradient and high width/depth ratio; boulder-dominated substrate
B2	Moderately entrenched, riffle-dominated channel with moderate gradient; boulder-dominated substrate
B3	Moderately entrenched, riffle-dominated channel with moderate gradient; cobble-dominated substrate
C3	Low-gradient, meandering, riffle/pool alluvial channel with well-defined floodplain; cobble-dominated substrate
B1-2	Moderately entrenched, riffle-dominated channel with moderate gradient; boulder- and bedrock-dominated substrate

Source: Rosgen (1994).

Following two landslides that contributed large amounts of fine sediment to upper Mark West Creek in the mid-2000s, Li and Parkinson (2009) assessed instream habitat in a small section of the upper watershed from Tarwater Road up to the confluence with North Fork Mark West Creek. In this assessment, pools were identified as a the dominant Level II habitat type and comprised approximately 68% of the stream length, followed by approximately 20% riffle habitat, 11% flatwater habitat, and 1% dry channel (Li and Parkinson 2009).

4.7 Water Quality

Pursuant to section 303(d) of the Clean Water Act, the State Water Board is responsible for assessing, protecting, and restoring surface water quality and submitting a list of impaired water bodies to the U.S. Environmental Protection Agency (EPA). The State Water Board has listed Mark West Creek and its tributaries upstream of the confluence with the Laguna de Santa Rosa as 303(d) impaired water bodies for sedimentation and temperature. Downstream of the confluence with the Laguna, Mark West Creek is also impaired for aluminum, dissolved oxygen, phosphorous, and manganese.

The NMFS Multispecies Recovery Plan (2016) also rates the entirety Mark West Creek as poor for temperature and watershed processes/sediment transport as they relate specifically to the rearing life stage of juvenile steelhead. Because juveniles rear in the creek throughout the year, Moyle (2002) and NMFS (2008) highlight the importance of maintaining temperatures below approximately 57°F, the maximum optimal temperature for rearing steelhead and Coho Salmon. Additionally, Reiser and Bjornn (1979) and Moyle (2002) note that high levels of suspended fine sediments can adversely impact rearing habitat and food availability, and can negatively impact survival by damaging the gills of juvenile fish. In an attempt to help address impairments caused by sediment, Pacific Watershed Associates assessed approximately half of the unpaved roads in the upper Mark West Creek subwatershed for potential sediment delivery sites (Sonoma RCD 2015). Other water quality related assessments in the watershed have generally been short-term and sporadic in nature, focused mainly on temperature. In general, targeting the causes of temperature-related impairments has been difficult. The Sonoma Resource Conservation District (RCD) noted that temperature loggers deployed over several years in reaches along St. Helena Road have consistently recorded water temperatures below 70°F through the low flow season, whereas temperatures lower in the creek near the Porter Creek confluence are significantly warmer, typically surpassing 70°F by mid-June (Sonoma RCD 2015). In the lower reaches, it is suspected that the higher temperatures result from lack of riparian canopy cover (NMFS 2016) and cold-water spring inputs (Sonoma RCD 2015).

4.8 Tubbs Fire

In October 2017, the Tubbs Fire burned approximately 57 square miles across sections of Napa, Sonoma, and Lake counties, including approximately 22 square miles (37%) of the Mark West Creek subwatershed. The burn area spanned the entire north-south extent of the watershed and was concentrated from just west of Highway 101 to Calistoga and Petrified Forest roads to the east. In addition to water quality and biological impacts, the fire may affect the hydrology of Lower Mark West Creek. Depending on the upslope burn severity, CalFire (2017) predicted that the 10%

exceedance flow (CDFW 2013b) in reaches of Mark West Creek could increase anywhere from 9-25%. Due to the likelihood of channel instability (e.g., channel aggradation) after the Tubbs fire, the potential study area has been constrained to the reaches of Mark West Creek above Calistoga Road (Figure 4).

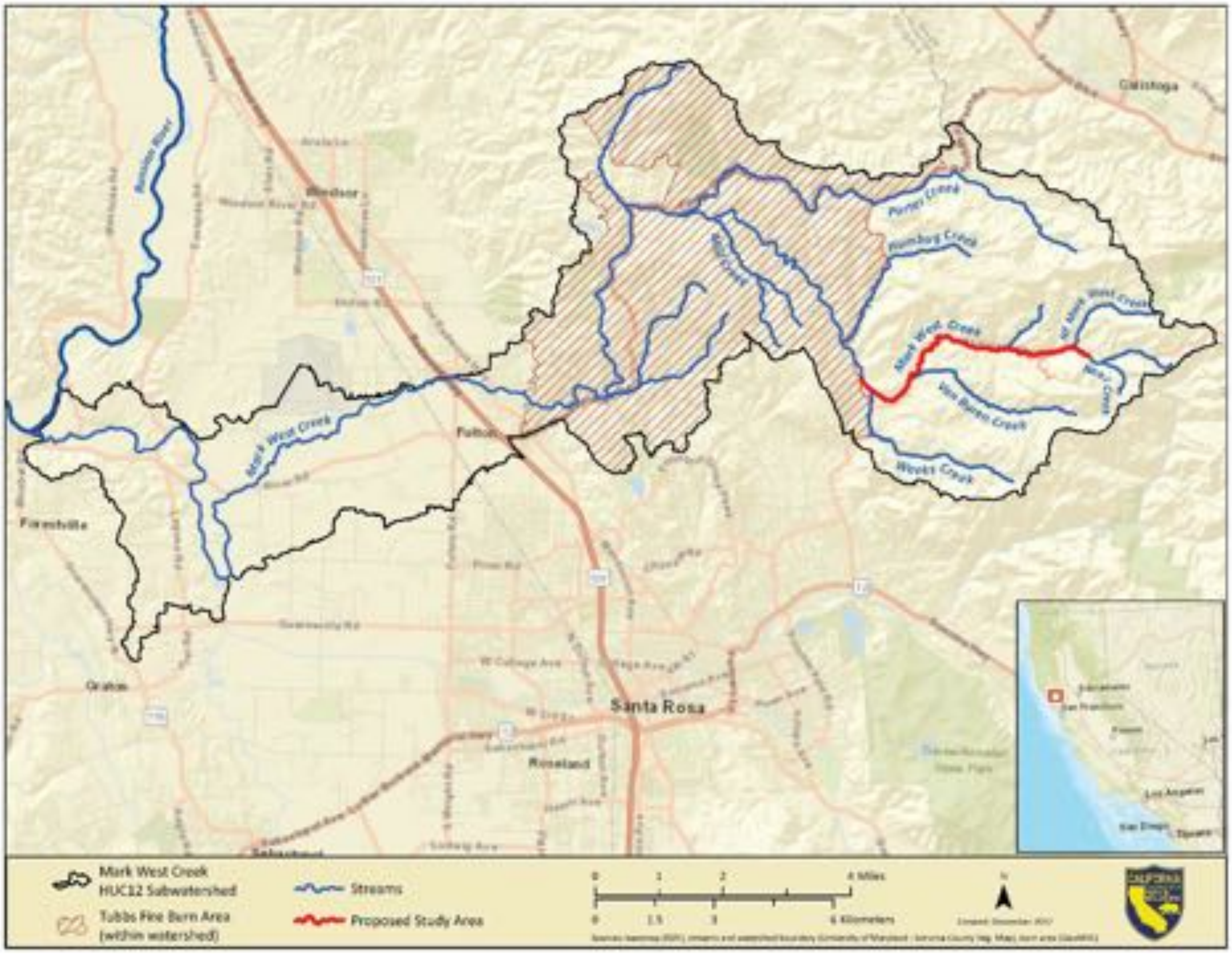

Figure 4. Map of the Mark West Creek subwatershed showing the Tubbs Fire burn area and the proposed study area.

5.0 METHODS AND PROTOCOLS

Department staff will conduct a stream survey within upper Mark West Creek following the Level III-IV (i.e., modified Level III) habitat type survey classifications, as described in the *California Salmonid Stream Restoration Manual* (Flosi et al. 2010) to identify mesohabitat types (CDFW 2015a). A corresponding discharge measurement (CDFW 2013a) will be measured each day of the survey; data will only be collected where landowner access is granted. Upon completion of the survey, the modified Level III mesohabitat classifications will be grouped into riffle, pool, run, or glide categories. The classification of different habitat types is based on characteristics such as channel morphology, gradient, substrate composition, and hydraulic characteristics. The assemblage and overall proportion of each mesohabitat type will help guide site selection for hydraulic habitat modeling (CDFW 2015c).

Mesohabitats were mapped using the on-the-ground method and are typed to the most detailed level III-IV typing as described in Flosi et al. (2010). This level of habitat delineation allows data to be used for other studies or aggregated into less detailed levels depending on the needs of individual studies (e.g. hydraulic habitat modeling). These surveys entail the identification of habitat types using specified criteria, along with measurements of habitat unit length and maximum pool depth for pool units. In addition, landmarks such as road crossings, bridges, and significant streambank alterations are noted.

Each habitat unit will be characterized as modelable or unmodelable according to the limitations of standard one-dimensional (1D) and two-dimensional (2D) hydraulic modeling methods. Modelable, in this context, is a term used to characterize a habitat unit's hydraulic properties and refers to whether the unit's water surface along a hypothetical transect would remain steady and flat over a broad enough range of flows to develop a predictive model. This characterization is necessary for the dataset to be compatible with stratified study site and transect selection techniques, where unmodelable mesohabitat units may be rejected prior to the selection process.

Below is a list of modified Level III mesohabitat types containing sufficient detail for the purpose of transect placement, hydraulic data collection, and transect weighting consistent with stratified sampling for hydraulic habitat modeling. The following mesohabitat types are generally considered modelable and should be retained for study site and transect selection:

- Pool (e.g., mid-channel, lateral scour, channel confluence)
- Glide
- Run/Step-run
- Pocket Water
- Low-Gradient Riffle

The following mesohabitat types are generally considered unmodelable and should be excluded from study site and transect selection:

- Cascade
- Chute
- High-Gradient Riffle

For hydraulic data collection, cascade and chute types are not sampled. High-gradient riffles may occasionally be sampled, but the determination must be done on a case-by-case basis.

Ideally, surveys will be conducted under flow conditions at which the mesohabitat types are readily apparent. That is, not when flows are so high that it appears as though all unit types are either runs or riffles or so low that there are only pools with undifferentiated riffles in between. For safety purposes, the survey team(s) will consist of at least two staff members familiar with salmonid habitat requirements. Team members will already have experience with or will have received recent training in habitat typing methods. At least one member of each survey team should be sufficiently experienced with hydraulic habitat modeling to classify each mesohabitat unit as modelable or unmodelable, irrespective of mesohabitat unit type.

5.1 Single Transect Hydraulic Based Habitat Methods

Single transect hydraulic based habitat methods require site-specific data to be collected along one or more transects within a stream reach. The site-specific data are used with a computer program to model hydraulic parameters. Single transects are placed across the shallow portion (i.e., hydraulic control) of representative riffles. Single transect hydraulic based habitat methods assume that if adequate conditions are maintained over the shallow portions of a stream reach, then the hydraulic habitat in other parts of the stream reach will also be sufficient (Annear et al. 2004).

5.1.1 Habitat Retention Method

The Habitat Retention Method (HRM; CDFW 2016) is a single-transect biology-based method (Nehring 1979) used to estimate hydraulic characteristics (i.e., average depth, average velocity, and percent wetted perimeter) over a range of flows. The HRM quantifies a minimum flow, sufficient to provide a basic survival level for fish during times of the year when streamflow is at its lowest (Annear et al. 2004). With a goal of sampling at least three representative riffles per reach, the method assumes that if a prescribed flow adequately meets hydraulic criteria at the shallowest part of the riffles (i.e., the hydraulic control), then conditions throughout the remainder of the reach should also be sufficient (Nehring 1979; Annear et al. 2004). The HRM may also be used to evaluate fish passage and/or habitat connectivity flows at riffle sites.

5.1.2 Wetted Perimeter Method

The Wetted Perimeter Method (WPM) is used to determine flows that support the maintenance of benthic macroinvertebrate (BMI) habitat and productivity in riffles with rectangular streambed profiles. The WPM is typically applied during the summer and/or fall low flow months (Annear et al. 2004, CDFW 2013d). The wetted perimeter refers to the perimeter of a cross-sectional area of the wetted streambed along a transect, which varies according to discharge. After collecting WPM data and corresponding discharges, a relationship between discharge and wetted perimeter can be developed. Historically, application of the WPM required collecting data over an expansive range of discharge events to determine the relationship between wetted perimeter and discharge at each site. Recent applications of the WPM generally use computer-based water surface profile modeling programs based on the Manning's equation to develop this relationship (Annear et al. 2004). Using the graphical relationship between wetted perimeter and discharge, the inflection point on the wetted perimeter/discharge curve is identified as a threshold where it is assumed that the corresponding flow can protect BMI production at an adequate level to sustain fish populations (Annear et al. 2004).

5.2 Hydraulic Habitat Modeling

Hydraulic modeling, in conjunction with depth, velocity, and substrate/cover criteria for the target fish species and life stage(s) can be used to determine the relationship between streamflow and suitable habitat. One-dimensional or two-dimensional hydraulic-based habitat models are designed to predict hydraulic conditions within a reasonable range of flow levels that are not sampled. Study site selection for 1D or 2D modeling will depend on reach access, the need for applying a 2D model, and channel complexities identified through habitat mapping.

Any currently available standard software package that meets the standards set by Waddle (2000) can be used for 1D habitat modeling. Except in reaches with highly complex channel hydraulics, reaches of most river channels can be adequately evaluated with standard 1D hydraulic models such as those found in PHABSIM (Waddle 2001), SEFA (Payne and Jowett 2012), or similar programs.

In highly complex channels where depth and velocities cannot be accurately predicted using a single transect approach, a 2D hydrodynamic model is often used to predict flow characteristics and features of ecological importance (Crowder and Diplas 2000; Waddle 2010). While virtually any available 2D model can be used for hydraulic assessment, the modeling software River2D (Steffler & Blackburn 2002) is frequently used by the Water Branch. River2D has the ability to evaluate fish passage criteria for depth and velocity along with site-specific topographic features to produce relationships between flow and habitat suitability or passage conditions.

5.3 Single Transect Hydraulic Based Habitat Method Data Collection

Department staff identify representative riffle sites for HRM and WPM that are representative of the overall geomorphic structure and shape of the reaches of interest within the study area (CDFW 2016). Once sites are selected, cross-sectional transects are established along the hydraulic control of each riffle with a measuring tape and a headpin and tailpin positioned on the left bank and right bank, respectively. The pins are placed at or above the bankfull elevation. For the purposes of this method, bankfull elevation is defined as the location where the vegetation emerges at the toe of the bank, there is a change in slope along the cross-sectional channel profile, and/or there is a change in substrate composition from coarser to finer material (CDFW 2016). Bed elevations are measured along each transect using an auto level and surveying stadia rod at one-foot intervals following the procedures set forth in the Department’s standard operating procedure (SOP) for Streambed and Water Surface Elevation Data Collection (CDFW 2013c). Smaller increment measurements are taken in areas with highly variable bed topography. In addition, water surface elevations (WSELs) are measured mid-channel and near each bank to determine the water surface profile along the transect (CDFW 2013c). The length of the riffle along with WSELs measured near the left and right bank at the downstream extent of the riffle are used to compute the water surface slope. A temporary staff gage is used to monitor the stage at the beginning and end of each data collection event to ensure that flow levels do not fluctuate during the course of data collection. A discharge measurement is taken for each transect using a flow meter and top setting wading rod (CDFW 2013a), or if one exists, flow data from a nearby stream gage can be paired with the date and time the transect was surveyed. Discharge measurements are then associated with the survey data to estimate hydraulic properties using Manning's equation for open channel flow.

Along with the measured discharge (Q) and calculated channel slope (S), the bed elevation data are used to calculate the flow area (A), wetted perimeter (P), and hydraulic radius (R) for the cross-section. These values are then used to calculate the Manning's roughness coefficient (n) using the Manning's equation for open channel flow, given below:

$$Q = \left(\frac{1.486}{n}\right) AR^{\frac{2}{3}}S^{\frac{1}{2}}$$

While several programs are capable of modeling these hydraulic parameters, the Department generally uses the commercially available software program Hydraulic Calculator (HydroCalc; Molls 2008). HydroCalc is based on the Manning's equation and can be used to develop discharge rating curves in addition to estimating the listed hydraulic parameters (see HRM SOP for procedures; CDFW 2016).

For HRM, when the criteria for average depth and at least one other parameter are met (Table 5), flows are assumed to be adequate for habitat connectivity and aquatic ecosystem habitat maintenance. For the WPM analysis, a relationship between discharge and wetted perimeter is developed (CDFW 2016). The breakpoint and incipient asymptote (curve inflections), are identified as thresholds of desired habitat conditions. These curve inflections (i.e., the breakpoint and incipient asymptote) are used to determine the instream flow needs necessary to maintain riffle habitat and production of benthic macroinvertebrates.

Table 5. Key flow parameters used to determine flow criteria in riffle habitats using the HRM.

Bankfull Width (ft)	Average Depth (ft)	Average Velocity (ft/sec)	Wetted Perimeter (%)
1-20	0.2	1.0	50
21-40	0.2-0.4	1.0	50
41-60	0.4-0.6	1.0	50-60
61-100	0.6-1.0	1.0	70

Sources: Nehring 1979; CDFW 2016

5.4 Hydraulic Habitat Modeling Data Collection

The number and range of river flows, mesohabitats, reaches, and transects sampled within river segments influence the extrapolation range, representativeness, applicability, reliability, and utility of any model. It is critical that discharges, mesohabitats, and microhabitats are effectively sampled in order to develop usable 1D and/or 2D simulations. The Department's standard for 1D analyses is to include: a) sampling of at least three distinct river flows; b) sampling of three units of each significant mesohabitat type within each generally homogeneous river segment; and c) for simulations, at least three transects within each mesohabitat unit. The actual number of flows, mesohabitats, or transects sampled may be dependent upon the complexity of riverine conditions, the length of homogeneous reaches, the study objectives, and landowner access. In specific cases, it may be appropriate to sample less or more than three replicates of each mesohabitat unit, three microhabitat transects per unit, and/or water depth and velocity characteristics at a range of at least three flows.

Hydraulic and structural parameters are measured using a combination of standard techniques from the U.S. Fish and Wildlife Service (USFWS) methodology (Trihey and Wegner 1981; Bovee 1982; Bovee 1997; Bovee et al. 1998; USFWS 2011). The data collected at the upstream and downstream transects at each site (i.e., site boundaries) include: 1) WSELs; 2) wetted streambed elevations; 3) dry ground elevations to points above bankfull discharge; 4) mean water column velocities measured at the points where bed elevations are taken; and 5) substrate and cover classification at locations where wetted streambed and dry ground elevations are surveyed (CDFW 2013c; CDFW 2015c). If there is a hydraulic control downstream of a given transect, differential leveling is used to survey the stage of zero flow, which is found in the thalweg downstream of the transect.

Each cluster of transects, or each transect if need be, should have a corresponding discharge that accurately represents the conditions at the time of survey. A temporary staff gage is used to monitor the stage at the beginning and end of each data collection event to ensure that flow levels do not fluctuate during the course of data collection.

Continuously recording water level loggers may be deployed in certain reaches to monitor changes in stage during calibration measurements. Bed topography, substrate data, instream/overhead cover, water surface elevations, velocity profiles, and associated discharges are collected.

Two-dimensional hydrodynamic models use depth-averaging techniques to simulate water depth and velocity in sites with complex flow patterns. Data collection for 2D models consists of detailed bed elevations, horizontal position, estimates of substrate composition, and instream/overhead cover. Transects at the upstream and downstream extent of a site are established and used to define the boundary conditions, which are determined by water stage, flow, and channel roughness. Channel roughness is an important hydraulic parameter that is characterized in the model by the bed topography and, to a lesser degree, the substrate size estimates. The upstream boundary requires an accurate inflow amount and the downstream boundary requires a corresponding WSEL for the given inflow. The bed topography data are collected with a total station and/or Real Time Kinematic Global Positioning System (RTK GPS) surveying equipment. Bed topography data are collected at a higher point density in areas with highly variable topography and patchy substrate and cover, and at a lower point density in areas with more uniform topography, substrate, and cover. Topography data are collected at a distance of one channel width upstream of the upstream transect to improve the accuracy of the flow distribution at the upstream end of the sites.

5.5 Hydraulic Habitat Modeling

One-dimensional hydraulic modeling procedures, appropriate to the study site, will be used to model water surface elevations and velocities at each selected cross-section. For WSELs, these procedures include the development of stage-discharge rating curves using log-log regression, hydraulic conveyance (MANSQ or similar), and/or step-backwater models (e.g., WSP, HEC-RAS); direct comparison of results; and selection of the most appropriate and accurate method. Water velocities will be simulated using the Manning's n method of velocity distribution across all transects, with calibrations generally consisting of correction of over- or under-simulated velocities at individual sample points (i.e., velocity adjustment factors, or VAFs). Data file construction, calibration, simulation, reporting, review, and consultation will follow standard procedures and guidelines.

Mesohabitat types are weighted and combined to develop a representation of hydraulic characteristics and fish habitat suitability for each 1D reach or sub-reach. Mesohabitat weighting is based on the relative proportion of each of the modeled mesohabitats within the reach or sub-reach. A final habitat index for each study site is produced by combining hydraulic simulations over a range of flows with HSC for the target species and life stage(s). Any currently available standard software package that meets the standards set by Waddle (2000) can be used for 1D habitat modeling.

Two-dimensional model calibration consists of adjusting the roughness values in the model until a reasonable match is obtained between the simulated water surface elevations and the surveyed water surface elevations as well as the channel's wetted edge measurements taken along the study site at a given flow. Models may be calibrated at a single flow and then validated at the two other flows, or the model can be calibrated at each measured flow.

Once calibrated, the downstream water surface elevation and the inflow to the 2D model site are changed to simulate the flows of interest. Each modeled flow is then run to a steady state solution. That is, for a constant inflow to the site, the model is run until there is a constant outflow and the two flows are essentially equal. Typical convergence tolerance is 1% of the inflow. Another measure of convergence is the solution change. Ideally the solution change will become sufficiently small (e.g., 0.00001) once converged. In some cases, the solution change will reach a relatively small value and refuse to decrease any further indicating a small, persistent oscillation at one or more points. This oscillation is often associated with a shallow node that alternates between wet and dry. This oscillation may be considered acceptable if the size of the variation is within the desired accuracy of the model (Steffler and Blackburn 2002).

At least 50 randomly selected paired depth and velocity measurements are collected (in addition to the depths and velocities measured along the upstream and downstream transects) to validate the 2D model[10] (USFWS 2011). The locations of the validation measurements will be distributed randomly throughout the site. The flow present during validation data collection will be determined from gage readings, if gage data are available. If gage data are not available, staff will measure the flow during validation data collection.

The fish habitat component of River2D is based on the same habitat index utilized in standard 1D models. The habitat index for the entire site is calculated by expanding the composite suitability index for every point in the model domain with the area associated with that point, and then summing those values for all points. The composite suitability is calculated as the product of suitability values for depth, velocity, and channel index (cover and substrate codes). The output includes node characteristics of habitat suitability values for depth, velocity, channel index (substrate and/or cover), and combined parameters at a number of flows for each species and life stage of interest. Model outputs at selected flows will also include image files of the plan view showing any change in suitability for each habitat parameter for each species and life stage.

The habitat index versus discharge function is a static relationship between discharge and habitat that does not represent how often a specific flow/habitat relationship occurs. For this reason, in many cases the index alone should not be considered the final result of a 1D or 2D model. A more complete analysis is known as a habitat time series (HTS) analysis. A HTS analysis integrates the habitat index versus flow function with hydrology to provide a dynamic analysis of flow versus habitat. Results of the HTS are

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[10] 2D model calibration and validation will follow USFWS (2011) standards, as discussed in Section 6.1 Quality Assurance.

most useful when the broadest possible range of hydrology is used for the model. For this reason, it may be necessary to extend the stage-discharge rating curve beyond 2.5 times the highest calibration flow with additional stage-discharge measurements made during field data collection to support the analysis.

5.6 Temperature Monitoring

Water temperature data may be collected and evaluated as part of this study. Water temperature data would be recorded at a frequency of no less than hourly measurements at key locations throughout the study reaches using digital HOBO®, Solinst®, or TidbiT® data loggers. TidbiT® data loggers are used where water depths are anticipated to be too shallow to use the larger HOBO® or Solinst® loggers. Calibration, placement, sampling interval, and data processing of the logger data is done in a manner consistent with guidance provided by the U.S. Department of Agriculture (Dunham et al. 2005). Data loggers are generally placed in secured stilling wells or anchored to exposed roots along the banks of the creek in pool habitats using plastic cable zip ties. Suspending the loggers prevents them from being buried by sediment and keeps the instruments out of sight to avoid tampering by humans and/or animals. Any temperature data collected may be combined with existing temperature monitoring data when appropriate to assess temperature and discharge relationships during the rearing period.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

All field equipment, including the Marsh-McBirney and HACH FH950 flow meters, will be calibrated according to manufacturer's instructions before data collection begins. Discharges will be measured following the protocols set forth in the SOP for Discharge Measurements in Wadeable Streams (CDFW 2013a). Velocities will be measured to the nearest 0.01 cfs. Water surface and bed elevations will be measured to the nearest 0.01 ft using standard surveying techniques (i.e., differential leveling) as described in the Streambed and Water Surface Elevation SOP (CDFW 2013c).

Wetted streambed elevations will be determined by subtracting the measured depth from the surveyed WSEL at a measured flow. WSELs will be measured at a minimum of three locations along each transect. WSELs measured along each transect for each survey event will be averaged together unless the surface is found to be sloped along the transect line or if a portion of the surface is determined to be unrepresentative of the water surface with respect to the transect stage-discharge relationship. The WSELs measured at each transect will be evaluated and a single representative WSEL will be derived consistent with the guidance provided in the PHABSIM User's Manual (Waddle 2001). WSELs will be collected at a minimum of three relatively evenly spaced calibration flows, spanning approximately an order of magnitude. Model calibration flows will be selected so that the lowest simulated flow is no less than 0.4 of the lowest calibration flow and the highest simulated flow is at most 2.5 times the highest calibration flow. If a 2D model is used for the study, the accuracy of the 2D bed topography elevations collected should be 0.1 ft and the horizontal accuracy should be at least 1.0 ft (USFWS 2011).

The Department will use the USFWS (2011) standards for calibrating and validating any two-dimensional hydraulic habitat model, if used. The standards include:

- Mesh Quality: the quality of the fit between the final bed profile and the computational mesh, as measured by the Quality Index value, should be at least 0.2.
- Solution Change/Net Flow: when the model is run to steady state at the highest flow simulated, the solution change should be less than 0.00001 and the net flow should be less than one percent.
- Froude Number (FN): the maximum FN for low gradient streams should be less than one.
- Water Surface Elevation: if developing a 2D model, WSELs predicted at the upstream transect should be within 0.1 foot of the WSEL predicted by PHABSIM for the highest simulated flow (or observed at the highest measured flow).
- Velocity Validation: the correlation between at least 50 spatially-distributed measured and simulated velocities should be greater than 0.6.

Data sheets will be checked in the field by a designated field team lead to ensure that all data and relevant information has been collected for the given method(s) being used. All data are transferred from field data sheets into an electronic format upon returning from field data collection events, and quality control checks will be conducted for every electronic data sheet to ensure that the data were translated correctly. If data collection errors are discovered, the Project Coordinator will review the issues with the appropriate personnel to develop a plan for corrective action so that resampling, if required, can be scheduled during the same sampling season.

7.0 DATA MANAGEMENT AND REPORTING

Field data will be collected by Department staff from the Water Branch and, with resources permitting, Bay-Delta Region staff. Water Branch staff will prepare a final technical report with assistance from Bay-Delta Region staff. The Bay-Delta Region, Department Engineering, and Fisheries Branch will review the technical report.

7.1 Target Audience and Management Decisions

The Department has the responsibility to conserve, protect, and manage fish, wildlife, native plants, and their associated habitats. Accordingly, the Department has an interest in assuring that water flows within streams are maintained at levels that are adequate for long-term protection, maintenance, and proper stewardship of fish and wildlife resources. Using criteria generated from the flow study, the Department intends to develop flow recommendations for juvenile steelhead and Coho Salmon in upper Mark West Creek. These recommendations are not requirements that will be self-executing. Rather, they will represent beneficial uses relating to fish and wildlife preservation and enhancement to be considered by the Water Board in any future proceedings that the Water Board may or may not hold regarding applications for new diversions, permit requests, or other proceedings as set forth in Section 1257.5 of the California Water Code.

7.2 Coordination and Review

To the extent possible, entities or stakeholders that have an interest in the results and interpretation of the study may be involved in study scoping and implementation.

7.3 Data Management and Reporting

All data generated by this project will be maintained in field log books and/or data sheets, as well as in an electronic spreadsheet format. The Department will store the hard copies and electronic data. Final documents, including the technical report, will be posted on the Department's website.

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APPENDIX D

Environmental Science & Technology

Viewpoint

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High Time to Assess the Environmental Impacts of Cannabis Cultivation

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On November 8, 2016, four additional U.S. states (California, Massachusetts, Nevada, and Maine) legalized the use of recreational marijuana and four more relaxed medical marijuana laws. This is effectively creating a new industry in United States, one that looks set to rival all but the largest of current businesses with projected income expected to exceed that of the National Football League by 2020. In Colorado sales revenues have reached \$1 billion, roughly equal to that from grain farming in the state and a third higher than residential construction,[1] an industry with strict environmental monitoring procedures.

The few studies that have investigated specific practices associated with marijuana cultivation have identified potentially significant environmental impacts due to excessive water and energy demands and local contamination of water, air, and soil with waste products such as organic pollutants and agrochemicals[2,3] (see Figure 1). *Cannabis* spp. require high temperatures (25−30 °C for indoor operations), strong light (~600 W m^{-2}), highly fertile soil,[2] and large volumes of water (22.7 l d^{-1} per plant,[3] around twice that of wine grapes[3]). A study of illegal outdoor grow operations in northern California found that rates of water extraction from streams threatened aquatic ecosystems[3] and that water effluent contained high levels of growth nutrients, as well as pesticides, herbicides and fungicides, further damaging aquatic wildlife.[3]

Controlling the indoor growing environment requires considerable energy inputs, with concomitant increases in greenhouse gas emissions.[2] It has been estimated that the power density of marijuana cultivation facilities is equal to that of data centers and that illicit grow operations account for 1% of the U.S.'s average energy usage.[2] The carbon footprint of indoor growing facilities, however, is heavily dependent on the power source. For example, illicit growers relying on generators produce more than three times the CO_2 of facilities powered by the grid.[2] There is, therefore, significant potential to reduce both the energy consumption and the carbon footprint through more informed decisions regarding growing conditions, the equipment used and the power source.

Considerably less is known about the potential impacts of this industry on indoor and outdoor air quality. Sampling carried out in conjunction with law enforcement raids on illicit grow operations have measured concentrations of highly reactive organic compounds that were 5 orders of magnitude higher than background.[4] These compounds have clear implications for indoor air quality and thus occupational health, but also on outdoor air quality. In regions where volatile organic compound (VOC) emissions are low relative to those of nitrogen oxides (released from combustion processes), even a small increase in VOC emissions can result in production of secondary pollutants such as ozone and particulate matter. Since these latter compounds are both criteria air pollutants, such a shift in conditions could then lead to nonattainment of the National Air Quality Standards.

Previous studies have been hampered by a lack of reliable data[5] on which to base assessments of the likely consequences of large-scale cultivation and production of marijuana (see Figure 1). The impacts are therefore predicated on conditions and practices prevalent in illicit grow operations. Given that the methods employed in these illegal operations are driven by the need for secrecy, the methods have not been optimized to minimize environmental damage. This speaks to the urgent need for rigorous scientific research and evaluation to aid the new industry and relevant regulatory bodies in assessing the current environmental threats of marijuana cultivation, identifying the opportunities to mitigate such impacts, and developing a framework of stewardship worthy of a modern progressive industry.

Research, both fundamental and applied, is required in the following areas:

Agronomy and plant physiology:

- determine growth rates and cycles of commonly grown *Cannabis* spp. strains;

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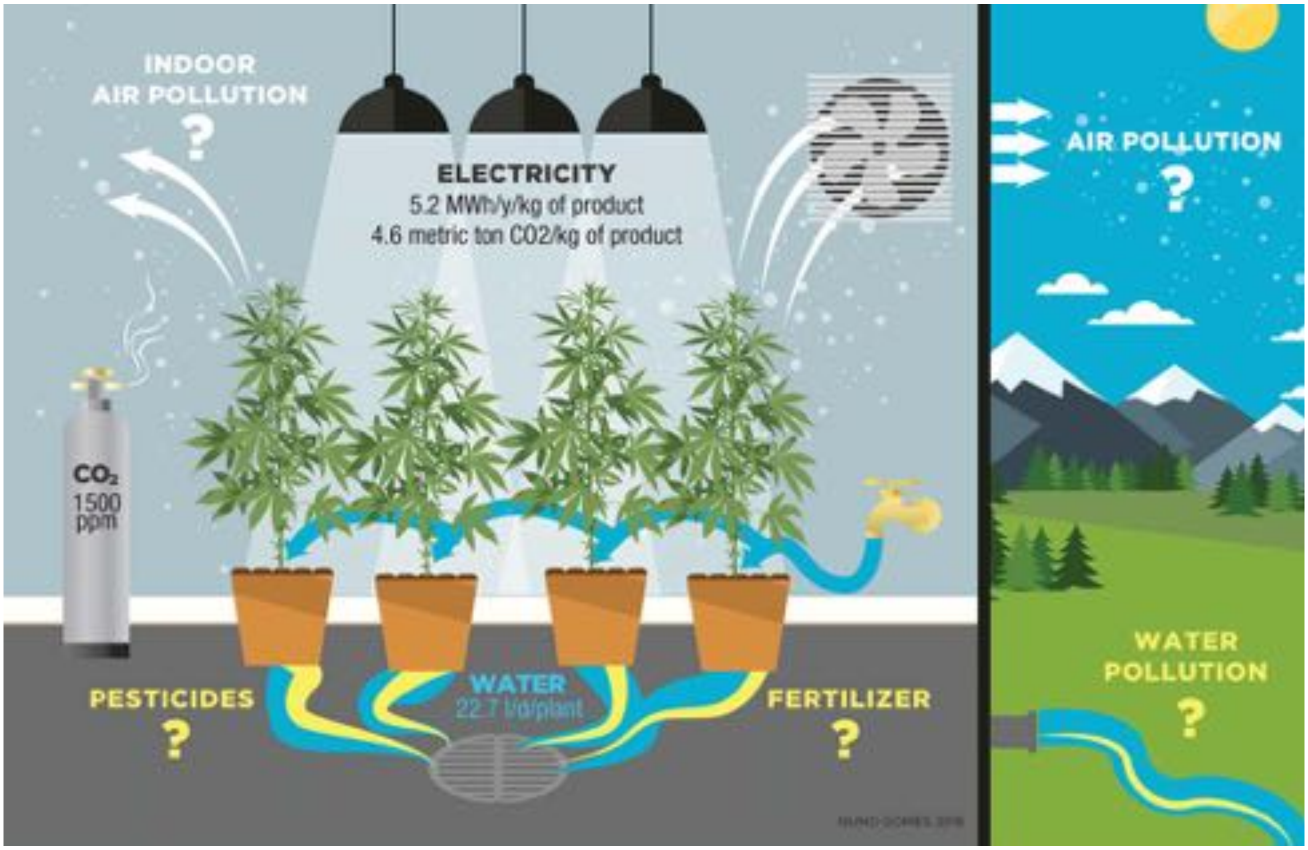

Figure 1. Environmental impacts of indoor marijuana cultivation[1−3] (a question mark indicates that the magnitude of the effect has not been previously estimated). Figure credit: Nuno Gomes 2016.

- determine optimal growth conditions for each stage of the growing cycle;
- identify best practices for minimizing water use and irrigation; and
- identify best practices for minimizing fertilizer, fungicide, and pesticide application.

Waste treatment and management:

- analyze wastewater streams, evaluate pollutant concentrations and explore the possibility of (a) reducing pollution through good agronomy practice and (b) pretreating effluents before discharge; and
- identify best practices for reducing solvent use for processing harvested plant material, and for treating waste prior to discharge.

Outdoor air quality:

- identify and measure emission rates of volatiles from *Cannabis* spp. at different developmental stages and growing conditions;
- identify and measure emission rates of volatiles from soils and plant detritus;
- measure concentrations of trace gases and particles in grow operations and the atmosphere outside such facilities; and
- identify opportunities for reducing emissions.

Occupational health

- identify and quantify the risks to workers exposed to conditions encountered within grow operations.

Such research falls firmly within the remit of U.S. Federal funding agencies, including the U.S. Department of Agriculture, Environmental Protection Agency, National Institutes of Health, and Occupational Safety and Health Administration. The ambiguous legal status of marijuana in the U.S., however, has made it historically difficult for these agencies to actively fund research in this field.[5] We call for this situation to be urgently addressed and funding made available to determine the risk posed to the workforce, the public and the natural environment by this burgeoning industry.

This is an industry undergoing a historic transition, presenting an historic opportunity to be identified as a progressive, world-leading example of good practice and environmental stewardship. Such recognition would lend itself to branding via an "eco-label" scheme that could include formulation of exemplar practices and procedures at every stage of production and supply such as those found in the Marine Stewardship Council's "Certified sustainable seafood." Advanced certification could encourage on-site energy generation from renewable sources, treatment and reuse of irrigation water, and organic growing practices. Such a scheme would provide an incentive for businesses to engage with local agencies, communities and regulators to conduct full environmental impact assessments of marijuana grow operations to minimize risk. This inclusive solutions-based approach would set the bar in accountability and transparency, allowing consumers to make a genuine choice and establishing a progressive business model fit for the 21st century that could act as a roadmap for others to follow.

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Notes

The authors declare no competing financial interest.

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APPENDIX E

PLOS | ONE

RESEARCH ARTICLE

Impacts of Surface Water Diversions for Marijuana Cultivation on Aquatic Habitat in Four Northwestern California Watersheds

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Data Availability Statement: Most data used are available via public sources (USGS gage data, EWRIMS, and Google Earth), but specific spatial locations of marijuana grows cannot be shared due to legal and privacy concerns. Summary data and all methods/information needed to replicate the study are included in the manuscript. Plant counts and greenhouse counts and measurements for all watersheds are included as Supporting Information (excel spreadsheets).

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Abstract

Marijuana (*Cannabis sativa* L.) cultivation has proliferated in northwestern California since at least the mid-1990s. The environmental impacts associated with marijuana cultivation appear substantial, yet have been difficult to quantify, in part because cultivation is clandestine and often occurs on private property. To evaluate the impacts of water diversions at a watershed scale, we interpreted high-resolution aerial imagery to estimate the number of marijuana plants being cultivated in four watersheds in northwestern California, USA. Low-altitude aircraft flights and search warrants executed with law enforcement at cultivation sites in the region helped to validate assumptions used in aerial imagery interpretation. We estimated the water demand of marijuana irrigation and the potential effects water diversions could have on stream flow in the study watersheds. Our results indicate that water demand for marijuana cultivation has the potential to divert substantial portions of streamflow in the study watersheds, with an estimated flow reduction of up to 23% of the annual seven-day low flow in the least impacted of the study watersheds. Estimates from the other study watersheds indicate that water demand for marijuana cultivation exceeds streamflow during the low-flow period. In the most impacted study watersheds, diminished streamflow is likely to have lethal or sub-lethal effects on state-and federally-listed salmon and steelhead trout and to cause further decline of sensitive amphibian species.

Introduction

Marijuana has been cultivated in the backwoods and backyards of northern California at least since the countercultural movement of the 1960s with few documented environmental impacts [1]. Recent increases in the number and size of marijuana cultivation sites (MCSs) appear to be, in part, a response to ballot Proposition 215, the Compassionate Use Act (1996). This California law provides for the legal use and cultivation of medical marijuana. In 2003, legislation was passed in an attempt to limit the amount of medical marijuana a patient can possess or

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cultivate (California State Senate Bill 420). However, this legislation was struck down by a 2010 California Supreme Court decision (*People v. Kelly*). As a result of Proposition 215 and the subsequent Supreme Court ruling, the widespread and largely unregulated cultivation of marijuana has increased rapidly since the mid-1990s in remote forested areas throughout California [2]. California is consistently ranked highest of all states for the number of outdoor marijuana plants eradicated by law enforcement: from 2008–2012 the total number of outdoor marijuana plants eradicated in California has ranged from 53% to 74% of the total plants eradicated in the United States [3]. In spite of state-wide prevalence, there is not yet a clear regulatory framework for the cultivation of marijuana, and from an economic viewpoint there is little distinction between plants grown for the black market and those grown for legitimate medical use [4].

Northwestern California has been viewed as an ideal location for marijuana cultivation because it is remote, primarily forested, and sparsely populated. Humboldt, Mendocino, and Trinity Counties, the three major counties known for marijuana cultivation in Northwestern California [5], comprise 7% (26,557 km^2) of the total land area of the state of California. However, their combined population of 235,781 accounts for only 0.62% of the state's total population (United States Census Data 2012). Humboldt County, with an area of 10,495 km^2, has over 7689 km^2 of forestland comprising more than 70% of its land base. More importantly, Humboldt County has 5,317 km^2 of private lands on over 8,000 parcels zoned for timber production [6]. This makes Humboldt County a feasible place to purchase small remote parcels of forestland for marijuana cultivation.

The broad array of impacts from marijuana cultivation on aquatic and terrestrial wildlife in California has only recently been documented by law enforcement, wildlife agencies, and researchers. These impacts include loss and fragmentation of sensitive habitats via illegal land clearing and logging; grading and burying of streams; delivery of sediment, nutrients, petroleum products, and pesticides into streams; surface water diversions for irrigation resulting in reduced flows and completely dewatered streams [2,7–10]; and mortality of terrestrial wildlife by rodenticide ingestion [11,12]. Though these impacts have been documented by state and federal agencies, the extent to which they affect sensitive fish and wildlife species and their habitat has not been quantified. These impacts have gained attention in recent years [7,9] because of the continuing prevalence of "trespass grows," illicit marijuana cultivation on public land. In comparison, the extent of cultivation and any associated environmental impacts on private lands are poorly understood, primarily because of limited access. In addition, state and local agencies lack the resources to address environmental impacts related to cultivation on private lands. In contrast with many MCSs on public lands, MCSs on private lands appear to be legal under state law, pursuant to Proposition 215. Regardless of the legal status of these MCSs, the water use associated with them has become an increasing concern for resource agencies [13].

California's Mediterranean climate provides negligible precipitation during the May—September growing season. In Northern California, 90–95% of precipitation falls between October and April [14]. Marijuana is a high water-use plant [2,15], consuming up to 22.7 liters of water per day. In comparison, the widely cultivated wine grape, also grown throughout much of Northwestern California, uses approximately 12.64 liters of water per day [16]. Given the lack of precipitation during the growing season, marijuana cultivation generally requires a substantial amount of irrigation water. Consequently, MCSs are often situated on land with reliable year-round surface water sources to provide for irrigation throughout the hot, dry summer growing season [7,8,12]. Diverting springs and headwater streams are some of the most common means for MCSs to acquire irrigation water, though the authors have also documented the use of groundwater wells and importing water by truck.

The impacts to aquatic ecosystems from large hydroelectric projects and other alterations of natural flow regimes have been well documented [17–20], but few studies have attempted to quantify the impacts of low-volume surface water diversions on stream flows [21,22]. A study in the Russian River watershed in Sonoma County, CA, concluded that the demand of registered water diversions exceeded stream flows during certain periods of the year, though this study did not quantify unregistered diversions. In addition, this study indicates that these registered diversions have the potential to depress spring base flows and accelerate summer recession of flows [22]. We postulate that the widespread, increasing, and largely unregulated water demands for marijuana cultivation, in addition to existing domestic demands, are cumulatively considerable in many rural Northern California watersheds.

In northern California, unregulated marijuana cultivation often occurs in close proximity to habitat for sensitive aquatic species. Because of this proximity and the water demands associated with cultivation, we chose to focus on the cumulative impacts of low-volume surface water diversions associated with marijuana cultivation. We evaluate these water demands at a watershed scale to determine whether they could have substantial effects on streamflow during the summer low-flow period. In addition, we discuss which sensitive aquatic species are most likely to be impacted by stream diversions and describe the nature of these impacts.

Methods

Methods are presented for the following components of the study: study area selection, data collection, water use estimates, and hydrologic analysis. For the purposes of this study, a MCS is defined as any area where marijuana is grown, either outdoors or inside a greenhouse, based on our aerial image interpretation. Because marijuana cultivation is federally illegal, its scope and magnitude are difficult to measure precisely [2,4,23]. However, the authors have accompanied law enforcement on search warrants and site inspections to evaluate more than 40 MCSs in the Eel River watershed and other watersheds in northwestern California. During these site inspections the number, size, and arrangement of marijuana plants were recorded, as were the water sources, conveyance and storage methods. These on-the-ground verification data were used as the basis for identifying characteristics of MCSs from aerial images.

Study Areas

Four study watersheds were selected—Upper Redwood Creek, Salmon Creek, and Redwood Creek South, located in Humboldt County; and Outlet Creek, located in Mendocino County (Figs. 1–4). Study watersheds were selected using the following criteria: (1) they are dominated by privately owned forestlands and marijuana cultivation is widespread within their boundaries as verified by low altitude survey flights and aerial imagery. (2) The primary watercourse, or downstream receiving body, has documented populations of sensitive aquatic species, such as coho salmon (*Oncorhynchus kisutch*). (3) Watersheds are of sufficient size so as to allow realistic population-scale and regional ecological relevance, but are not so large that conducting an analysis would be infeasible given limited staffing resources. (4) Streams in the watershed had either a flow gage, or nearby streams were gaged, which would allow proxy modeling of the low-flow period in the study watershed.

Habitat

The study watersheds are dominated by a matrix of open to closed-canopy mixed evergreen and mixed conifer forests with occasional grassland openings. Dominant forest stands include Tanoak (*Notholithocarpus densiflorus*) and Douglas-fir (*Pseudotsuga menziesii*) Forest Alliances ("Alliance" is a vegetation classification unit that identifies one or more diagnostic species in the upper canopy layer that are indicative of habitat conditions) [24]. These forests are dominated by Douglas—fir, tanoak, madrone (*Arbutus menziesii*), big leaf maple (*Acer*

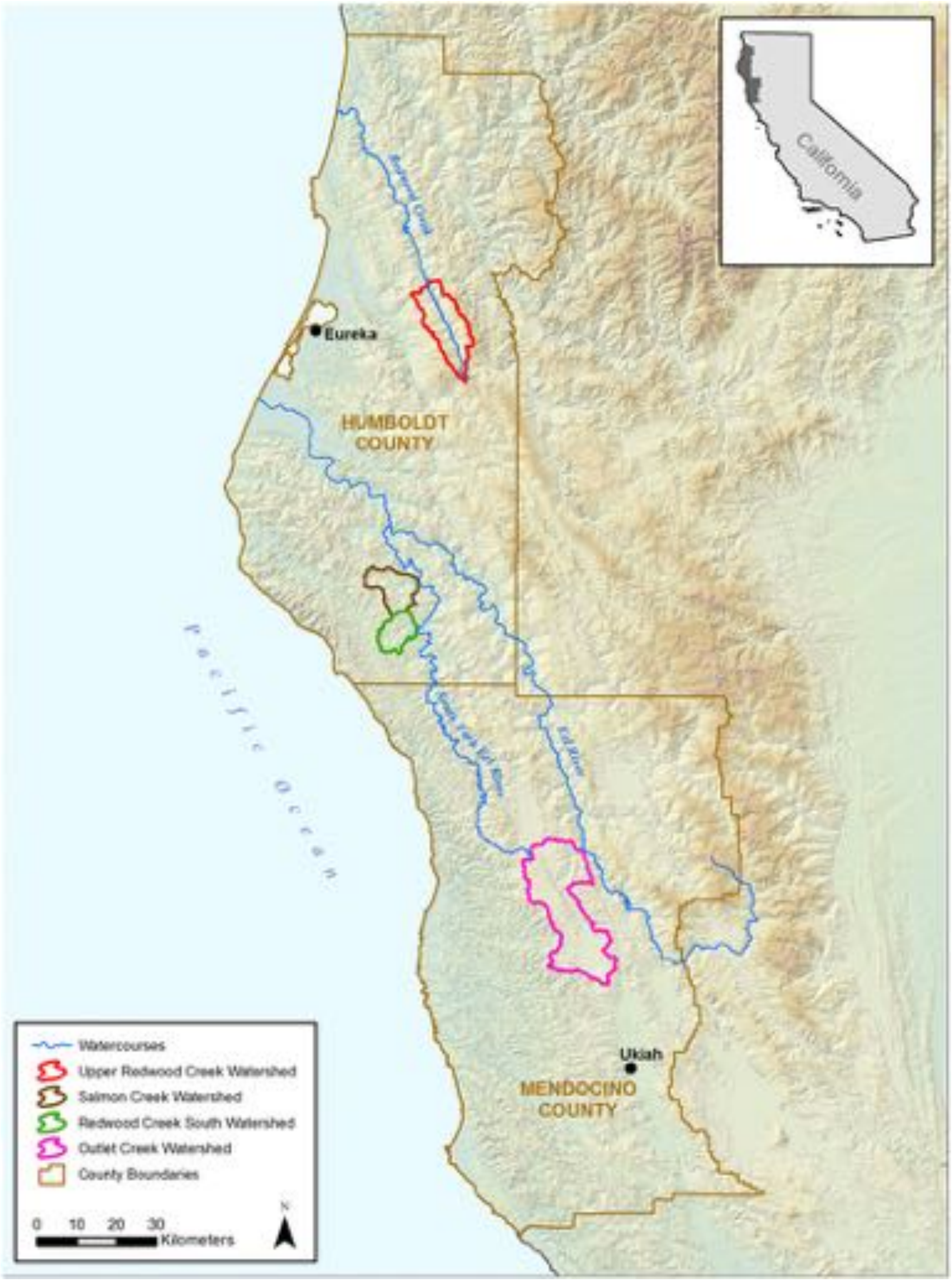

Fig 1. Study Watersheds and Major Watercourses.

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macrophyllum), and various oak species (*Quercus* spp.). The Redwood (*Sequoia sempervirens*) Forest Alliance, as described by Sawyer et al. [24] is dominant in areas of Upper Redwood Creek and in lower Salmon Creek and Redwood Creek South and includes many of the same dominant or subdominant species in the Tanoak and Douglas-fir Forest Alliances. These watersheds, a product of recent and on-going seismic uplift, are characterized as steep

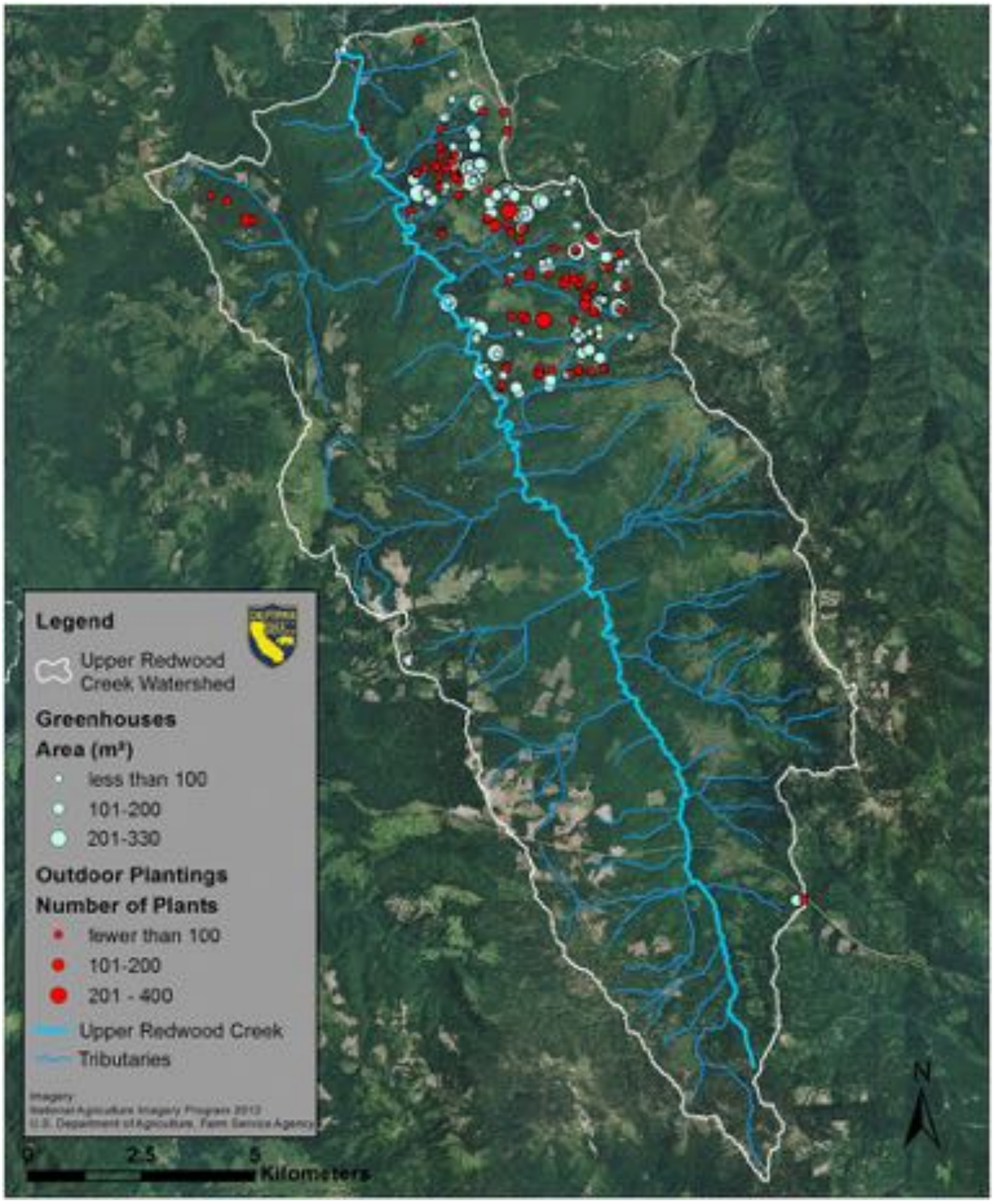

Fig 2. Upper Redwood Creek Watershed. Outdoor marijuana plantings are marked in red and greenhouses are marked in light green.

doi:10.1371/journal.pone.0120016.g002

mountainous terrain dissected by an extensive dendritic stream pattern, with the exception of Upper Redwood Creek, which has a linear trellised stream pattern [25].

Data Collection and Mapping Overview

Study watershed boundaries were modified from the Calwater 2.2.1 watershed map [26] using United States Geological Survey (USGS) 7.5 minute Digital Raster Graphic images to correct for hydrological inconsistencies. These watershed boundaries and a reference grid with one square kilometer (km^2) cells were used in Google Earth mapping program and ArcGIS (version 10.x, ESRI, Redlands, CA). Using Google Earth's high-resolution images of northern California

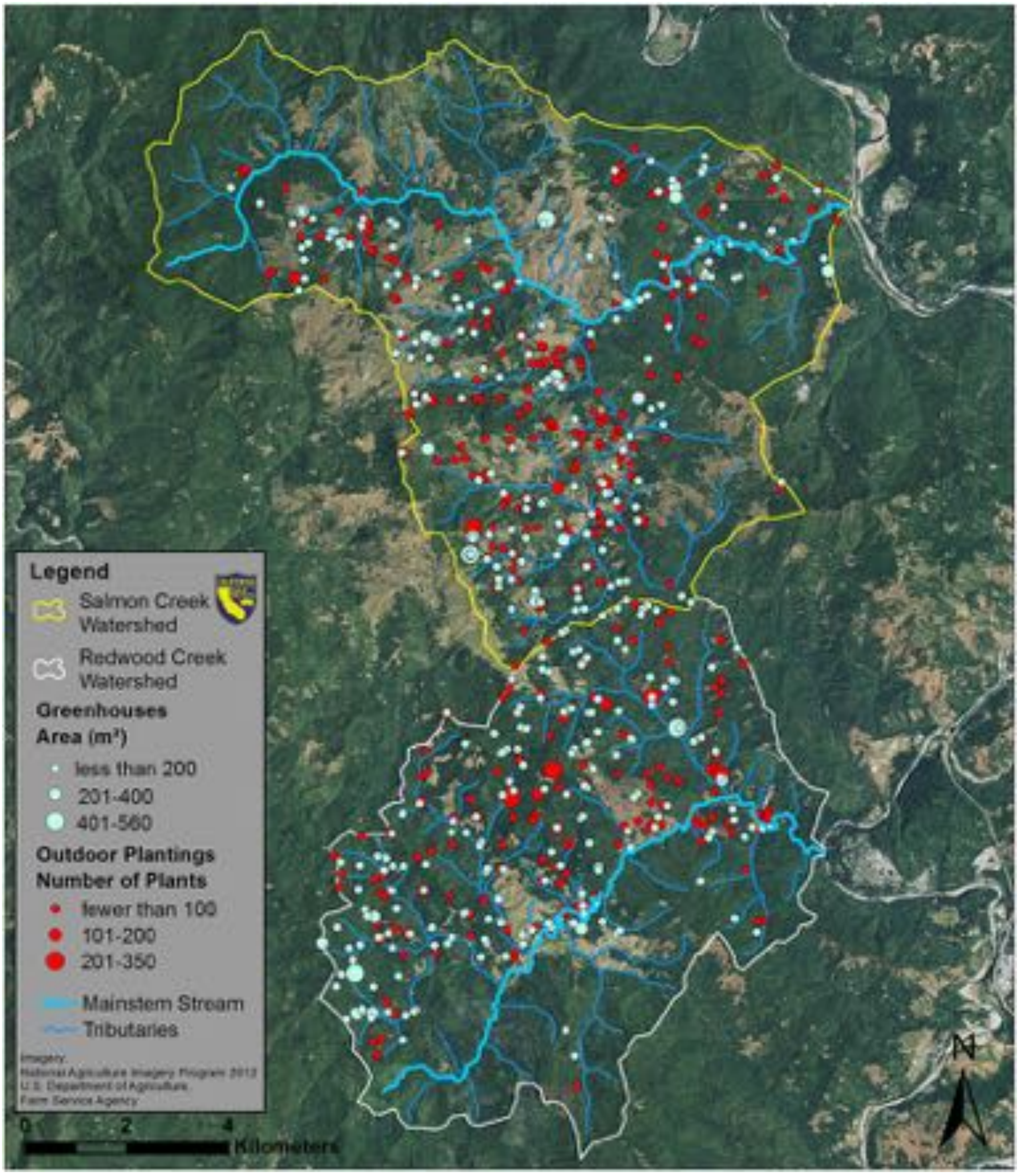

Fig 3. Salmon Creek and Redwood Creek South Watersheds. Outdoor marijuana plantings are marked in red and greenhouses are marked in light green.

doi:10.1371/journal.pone.0120016.g003

(image dates: 8/17/11, 7/9/12, and 8/23/12) as a reference, features of interest such as greenhouses and marijuana plants were mapped as points in ArcGIS. We identified greenhouses by color, transparency, elongated shape, and/or visible plastic or metal framework. Although we could not confirm the contents of greenhouses, the greenhouses we measured were generally associated with recent land clearing and other development associated with the cultivation of marijuana, as observed in our site inspections with law enforcement. Greenhouses clearly associated with only non-marijuana crop types, such as those in established farms with row crops, were excluded from our analysis. We identified outdoor marijuana plants by their shape, color, size and placement in rows or other regularly spaced configurations. We measured greenhouse lengths and widths using the Google Earth "Ruler" tool to obtain area, and counted and recorded the number of outdoor marijuana plants visible within each MCS. We also examined

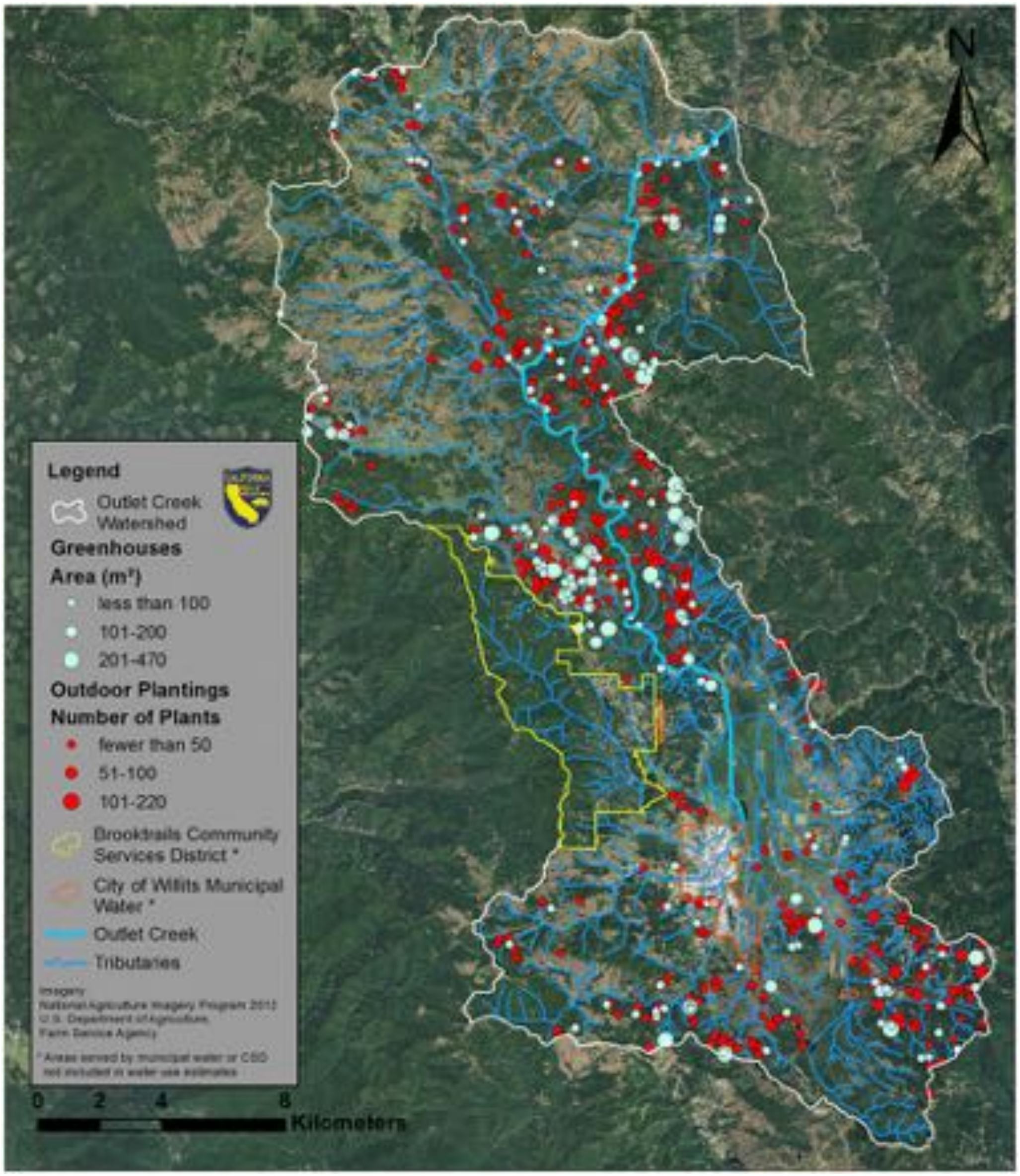

Fig 4. Outlet Creek Watershed. Outdoor marijuana plantings are marked in red and greenhouses are marked in light green.

doi:10.1371/journal.pone.0120016.g004

imagery from previous years using the Google Earth "Historical Imagery" tool to confirm that outdoor plants were not perennial crops, such as orchards.

Plant Abundance and Water Use Estimates

For each watershed, we totaled the number of marijuana plants that were grown outdoors and combined this value with an estimated number of marijuana plants in greenhouses to get a total number of plants per watershed. To develop a basis for estimating the number of marijuana plants in greenhouses, we quantified the spatial arrangement and area of marijuana plants in 32 greenhouses at eight different locations in four watersheds in Humboldt County while accompanying law enforcement in 2013. We calculated 1.115 square meters (m^2) per plant as an average spacing of marijuana plants contained within greenhouses. For the purposes of this study, we assume that the average greenhouse area to plant ratio observed by the authors on law enforcement visits was representative of the average spacing used at MCSs in the study watersheds.

Our water demand estimates were based on calculations from the 2010 Humboldt County Outdoor Medical Cannabis Ordinance draft [27], which states that marijuana plants use an average of 22.7 liters per plant per day during the growing season, which typically extends from June-October (150 days). Water use data for marijuana cultivation are virtually nonexistent in the published literature, and both published and unpublished sources for this information vary greatly, from as low as 3.8 liters up to 56.8 liters per plant per day [7,28]. The 22.7 liter figure falls near the middle of this range, and was based on the soaker hose and emitter line watering methods used almost exclusively by the MCSs we have observed. Because these water demand estimates were used to evaluate impacts of surface water diversion from streams, we also excluded plants and greenhouses in areas served by municipal water districts (Outlet Creek, Fig. 4).

Hydrologic Analyses: Estimating Impacts on Summer Low Flows

The annual seven-day low flow, a metric often used to define the low flow of a stream, is defined as the lowest value of mean discharge computed over any seven consecutive days within a water year. This value varies from year to year. Annual seven-day low flow values for the ungaged watersheds in this study were estimated by correlating to nearby USGS gaged streams. Annual seven-day low flow values for Elder Creek (Fig. 5), a gage used for this correlation, demonstrate the year-to-year variability in the study watersheds. Elder Creek is considered to be the least disturbed of the gaged watersheds, and is also the smallest, with a contributing area of 16.8 square kilometers. The annual seven-day low flow estimates were made by scaling the gaged data by the ratio of average flow of the ungaged and gaged stream, a method that provides better estimates than scaling by watershed area [29]. Regression equations based on average annual precipitation and evapotranspiration were used to estimate average annual flow, providing a more unique flow characterization than using watershed area alone. These methods were developed by Rantz [30]. The gaged data were either from within the watershed of the study area or from a nearby watershed. Correlation with daily average flow data from a gaged

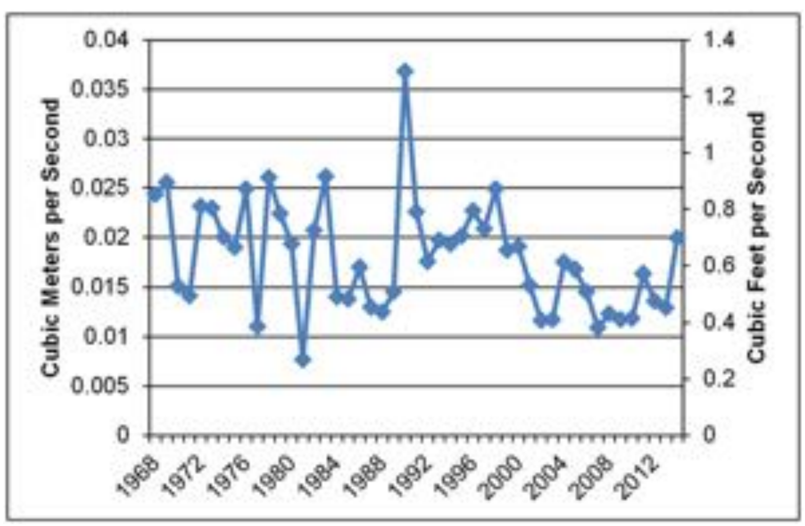

Fig 5. Elder Creek annual seven-day low flow. Values are shown for the period of record (water years 1968–2014).

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stream makes sense when the ungaged watershed is considered to be hydrologically similar to the gaged watershed, i.e. similar geology, vegetation, watershed size and orientation, and atmospheric conditions (precipitation, cloud cover, temperature). The accuracy of gaged data at low flows can be problematic because gaging very low flows is difficult and limited depending on the location of the gage and the precision in low-flow conditions, but the method can still provide a rough estimate of low flow by taking into account the range of uncertainty. Data were used from the closest most relevant gaged watershed for correlation to the ungaged sites.

Data for the gaged stations are shown in Table 1. This table includes the estimated average annual flow calculated from both the gaged data and also by use of the regression equations for comparison. The annual seven-day low flow for the period of record of each of the gaged stations is shown in Table 2. This table also shows the minimum, average, and maximum seven-day low flow values over the period of record as a way to represent the variability of the low flow from year to year. To estimate the annual seven-day low flow for the ungaged streams, the average annual seven-day low flow of the gaged stream was multiplied by the ratio of the annual average streamflow of the ungaged stream and the annual average streamflow of the gaged stream. A range of values, including the lowest and highest estimate for each location were calculated to represent the annual variability.

The mean annual streamflow of each ungaged stream was estimated using a regression equation, based on estimates of runoff and basin area developed by Rantz [30] (Equation 1). The mean annual runoff was estimated from a second regression equation (Equation 2) based on the relationship between mean annual precipitation and annual potential evapotranspiration for the California northern coastal area [30]. Mean annual precipitation values are from the USGS StreamStat web site (http://water.usgs.gov/osw/streamstats/california.html), which uses the PRISM average area weighted estimates based on data from 1971–2000. The estimates of mean annual evapotranspiration were taken from a chart produced by Kohler [31].

$$Q_{Avg} = 0.07362 = \left(\frac{m^3}{sec} \times yr \times cm \times km^2\right) \times R \times A \qquad eq.(1)$$

Table 1. USGS stream gages in or near study watersheds.

Watershed	Gage	Period of Record	Area (km^2)	MAP[a] (cm/yr)	PET[b] (cm/yr)	Mean Annual Runoff (cm/yr)	Q[c]avg (CMS[d]), predicted	Qavg (CMS), gaged	% difference
South Fork Eel River	USGS 11476500	10/1/1930–9/30/2012	1390.8	192.8	101.6	129.0	57.8	52.0	-11.1
Bull Creek	USGS 11476600	10/1/1967–9/30/2012	72.5	166.4	101.6	102.6	2.4	3.3	27.1
Elder Creek	USGS 11475560	10/1/1967–9/30/2012	16.8	215.9	101.6	152.1	0.8	0.7	-14.9
Outlet Creek	USGS 11472200	10/1/1956–9/30/1994	417.0	152.9	101.6	89.2	12.1	11.1	-8.8
Upper Redwood Creek	USGS 11481500	10/01/1953–10/1/2013	175.3	231.1	86.4	173.5	9.6	8.5	-12.6
Redwood Creek South	Ungaged	N/A	64.7	157.2	101.6	93.5	0.46	N/A	N/A
Salmon Creek	Ungaged	N/A	95.1	151.4	101.6	87.6	0.48	N/A	N/A

[a]mean annual precipitation

[b]potential evapotranspiration

[c]flow

[d]cubic meters per second

doi:10.1371/journal.pone.0120016.t001

Table 2. Annual seven-day low flow range for period of record.

Gage	Seven-day low flow for period of record in cubic meters per second		
	Minimum	Average	Maximum
SF Eel Miranda	0.3519	0.8829	1.796
Bull	0.0059	0.0310	0.0853
Elder	0.0076	0.0180	0.0368
Outlet Creek	0.0000	0.0162	0.0498
Upper Redwood Creek	0.0265	0.1064	0.2601
Redwood Creek South (based on Elder Creek)	0.004	0.010	0.021
Salmon Creek (based on Elder Creek)	0.005	0.011	0.022

doi:10.1371/journal.pone.0120016.t002

With

$$R = MAP - 0.4(PET) - 9.1$$

Where

$$Q_{Avg} = \textit{mean annual discharge}\left(\frac{m^3}{sec}\right)$$

$$R = \textit{mean annual runoff}\left(\frac{cm}{yr}\right)$$

$$A = \textit{drainage area}(km^2)$$

$$MAP = \textit{mean annual precipitation}\left(\frac{cm}{yr}\right)$$

$$PET = \textit{potential evapotranspiration}\left(\frac{cm}{yr}\right)$$

Estimates of average annual flow made by using these equations range from-15% to +27% below and above the calculated value using the gaged daily average data (Table 1). The Bull Creek gage estimate produced the largest deviation of 27% and may be considered an outlier because of the known disturbances in the watershed due to historic logging practices, and USGS reported "poor" low flow data.

The mean annual flow for each ungaged watershed was calculated using the Rantz method described above. The mean annual precipitation and runoff values are shown in Table 1 with the predicted mean annual flow for the ungaged streams. The annual seven-day low flows for Upper Redwood Creek and Outlet Creek were calculated using data from their respective stream gages. For Redwood Creek South and Salmon Creek, both watersheds with no main-stem gage, the annual seven-day low flow was calculated in the same way by using the data from nearby gaged streams within the South Fork Eel watershed (Bull Creek, Elder Creek, and South Fork Eel near Miranda gage). Fig. 6 shows three different estimates of the duration curves of the annual seven-day low flow for the Redwood Creek South ungaged site based on the three different nearby gages. The variations between these estimated duration curves (Fig. 6) illustrate the relative variability of annual seven-day low flow. Reasons for this

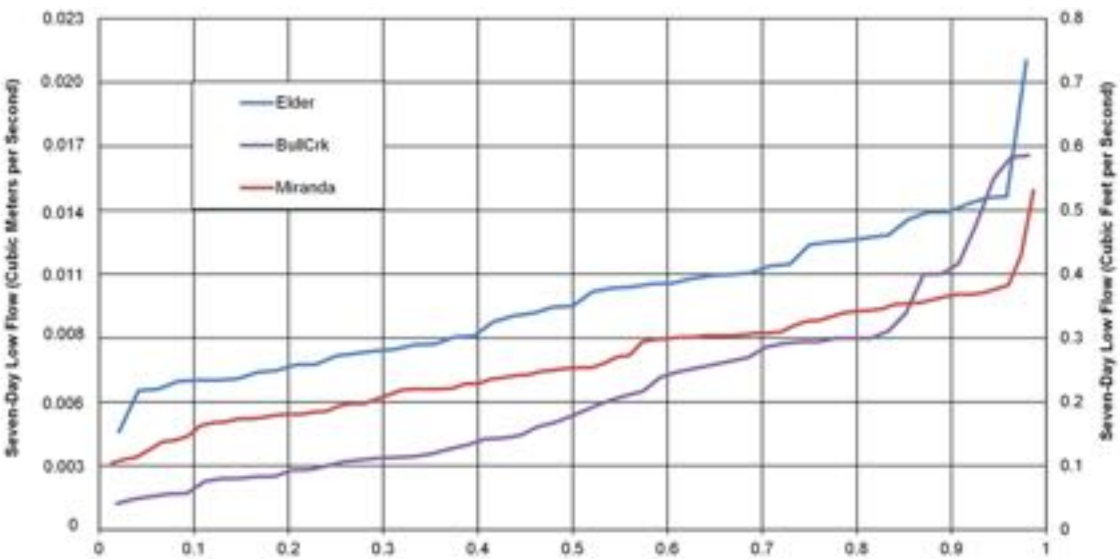

Fig 6. Duration curve of estimates of annual seven-day low flow for Redwood Creek South based on USGS data from nearby streams (Elder Creek, South Fork Eel at Miranda, and Bull Creek).

doi:10.1371/journal.pone.0120016.g006

variability may include the difference in hydrologic response of the gaged watersheds from the ungaged watersheds, differences in withdrawals or low flow measurement error, differences in the atmospheric patterns over the watershed, or differences in watershed characteristics (watershed size, orientation, land use, slope etc.). The gaged watersheds differed from the study watersheds in several ways, such as size (Miranda gage), disturbance (Bull Creek gage), and distance and orientation from the study watersheds (Elder Creek gage). Despite the differences, the Elder Creek gage most likely represents the best data set for correlation to the ungaged watersheds based on its similar size and relative unimpairment. The estimated values represent the upper limit of low flows for the ungaged streams, thus are conservative values and may be an overestimate.

Results

MCSs were widespread in all four study watersheds. In general, MCSs were clustered and were not evenly distributed throughout the study watersheds (Figs. 2–4). Estimated plant totals ranged from approximately 23,000 plants to approximately 32,000 plants per watershed (Table 3). Using the plant count estimates multiplied by our per plant daily water use estimate of 22.7 liters [27] we determined that water demands for marijuana cultivation range from 523,144 liters per day (LPD) to 724,016 LPD (Table 3). We also calculated the daily water use for each parcel that contained at least one marijuana cultivation site (S1 Table). Histograms showing the frequency distribution of daily water use per parcel are displayed for each watershed in Fig. 7. The majority of parcels in this study use an estimated 900 to 5,000 LPD for marijuana cultivation. These water use estimates are only based on irrigation needs for the marijuana plants counted or the greenhouses measured on that parcel, and do not account for indoor domestic water use, which in Northern California averages about 650 liters per day [32]. Thus, our water use demand estimates for marijuana cultivation are occurring in addition to domestic household uses that may occur and are also likely satisfied by surface water diversions.

Outdoor plants and greenhouses were identified from aerial images of Humboldt and Mendocino Counties. Greenhouse areas were estimated using the Google Earth measuring tool and

Table 3. Marijuana mapping summary of four watersheds.

Watershed	Outdoor Plants	Green-houses (counted)	Total area, m^2 (Green-houses)	Estimated Plants in Green-houses	Estimated Total Plants in Watershed	Estimated Water Use per Day (Liters)
Upper Redwood Creek	4,434	220	20749.4	18,612	23,046	523,144
Salmon Creek	11,697	302	20557.5	18,440	30,137	684,110
Redwood Creek South	10,475	324	18703.9	16,777	27,252	618,620
Outlet Creek	15,165	266	18651.1	16,730	31,895	724,016

doi:10.1371/journal.pone.0120016.t003

an average area of 1.11484 m^2 (converted from 12 ft^2) per plant was used to estimate total number of plants in greenhouses.

Minimum and maximum annual seven-day low flow values in these watersheds (Table 2) ranged from 0.0–0.05 cubic meters per second (CMS) in Outlet Creek to. 03 -. 26 CMS in

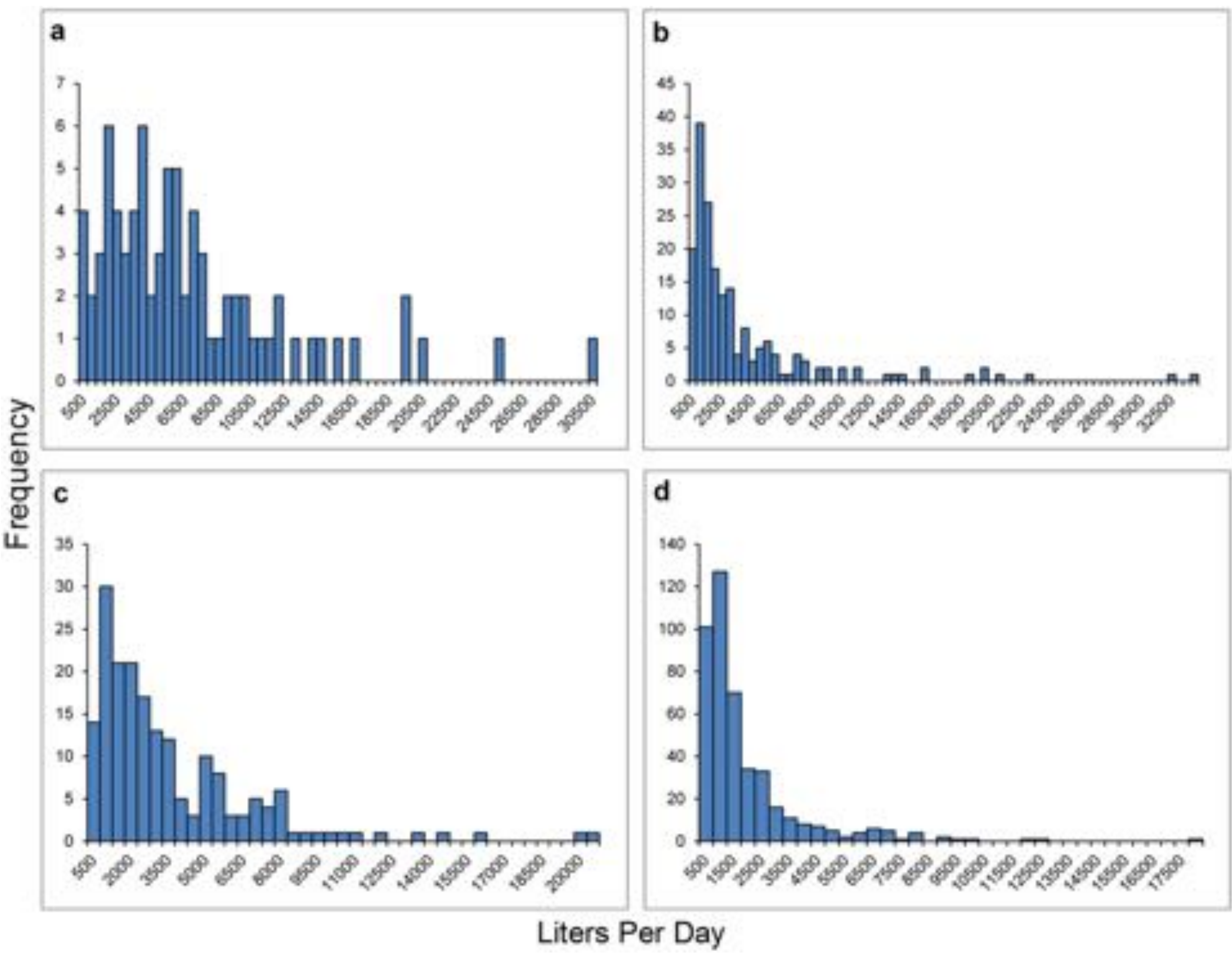

Fig 7. Frequency distribution of the water demand in liters per day (LPD) required per parcel for marijuana cultivation for each study watershed. (a) Upper Redwood Creek watershed, 79 parcels with marijuana cultivation, average water use 6622 LPD, (b) Salmon Creek watershed, 189 parcels with marijuana cultivation, average water use 3620 LPD, (c) Redwood Creek South watershed, 187 parcels with marijuana cultivation, average water use 3308 LPD, (d) Outlet Creek watershed, 441 parcels with marijuana cultivation, average 1642 LPD. See also S1 Table.

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Upper Redwood Creek. By comparing daily water demands to minimum and maximum annual seven-day low flow values, we arrived at a range of values that represent water demand for marijuana cultivation as a percentage of stream flow in each watershed (Table 4, S2 Table). In Upper Redwood Creek, which had the greatest summer flows (Table 2), we estimate water demand for marijuana cultivation is the equivalent of 2–23% of the annual seven-day low flow, depending on the water year. In Redwood Creek South, our data indicate that estimated water demand for marijuana cultivation is 34–165% of the annual seven-day low flow, and in Salmon Creek, estimated water demand for marijuana is 36–173% of the annual seven-day low flow. In Outlet Creek, estimated demand was 17% of the maximum annual seven-day low flow. However, the percent of the annual seven-day low flow minimum could not be calculated because this minimum stream flow was undetectable at the gage (flow <0.00 CMS) in nine of 38 years during the period of record (1957–1994). Due to this minimum annual seven-day low flow of almost zero, marijuana water demand is greater than 100% of the minimum annual seven-day low flow, but we cannot determine by how much.

We also compared the per-watershed daily water demands to the seven-day low flow values for each year of data available in order to better understand the magnitude and frequency of these water demands (Fig. 8, S2 Table). Although substantial demand for water for marijuana cultivation is a more recent and growing phenomenon, by comparing the water use estimates from our remote sensing exercise to historical stream flow data we can better understand how this demand as a percentage of stream flow may vary over the years. Our results indicate that if the same level of water demand for marijuana cultivation had been present for the period of record of the gages, this demand would have accounted for over 50% of streamflow during the annual seven-day low flow period in the majority of years in the Redwood Creek South and Salmon Creek watersheds (based on Elder Creek gage data that spans from water year 1968–2014). In Outlet Creek, the annual seven-day low flow data varied greatly over the period of record (water year 1957–1994) and was too low to measure in nine of the 38 years. The seven-day low flow value was therefore recorded as zero, which means that the water demand was greater than 100% of streamflow, but we could not calculate the water demand as a percentage of stream flow in those years. In Upper Redwood Creek, water demand was much less pronounced in comparison to stream flow, with water demand never accounting for more than 23% of the annual seven-day low flow, and accounting for 10% or greater of the annual seven-day low flow in only 30% of years during the period of record (water year 1954–2014 with a gap between 1959–1972). To summarize, we estimate that in three of the four watersheds evaluated, water demands for marijuana cultivation exceed streamflow during low-flow periods.

Table 4. Estimated water demand for marijuana cultivation expressed as a percentage of seven-day low flow in four study watersheds.

Watershed	Area (km^2)	Plants per km^2	Demand as percent of seven-day low flow	
			Percent of low flow maximum	Percent of low flow minimum
Upper Redwood Creek	175.3	131.6	2%	23%
Salmon Creek	95.1	316.9	36%	173%
Redwood Creek South	64.7	421.2	34%	165%
Outlet Creek	419.1	76.1	17%	>100%*

* The seven-day low flow minimum was measured as 0.0 CMS at the gage.

doi:10.1371/journal.pone.0120016.t004

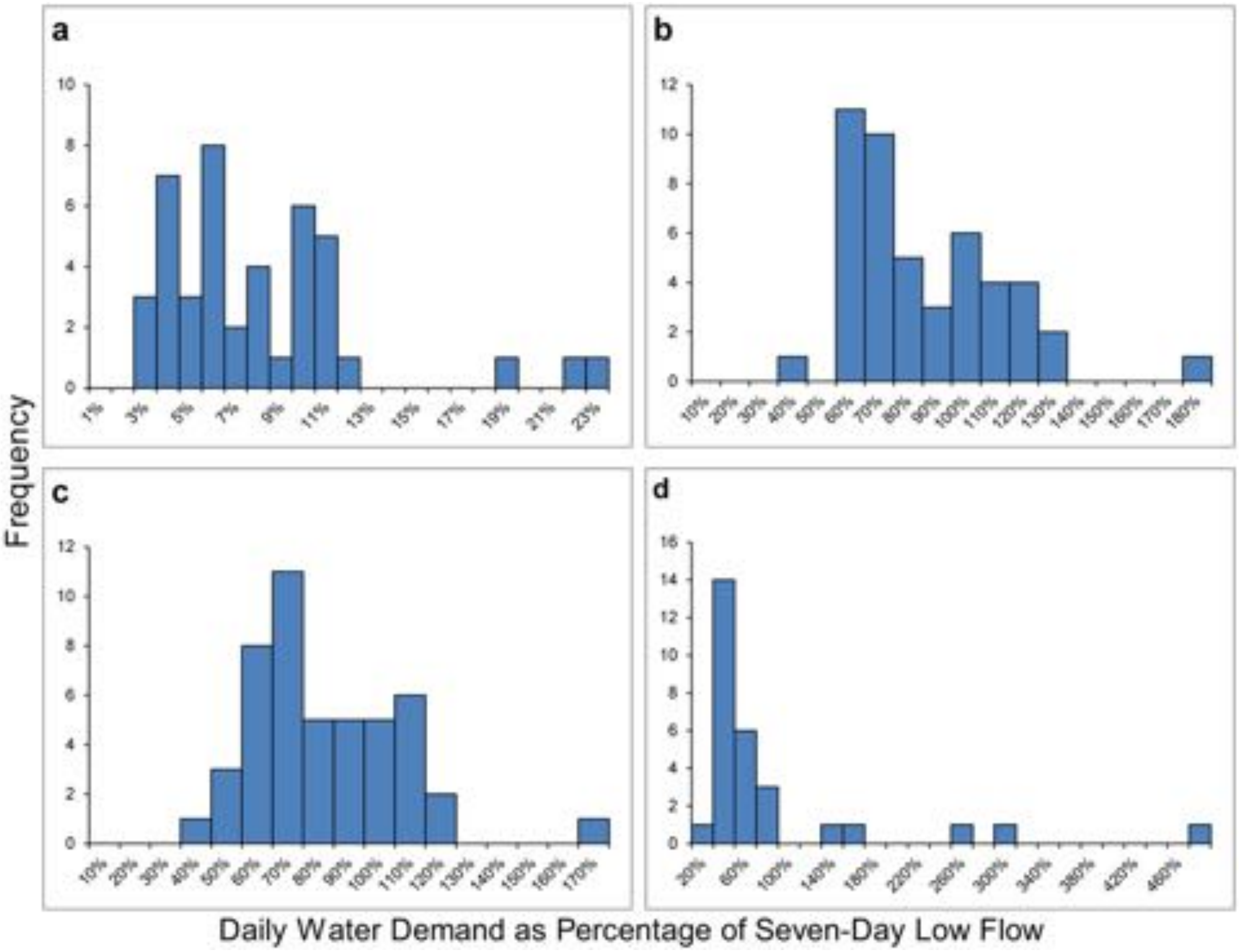

Fig 8. Frequency distribution of the water demand for marijuana cultivation as a percentage of seven-day low flow by year in each study watershed. Water demand data are from a remote sensing exercise using aerial imagery from 2011–2012 and are compared with each year's annual seven-day low flow value for the period of record in each study watershed: (a) Upper Redwood Creek watershed (USGS gage near Blue Lake, CA, coverage from water year (WY) 1954–1958 and 1973–2014), (b) Salmon Creek watershed (data modeled using USGS gage on Elder Creek, CA, coverage from WY 1968–2014), (c) Redwood Creek South (data modeled using USGS gage on Elder Creek, CA, coverage from WY 1968–2014), and (d) Outlet Creek (USGS gage near Longvale, CA, coverage from WY 1957–1994). Data from WYs 1977, 1981, 1987–1989, and 1991–1994 are excluded from Outlet Creek watershed due to seven-day low flow values of zero at the gage. Water demand as a percentage of seven-day low flow would be >100% in these years, but we cannot determine by how much.

doi:10.1371/journal.pone.0120016.g008

Discussion

Aerial Imagery Limitations and Water Demand Assumptions

Due to a number of factors, it is likely that the plant counts resulting from aerial imagery interpretation (Table 3) are minimum values. The detection of marijuana plants using aerial imagery was found most effective for larger cultivation plots in forest clearings greater than 10 m^2 because forest canopy cover and shadows can obscure individual plants or small plots, preventing detection. Some cultivators plant marijuana on a wide spacing in small forest canopy openings in order to avoid aerial detection [7,8]. The authors have also observed a variety of cultivation practices such as the use of large indoor cultivation facilities that could not be detected via aerial imagery. Moreover, a review of Google Earth historical aerial images after field inspections revealed that all MCSs visited in 2013 were either new or had expanded substantially since the previous year. Therefore, it is likely our results underestimate the total number of plants currently grown in these study watersheds and consequently underestimate the associated water demands.

Marijuana has been described as a high water-use plant [2,15] that thrives in nutrient rich moist soil [33]. Marijuana's area of greatest naturalization in North America is in alluvial bottomlands of the Mississippi and Missouri River valleys where there is typically ample rain during the summer growing season [23,33]. Female inflorescences and intercalated bracts are the harvested portion of the marijuana plant. According to Cervantes [15], marijuana uses high levels of water for floral formation and withholding water stunts floral formation. Cervantes recommends marijuana plants be liberally watered and "allow for up to 10 percent runoff during each watering."

There is uncertainty as to actual average water use of marijuana plants because there are few reliable published reports on marijuana water use requirements. As with the cultivation of any crop, variation in average daily water use would be expected based upon many variables, including the elevation, slope, and aspect of the cultivation site; microclimate and weather; size, age, and variety of the plant; native soil type and the amount and type of soil amendments used and their drainage and water retention characteristics; whether plants are grown outdoors, in greenhouses, or directly in the ground or in containers and the size of the container; and finally, the irrigation system used and how efficiently the system is used and maintained [34–36]. However, our water demand estimate of 22.7 L/day/plant based on the limited industry data available [27] comports with the U.S. Department of Justice 2007 Domestic Cannabis Cultivation Assessment [2], which indicates marijuana plants require up to 18.9 L/day/plant.

In many rural watersheds in Northern California, the primary source for domestic and agricultural water is from small surface water diversions [37]. These diversions must be registered with the State Water Resources Control Board (SWRCB), the agency responsible for administering water rights in California. SWRCB registrations are also subject to conditions set by the California Department of Fish and Wildlife in order to protect fish, wildlife, and their habitats. However, when querying the SWRCB's public database, we found low numbers of registered, active water diversions on file relative to the number of MCSs we counted in the study watersheds. The total number of registered, active diversions on file with the SWRCB accounted less than half of the number of parcels with MCSs that were visible from aerial imagery (Fig. 9). In some watersheds, the number was as low as 6%. Since we do not know if the registered diversions on file with the SWRCB belong to parcels with MCSs, it is uncertain if the registered diversions in a particular watershed are connected with any of the MCSs we counted.

Our calculations of water demand as a percentage of stream flow assume that all potential water users are diverting surface water or hydrologically-connected subsurface flow. Historical water use practices and our field inspections with law enforcement support this assumption, although there are few hard data available as there are relatively few active registered water diversions on file with the Division of Water Rights when compared to the potential number of water users in the watersheds (Fig. 9).

Implicit in our calculations is the assumption that all water users are pumping water at the same rate throughout the day, as well as throughout the growing season. In reality, we expect water demand to gradually increase throughout the season as plants mature. This increased water demand would coincide with the natural hydrograph recession through the summer months, creating an even more pronounced impact during the summer low-flow period. In a similar study that monitored flow in relation to surface water abstraction for vineyard heat protection, flows receded abnormally during periods of high maximum daily temperature [21]. These results indicate that water users can have measureable effects on instantaneous flow in periods of high water demand. Our results suggest that similar impacts could occur during the summer low flow period in the study watersheds.

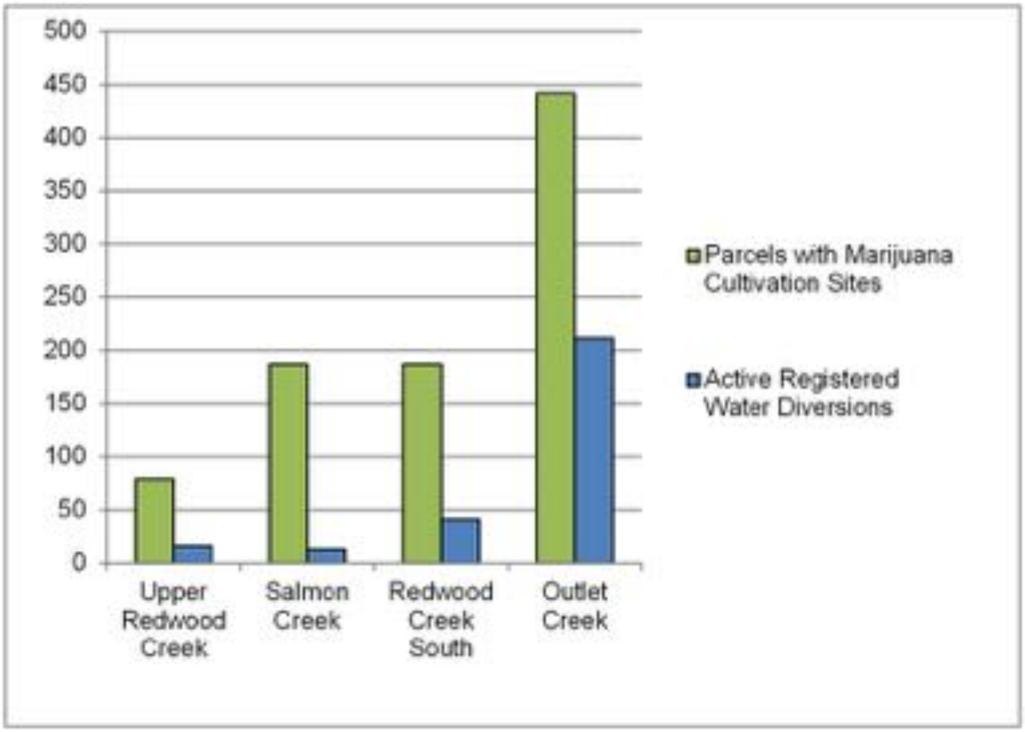

Fig 9. Active water rights in the study watersheds. Parcels with active registered water diversions (on file with California's Division of Water Rights) compared to parcels with marijuana cultivation sites (MCSs) in the four study watersheds.

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Additionally, our analysis assumes the water withdrawals will impact the entire watershed in an even, consistent way. In reality, we would expect water demand to be more concentrated at certain times of day and certain periods of the growing season, as described above. Furthermore, results of our spatial analysis indicate that MCSs are not evenly distributed on the landscape, thus impacts from water withdrawals are likely concentrated in certain areas within these watersheds. Because of these spatially and temporally clustered impacts, we may expect to see intensification of stream dewatering or temperature elevation in certain tributaries at certain times of year, which could have substantial impacts on sensitive aquatic species. Recent data indicate that peaks in high stream temperatures and annual low-flow events are increasing in synchrony in western North America [38], an effect that would be exacerbated by the surface water withdrawals we describe here. Further modeling and on-the-ground stream flow and temperature observations are needed to elucidate the potential extent of these impacts. The minimum streamflow estimates in Salmon Creek, Redwood Creek South, and Outlet Creek are so low that even a few standard-sized pumps operating at 38 liters per minute (LPM), which is a standard rate approved by the SWRCB for small diversions, could dewater the mainstem stream if more than four pumps ran simultaneously in any one area. It follows that impacts on smaller tributaries would be even more pronounced. In addition, on-site observations of MCS irrigation systems, though anecdotal, indicate many of these water conveyance, storage, and irrigation systems lose a substantial amount of water through leaks and inefficient design. This would significantly increase the amount of surface water diverted from streams beyond what would actually be needed to yield a crop. More study is needed to fully understand the impacts of MCS water demand on instantaneous flow in these watersheds.

Given that marijuana cultivation water demand could outstrip supply during the low flow period, and based on our MCS inspections and surface water diversion and irrigation system observations, we surmise that if a MCS has a perennial water supply, that supply would be used exclusively. However, for MCSs with on-site surface water sources that naturally run dry in summer, or are depleted though diversion, it is likely that direct surface water diversion is used until the source is exhausted, then water stored earlier in the year or imported by truck supplants the depleted surface water. It is difficult to determine to what degree imported water and wet season water storage is occurring. However, our on-site MCS inspections support the assumption that the vast majority of irrigation water used for marijuana cultivation in the study watersheds is obtained from on-site surface water sources and water storage and importation is ancillary to direct surface water diversions.

Comparison of Water Demands to Summer Low Flows

Our results suggest that water demand for marijuana cultivation in three of the study watersheds could exceed what is naturally supplied by surface water alone. However, in Upper Redwood Creek, the data suggest that marijuana cultivation could have a smaller impact on streamflow, with demand taking up approximately 2% to 23% of flow (Table 4). This projected demand of flow contrasts with the 34% to >100% flow demand range in the other watersheds, most likely because Upper Redwood Creek has greater mean annual precipitation, less evapotranspiration, and generally higher stream flow than the other watersheds (Tables 1–2). Furthermore, approximately half of the Upper Redwood Creek watershed is comprised of either large timber company holdings or federal lands. As Fig. 2 illustrates, MCSs in Upper Redwood Creek are concentrated within a relatively small area of privately-owned land that has been subdivided. It stands to reason that if all the land within the Upper Redwood Creek watershed was subject to the subdivision and parcelization that has occurred in Redwood Creek South, Salmon Creek, or Outlet Creek, the potential impacts to stream flow would also be greater.

In Outlet Creek, our results indicate a large range of potential water demand as a percentage of streamflow, from 17% in a "wet" year to greater than 100% when the stream becomes intermittent, as it does during many summers. Our data indicate that impacts to streamflow will vary greatly depending on the individual watershed characteristics, whether the year is wetter or drier than average, and the land use practices taking place.

Environmental Impacts

The extent of potential environmental impacts in these watersheds is especially troubling given the region is a recognized biodiversity hotspot. According to Ricketts et al. [39], the study watersheds occur within the Northern California Coastal Forests Terrestrial Ecoregion. This ecoregion has a biological distinctiveness ranking of "globally outstanding" and a conservation status of "critical" [39]. For example, Redwood National Park, 20 km downstream of the Upper Redwood Creek sub-basin, has approximately 100 km^2 of old-growth redwood forest, which is one of the world's largest remaining old-growth redwood stands. The study watersheds also occur within the Pacific Mid-Coastal Freshwater Ecoregion defined by Abell et al. [40]. This ecoregion has a "Continentally Outstanding" biological distinctiveness ranking, a current conservation status ranking of "Endangered" and its ranking is "Critical" with regards to expected future threats [40]. Not surprisingly, numerous sensitive species, including state- and federally-listed taxa, occur in the study watersheds or directly downstream (Table 5).

Our results indicate that the high water demand from marijuana cultivation in these watersheds could significantly impact aquatic- and riparian-dependent species. In the Pacific Coast Ecoregion, 60% of amphibian species, 16% of reptiles, 34% of birds, and 12% of mammals can

Table 5. Sensitive aquatic species with ranges that overlap the four study watersheds: Upper Redwood Creek (URC), Redwood Creek South (RCS), Salmon Creek (SC), and Outlet Creek (OC).

Scientific Name	Common Name	Conservation Status in California	Study Watershed
Oncorhynchus kisutch	coho salmon	State and federally-threatened	URC, RCS, SC, OC
Oncorhynchus tshawytscha	Chinook salmon	federally-threatened	URC, RCS, SC, OC
Oncorhynchus clarki clarki	coastal cutthroat trout	SSC[1]	URC
Oncorhynchus mykiss	steelhead trout	federally-threatened	URC, RCS, SC, OC
Rana aurora	northern red-legged frog	SSC	URC, RCS, SC, OC
Rana boylii	foothill yellow-legged frog	SSC	URC, RCS, SC, OC
Rhyacotriton variegatus	southern torrent salamander	SSC	URC, RCS, SC, OC
Ascaphus truei	coastal tailed frog	SSC	URC, RCS, SC
Emys marmorata	western pond turtle	SSC	RCS, SC, OC
Margaritifera falcata	western pearlshell	S1S2[2]	URC

[1]The California Department of Fish and Wildlife designates certain vertebrate species as Species of Special Concern (SSC) because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction. Though not listed pursuant to the Federal Endangered Species Act or the California Endangered Species Act, the goal of designating taxa as SSC is to halt or reverse these species' decline by calling attention to their plight and addressing the issues of conservation concern early enough to secure their long-term viability.

[2] The California Natural Diversity Database (CNDDB) designates conservation status rank based on a one to five scale, one being "Critically Imperiled", five being "Secure". Uncertainty about a rank is expressed by a range of values, thus a status of S1S2 indicates that there is uncertainty about whether *Margaritifera falcata* ranks as state "Critically Imperiled" (S1) or state "Imperiled" (S2) [41].

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be classified as riparian obligates, demonstrating the wide range of taxa that potentially would be affected by diminished stream flows [42]. The impacts of streamflow diversions and diminished or eliminated summer streamflow would however disproportionately affect aquatic species, especially those which are already sensitive and declining.

Impacts to Fish

Northern California is home to some of the southernmost native populations of Pacific Coast salmon and trout (i.e., salmonids) and the study area is a stronghold and refugia for their diversity and survival. Every salmonid species in the study watersheds has some conservation status ranking (Table 5). California coho salmon, for example, have undergone at least a 70% decline in abundance since the 1960s, and are currently at 6 to 15% of their abundance during the 1940s [43]. Coho salmon populations in all four study watersheds are listed as threatened under both the California and the Federal Endangered Species Acts, and are designated as key populations to maintain or improve as part of the Recovery Strategy of California Coho Salmon [43].

Of California's 129 native inland fish species, seven (5%) are extinct in the state or globally; 33 (26%) are in immediate danger of becoming extinct (endangered), and 34 (26%) are in decline but not at immediate risk of extinction (vulnerable) [44]. According to Katz et al. [45], if present population trends continue, 25 (78%) of California's 32 native salmonid taxa will likely be extinct or extirpated within the next century.

The diminished flows presented by this study may be particularly damaging to salmonid fishes because they require clean, cold water and suitable flow regimes [44]. In fact, water diversions and altered or diminished in-stream flows due to land use practices have been identified as having a significant impact on coho salmon resulting in juvenile and adult mortality [43].

Additionally, all four study watersheds are already designated as impaired for elevated water temperature and sediment by the U.S. Environmental Protection Agency pursuant to the Clean

Water Act Section 303(d). Reduced flow volume has a strong positive correlation with increased water temperature [44]. Increased water temperatures reduce growth rates in salmonids, increase predation risk [46], and increase susceptibility to disease. Warmer water also holds less dissolved oxygen, which can reduce survival in juvenile salmonids [44]. Both water temperature and dissolved oxygen are critically important for salmonid survival and habitat quality [47–50].

Reduced stream flows can also threaten salmonids by diminishing other water quality parameters, decreasing habitat availability, stranding fish, delaying migration, increasing intra and interspecific competition, decreasing food supply, and increasing the likelihood of predation [43]. These impacts can have lethal and sub-lethal effects. Experimental evidence in the study region suggests summer dry-season changes in streamflow can lead to substantial changes in individual growth rates of salmonids [51]. Complete dewatering of stream reaches would result in stranding and outright mortality of salmonids, which has been observed by the authors at a number of MCSs just downstream of their water diversions.

Impacts to Amphibians

Water diversions and altered stream flows are also a significant threat to amphibians in the northwestern United States [52,53]. The southern torrent salamander (*Rhyacotriton variegatus*) and coastal tailed frog (*Ascaphus truei*) are particularly vulnerable to headwater stream diversions or dewatering, which could lead to mortality of these desiccation-intolerant species [54]. To maximize the compatibility of land use with amphibian conservation, Pilliod and Wind [53], recommend restoration of natural stream flows and use of alternative water sources in lieu of developing headwater springs and seeps.

Numerous studies have documented the extreme sensitivity of headwater stream-dwelling amphibians to changes in water temperature [55,56] as well as amounts of fine sediment and large woody debris [57,58]. Additionally, Kupferberg et al. and others [52,59] have demonstrated the impacts of altered flow regimes on river-dwelling amphibians. However, the threat of water diversion and hydromodification—or outright loss of flow—from headwaters streams has not been well-documented in the amphibian conservation literature. This is likely because illegal and unregulated headwater stream diversions did not exist at this scale until the recent expansion of marijuana cultivation in the region. In contrast, timber harvesting, which until recently was the primary land use in forested ecoregions in the western United States, does not typically divert headwater streams in the same manner as MCSs. Timber harvesting operations, at least in California, have state regulatory oversight that requires bypass flows to maintain habitat values for surface water diversions. Thus, the results of our study highlight an emerging threat to headwater amphibians not addressed in Lannoo [60], Wake and Vredenburg [61], or more recently in Clipp and Anderson [62]

Future Water Demands and Climate Change

Flow modification is one of the greatest threats to aquatic biodiversity [63]. As in many parts of the world, the freshwater needed to sustain aquatic biodiversity and ecosystem health in our study area is also subject to severe competition for multiple human needs. The threats to human water security and river biodiversity are inextricably linked by increasing human demands for freshwater [64,65]. In California, irrigated agriculture is the single largest consumer of water, taking 70–80% of stored surface water and pumping great volumes of groundwater [44]. In our study area, agricultural demands account for 50–80% of all water withdrawals [66]. Only late in the last century have the impacts of water diversions on aquatic species become well recognized. However, these impacts are most often assessed on large regional scales, e.g.

major rivers and alluvial valleys, and the large hydroelectric dams, reservoirs, and flood control and conveyance systems that regulate them [67].

Few studies thus far have assessed the impacts of many small agricultural diversions on zero to third order streams and their cumulative effects on a watershed scale [21,22]. On a localized scale, with regional implications, this study detects an emerging threat to not only aquatic biodiversity but also human water security, since surface water supplies most of the water for domestic uses in watersheds throughout Northwestern California [37]. In these watersheds, the concept of "peak renewable water," where flow constraints limit total water availability [68], may have already arrived. In other words, the streams in the study watersheds simply cannot supply enough water to meet current demands for marijuana cultivation, other human needs, and the needs of fish and wildlife.

Due to climate change, water scarcity and habitat degradation in northern California is likely to worsen in the future. Regional climate change projections anticipate warmer average air temperatures, increases in prolonged heat waves, decreases in snow pack, earlier snow melt, a greater percentage of precipitation falling as rain rather than snow, a shift in spring and summer runoff to the winter months, and greater hydroclimatic variability and extremes [69–77]. Consequently, future hydrologic scenarios for California anticipate less water for ecosystem services, less reservoir capture, a diminished water supply for human uses, and greater conflict over the allocation of that diminished supply [70,71,75,78,79]. Climate change is expected to result in higher air and surface water temperatures in California's streams and rivers in the coming decades, which in turn could significantly decrease suitable habitat for freshwater fishes [80–83]. Due to a warming climate, by 2090, 25 to 41% of currently suitable California streams may be too warm to support trout [84].

Already, gage data and climate stations in northwestern California show summer low flow has decreased and summer stream temperatures have increased in many of northern California's coastal rivers, although these changes cannot yet be ascribed to climate change [85]. In an analysis of gage data from 21 river gaging stations, 10 of the gages showed an overall decrease in seven-day low flow over the period of record. This dataset included Upper Redwood Creek as well as the South Fork Eel River, the receiving water body for Redwood Creek South and Salmon Creek [85].

Our analysis suggests that for some smaller headwater tributaries, marijuana cultivation may be completely dewatering streams, and for the larger fish-bearing streams downslope, the flow diversions are substantial and likely contribute to accelerated summer intermittence and higher stream temperatures. Clearly, water demands for the existing level of marijuana cultivation in many northern California watersheds are unsustainable and are likely contributing to the decline of sensitive aquatic species in the region. Given the specter of climate change induced more severe and prolonged droughts and diminished summer stream flows in the region, continued diversions at a rate necessary to support the current scale of marijuana cultivation in northern California could be catastrophic for aquatic species.

Both monitoring and conservation measures are necessary to address environmental impacts from marijuana cultivation. State and federal agencies will need to develop more comprehensive guidelines for essential bypass flows in order to protect rearing habitat for listed salmonid species and other sensitive aquatic organisms. Installation of additional streamflow gages and other water quality and quantity monitoring will be necessary to fill data gaps in remote watersheds. In addition, increased oversight of water use for existing MCSs and increased enforcement by state and local agencies will be necessary to prevent and remediate illegal grading and forest conversions. Local and state governments will need to provide oversight to ensure that development related to MCSs is permitted and complies with environmental regulations and best management practices. Local and state agencies and nonprofit organizations should also continue to educate marijuana cultivators and the public about the environmental threats, appropriate mitigation measures, and permit requirements to legally develop MCSs and best protect fish and wildlife habitat. Finally, local governments should evaluate their land use planning policies and ordinances to prevent or minimize future forestland conversion to MCSs or other land uses that fragment forestlands and result in stream diversions.

Supporting Information

S1 Table. Number of outdoor plants counted, area of greenhouses measured, and estimated water use in Liters per day for each parcel in the study watersheds.
(XLSX)

S2 Table. Per-watershed daily water demands compared to seven-day low flow by year.
(XLSX)

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Author Contributions

Conceived and designed the experiments: SB MVH LM AC JO. Analyzed the data: JO AC MT SB MVH GL. Wrote the paper: GL JO AC MT SB. Collected the data: AC JO SB MVH GL.

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From: Richard Crowley
To: Cannabis
Subject: No cannabis in Sonoma County
Date: Thursday, March 16, 2023 9:27:09 PM

EXTERNAL

To whom it may concern:

Cannabis cultivation should, in my opinion, be HEAVILY restricted in almost all of California, Sonoma County included. It's a thirsty crop, requiring many times the water per acre that wine grapes do, and that makes it wholly inappropriate to plant in drought- and fire-prone areas with marginal groundwater, as my area, Franz Valley, is officially designated.

If the risks to groundwater weren't bad enough, the smell of cannabis is an externality that residents will not have any way to avoid if someone happens to be cultivating cannabis upwind.

Allowing cannabis cultivation in Sonoma County is bad for everyone except the people who are growing it and those few should not get to negatively impact everyone else.

Please move to disallow cannabis cultivation in Sonoma County.

Thank you,

Richard Crowley
8535 Franz Valley School Road

From:	Becky Evenich
To:	Crystal Acker; Cannabis
Cc:	Susan Gorin; David Rabbitt; Chris Coursey; Lynda Hopkins; district4
Subject:	Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zone for the Liberty Valley
Date:	Friday, March 17, 2023 2:02:46 PM
Attachments:	Liberty Valley Exclusion Zone and Liberty School District Boundary Map.pdf

EXTERNAL

Ms. Acker,

Please consider this email from The Neighbors of Liberty Valley as an official request to include the following areas in the Exclusion Zone for Cannabis moving forward:

Northeast border - Stony Point Road from Rainsville to Mecham including the Debbie Hill neighborhood off of West Railroad Avenue.
West border – corner of Stony Point Road and east side of Mecham to Pepper Road.
South border – Bodega Avenue (including Wiggins Hill)
Including – Pepper Road, Pepper Lane, Gonsalves Lane, King Road, Stowring Road, Old King Road, Queens Lane, Nommsen Road, Paulsen Lane, McBrown Road, Liberty Road, Darlene Drive, Packard Lane, Thomas Lane, Sprauer Road, Rancho Lane, Genazzi Lane, Bahnsen Lane, Liberty School Road, Brittany Court, Center Road, Hannan Ranch Road, Jewett Road, Live Oak Drive, Upland Drive, Valley View Drive, Lori Lane, Agatha Court, Stony Point Road, Camozzi Road, Debbie Hill Road.

This Exclusion Zone is what comprises the Liberty School District. Per the attached map of this zone, the Liberty School District is the highlighted green area. We have added two smaller areas which are highlighted in yellow. The Neighbors of Liberty Valley feel that these highlighted areas are what we consider to be The Liberty Valley.

The United States Post Office, an agency of the executive branch of the United States federal government has categorized the Liberty Valley as an “L” Route. This means that even though we are a rural residential are we are considered as a high volume / high density area. The USPS considers high volume/high density as an area with 12 or more boxes per mile. The Liberty School District alone has approximately 500 properties in the district. The Liberty Valley is approximately five (5) square miles. 500+ properties within five (5) square miles is unquestionably dense in population and in no way should have commercial cultivation sites within its boundaries and should be considered an exclusion zone.

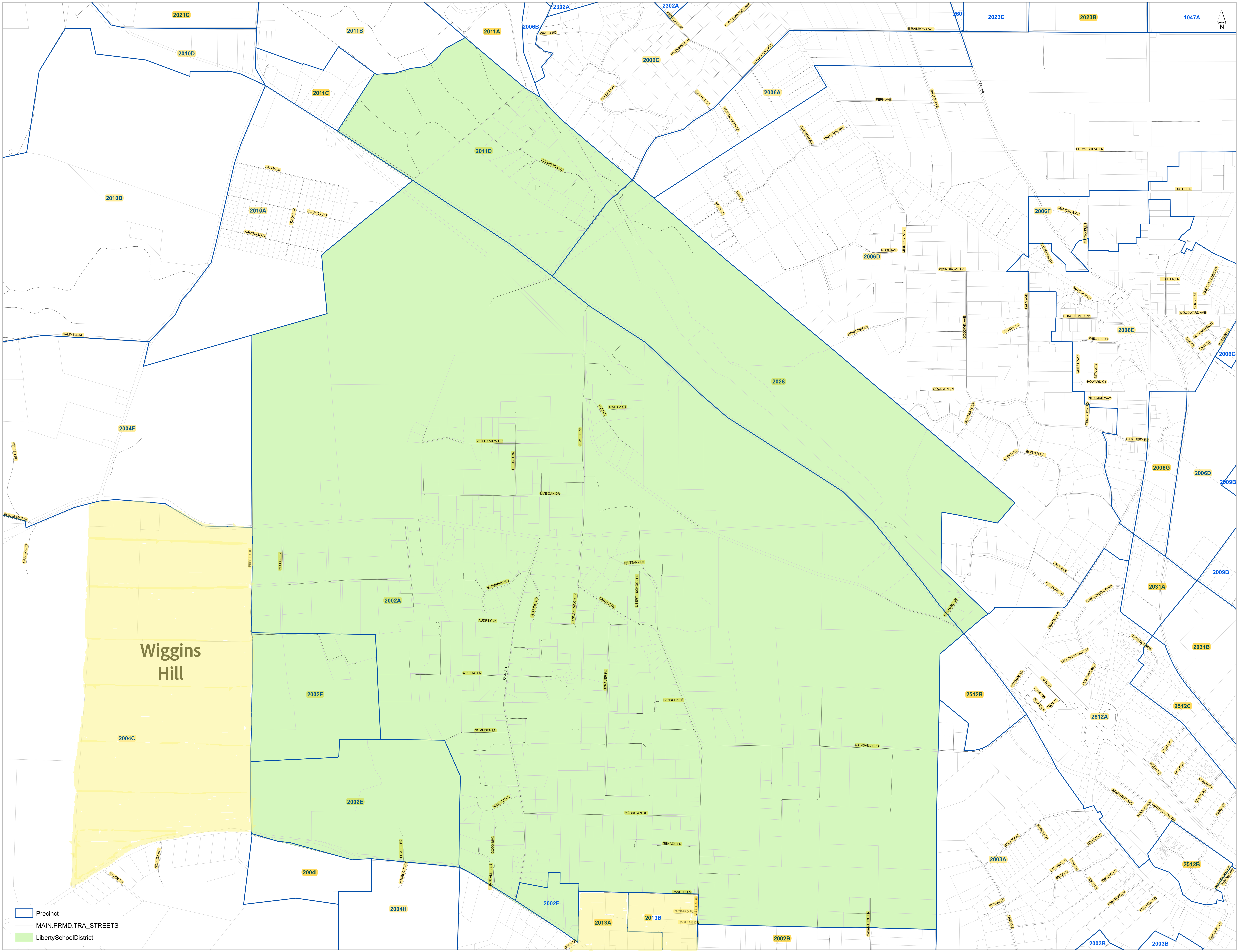
In addition, the analysis of Neighborhood Compatibility should take into consideration the following:

- **Aesthetics** – Pepper Road is a main thorough fare through the Liberty Valley. Pepper Road is also one of two major corridors through Petaluma to Bodega and Bodega Bay (the other being Bodega Avenue). Cannabis hoop houses do not fit into the scenic quality of the landscape and would take away from the traveler’s enjoyment of the view.

- **Health and Safety** – On November 28, 2020 a bullet from a current grow that backs up to Pepper Road went through a neighbor’s home on Pepper Lane (Sheriff Case #SD201128013). On September 07, 2011 a property on Pepper Lane was raided and five were arrested for cultivation and violations (Sheriff Case #SD110907006). With over 500 properties in a 5 square mile area healthy and safety is a main concern – there are too many people/families in a small area for a Commercial Cannabis operation and it would NOT be compatible to our neighborhoods. Law enforcement average response times are more than 20 minutes.
- **Water** – Over 50% of the Liberty Valley has water issues. The County has not updated their water studies for decades and therefore, does not understand that the current Water Zone the Liberty Valley is labeled, is outdated. During the height of the drought numerous properties were paying to have water trucked in. We cannot afford to have a commercial cannabis operation depleting our already scarce water table and wells.
- **Air Quality** – Going back to Pepper Road being a main corridor to the coast, cannabis odor is a negative impact to tourists or anyone out for a joyride, let alone the neighbors. The Liberty Valley is a wind tunnel and odor from any operation would negatively affect the whole area.

In closing, The Neighbors of Liberty Valley are fully aware that growing cannabis in Sonoma County is legal and are not opposed to it in general, but rather where it should be allowed to be legally grown. There are areas in Sonoma County that fit the profile for commercial grows. Those areas are tucked away where nobody would have any idea they were there. You wouldn’t see them or smell them. They would have less impact on water and wouldn’t be in high fire zones or in an area where roads are inadequate. And they most definitely wouldn’t be in the middle of rural residential neighborhood.

Thank you,
The Neighbors of Liberty Valley



Liberty School District

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Cc:	James Gore; Lynda Hopkins; Susan Gorin; Chris Coursey; David Rabbitt
Subject:	Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Inclusion Zones
Date:	Friday, March 17, 2023 12:10:17 PM

EXTERNAL

Date: March 17, 2023

To: **cannabis@sonoma-county.org**, **crystal.acker@sonoma-county.org**

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, James.Gore<James.Gore@sonoma-county.org>

Subject: Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for **Inclusion Zones**

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

Thank you for the opportunity to comment on the scope and items to be studied for "Sonoma County Comprehensive Cannabis Update" Project. The following comments are directed to the "Criteria for and mapping of Inclusion Zones…" as spelled out in the Project Description.

In response to this requirement two scoping requests are provided. One: Rules and Regulations to setting up and managing such zone, and Two: specific locations to be studied.

1) Study/Analyze the Rules and Regulations necessary to establish and manage such an inclusion zone.

   a. First the criteria's stated in the NOP to **identify** a zone appears to be well thought-out. Of course the devil is in the details on how these criteria are applied to a specific area. The fact that an area meets the criteria, should not automatically mean it becomes zoned such.
      i. Analyze and establish the separation criteria for the areas that border an inclusion zone, to assure no impacts to those outside the border. For example: setbacks, odor abatement plan, etc.
      ii. Only areas having a strong local interest in commercial cannabis activities should be considered.
   b. **Establishing and Managing** such zone requires a set of rules to follow:
      i. Analyze the effect on property values inside and outside zone and what financial compensation is due. In Washington and Colorado, neighboring properties affected by odor were able to have their property taxes reduced and receive compensation.
      ii. Analyze what rules the property owners would follow to elect to join such zone. Majority vote, unanimous vote? Determine the level of outreach by County that is necessary to assure such residences really wants to be included.
      iii. Analyze what protections are provided to a neighbor on the periphery of such proposed zone.
      iv. Analyze what day to day management might be required inside this zone, considering it could become a highly concentrated area. More security? More water monitoring? More smell monitoring both in and at the edge of the zone? For example Santa Barbara County requires an Odor Abatement Plan that minimizes odor drift to adjunct properties including schools, day care, retail, residential neighborhood.
      v. Analyze what real estate disclosures are required when a property in the is zone listed for sale. By law any item that might affect property values are required to be disclosure by the seller to a potential buyer.
   c. **Termination** of inclusion designation: Analyze what rules the property owners in an

existing zone could elect to terminate such designation.

2) Specific locations to be studied for inclusion zones. 4 locations suggest for study:
   a. Industrial Zones: These areas have all the services(water, sewer, etc.), are close to the workforce and housing, are secure, have fire and police nearby, and are less likely to encroach on residential neighborhoods. These would mainly be indoors, which the HdL report indicates are the only profitable operations and the only ones competitive in the California marketplace. Further these areas along could hold 100% of the cultivation requirements.
   b. Waste treatment plant- Plenty of open space, little to no residential housing nearby, and most importantly a ready supply of recycled water which a thirsty crop like cannabis requires.
   c. Supervisor Gore and Hopkins neighborhoods- Although this suggest might seem pointed, the rational is sound. Let me first relate a personal story which will provide an actual example why this makes good sense.
      i. I spent a good portion of my career in Telecom, working for Don Green “The father of Sonoma County’s Telecom Valley”, at the first startup, Optilink. Our flagship product the “Litespan 2000” after a slow start, became wildly successful, generating billions of dollars in sales. Looking back, I would say it was revolutionary for its time. The engineering staff worked long hours developing the first prototype in record time. Needless to say with a staff over 200, no sales, and cash being burned through, time was of the essence. The Marketing and Sales staff presented this remarkable new product to every communications company in America, who were skeptical of an unproven product by an unheard of company out of city only known for its chickens-Petaluma. Finally after more than a year of effort, the VP of Marketing called all the staff into the parking lot (there was no room that could hold 200 people). He announced one company was interested in ordering our product. As you can imagine, the staff went wild, high 5’s all around. After the cheers died down, he said, “but they want to try it first”. There was murmur, “oh brothers” in the crowd, then a few moments later the team spirit was back up “yea, we can do, our product is great, who wouldn’t want it, let’s get it done”. The Marketing VP said “the good news, you engineers don’t need to book any flights or any hotel rooms, and even better you can start installing today”. He looks across the parking lot, “see that hut, the one providing communication services to our building/our company, that’s where the first Litespan will go”. “Pacific Bell is tired of me pestering them with my wild claims of this magic box, and told me to put my money where my mouth is. Hence we are our own guinea pigs”. The engineer’s enthusiasm wasn’t quite the same as at the start of the meeting, but they got to work pronto. I’m happy to the report the Litespan 2000 performed extremely well. But it wasn’t without glitches at times. During those unfortunate times, when the network was down and I couldn’t complete my work, I was concerned but not worried. No I knew I was in the same boat as the President, Don Green. At such times, Mr. Green would calmly get up from his desk walk over to the engineers desk, and before he could say “do we have a problem”, the engineer would say “working on it Don”. Needless to say the bugs were address immediately and fixed in short order.
      ii. Supervisor Gore and Hopkins believe in cannabis and have consistently advocated for it over the last 7 years. Placing their neighborhoods in an inclusion zone allows them to experience the product upfront and personal every day. And like Don Green who had the power to direct and prioritize all 200 Optilink employee’s, Supervisors Gore and Hopkins, have the Code Enforcement department, Permit Sonoma, the Legal team and the Sheriff’s office at their fingertips. So when “glitches” in the new cannabis ordinance arise such as the recent incidence of a cannabis operator in the Barlow lane area discharging firearms, the neighbors will be concerned, but not worried. They know their Supervisor’s (and family) have a vested interest in resolving these “glitches”, will give them top priority and they will be resolved promptly in a fair way. Finally this recommendation will assure that all the bugs are worked out before cannabis is rolled out to another zone.
         1. Finally, I don’t know where the Supervisors live or what their neighbors think of commercial cannabis in their backyards. I trust the supervisors will take their neighbors’ concerns and wishes into account before making any decisions.

Thanks
Bill Krawetz, Sebastopol

From: J
To: Cannabis
Subject: Cannabis in SoCo
Date: Friday, March 17, 2023 4:48:29 PM

EXTERNAL

Hello,

I live on Pepper Lane in Petaluma, and am very concerned about what is going on with the cannabis industry in Sonoma County.

There was one new thing said at the meeting, and it was an important piece of information: the collapse of the cannabis industry statewide.

Unfortunately, this supports illegal growers, who have no tax to pay, and no county compliance to heed, and it undermines legal growers, who have those burdens.

Have any of you done the money math?

- How much tax income will be needed to provide enough salaries for a policing body to shut down the illegal growers, as well as monitor the legal ones?
- Given the current price of cannabis, how many legal growers, growing how much product, would there need to be to generate that income?
- Will there be sufficient revenue to justify the cost of all the manpower needed to manage this industry?
- It's been made apparent by multiple neighborhood speakers that allowing grow operations near or within neighborhoods will trigger legal battles. Is the county financially prepared to handle this?

Thank you for your attention to this important issue.

From:	kkyates
To:	Cannabis
Subject:	March 8 meeting
Date:	Friday, March 17, 2023 2:12:45 PM

EXTERNAL

My name is Katherine Yates and I live on Pepper Lane. Of all the meetings I have attended, the March 8 one seemed structurally problematic, made evident by the fact that 95% of the speakers did not address the meeting's stated subject.

Instead, they addressed the issues that have been stated over and over in these meetings, which you all must know by heart by now.

For people in neighborhoods they are:

1. Noise
2. Traffic
3. Crime
4. Visual impact
5. Setbacks
6. Water
7. Odor
8. Nighttime light pollution

For legal growers they are:

1. excessive restrictions
2. Excessive taxes
3. Endless application procedure
4. the county's failure to shut down the illegal growers.

My environmental issue for Ascent regards odor.

How will you measure odor? The speaker who asked how environmental impacts would be quantified raises a good question.

Wind carries odors, and knows no boundaries. Some parts of the unincorporated areas are much more windy than others. Will Ascent be looking at wind maps to make location-specific recommendations for setbacks? At the very least, it should be obvious that from an odor perspective, 300 feet is insufficient.

A number of the growers at the meeting were arguing for processing on their farms. Processing produces *much* more odor than growing. I once allowed a back yard grower to dry his plants in a shed of mine. The odor was intense, and spread quite a distance.

Ascent needs to be looking at this impact as well.

In conclusion:

There seems to be a basic failure among the county leadership on this issue to recognize that the unincorporated areas of the county have neighborhoods just as the incorporated areas do. Grows arent allowed in incorporated neighborhoods, and the same should be true around unincorporated ones. This has been made so obvious from all the meetings that it is baffling why the debate drags on. Doing what Colorado does, in allowing neighborhoods to vote regarding grows near them, is an interesting idea.

Thank you for the work you all are doing on this issue.

Sincerely

Katherine Yates

From: Ken Freeman
To: Cannabis; Crystal Acker
Subject: Exclusion Zone Ragle Ranch
Date: Friday, March 17, 2023 3:16:46 PM
Attachments: Exclusion Zone Ragle Ranch.pdf

EXTERNAL

Dear Ms. Acker,

As a note of background, my wife and I own Freeman, a small, high-end, winery at 1300 Montgomery Road. Five years ago, we went thru a bruising-battle with our neighbors to get approval for a small number of appointment-only tastings. During the process it became very clear that Montgomery Road is very narrow and tight - and adding a commercial cannabis operation will add lots of daily traffic and make the road even more dangerous.

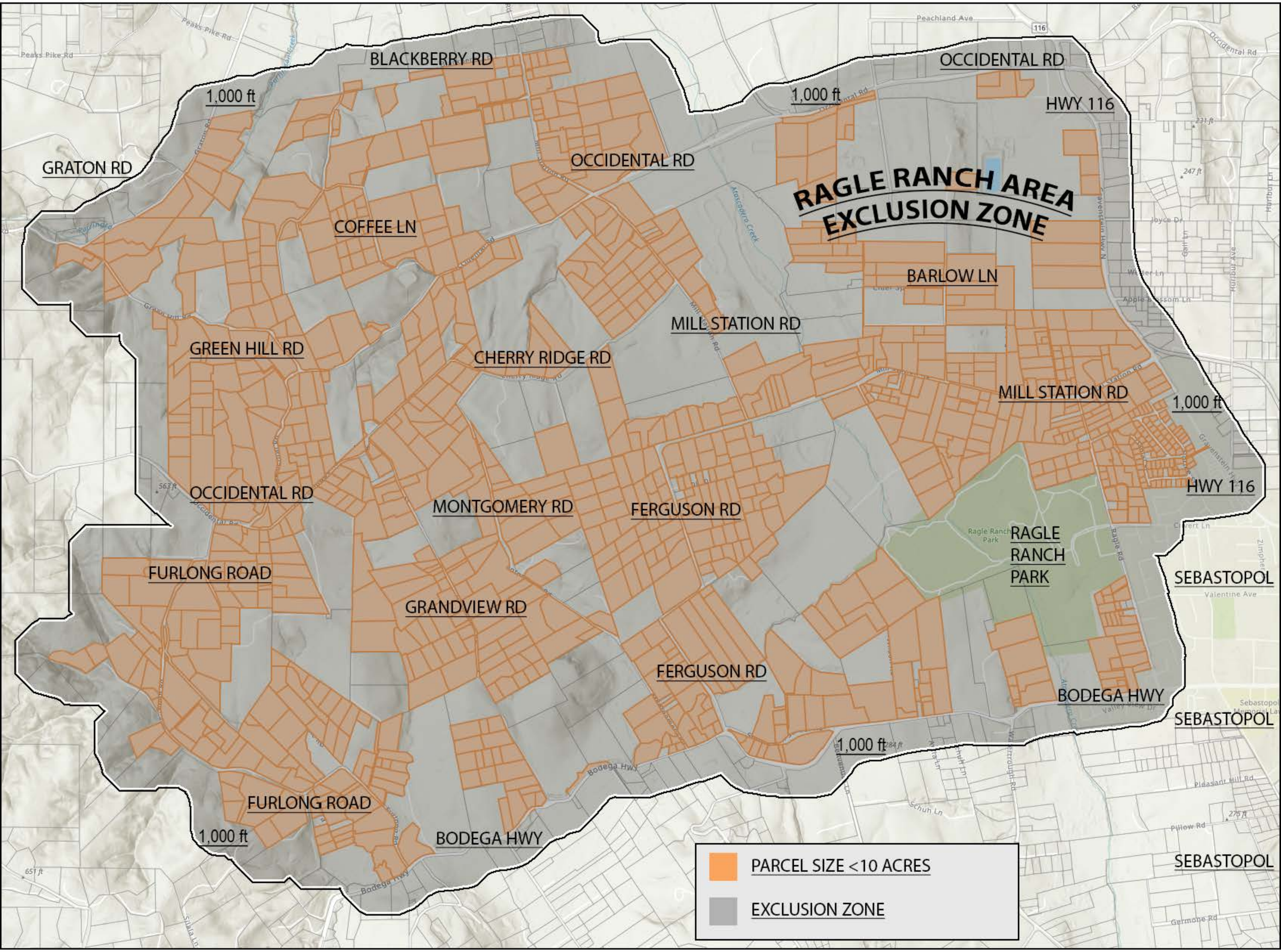
Additionally, we have a nine acre, organically farmed vineyard just down Montgomery Road on the hillside which produces highly rated wine and is sold in leading restaurants and wine shops around the world. It is a fact that grapes are permeable and will pick up the very noxious scent of Cannabis while its growing and being processed.

I am actually not opposed to Cannabis, but not on Montgomery Road. I have been on the Sonoma Land Trust Board for five years, and with Sonoma County's 2.2 Million acres there are lots of potential Cannabis growing areas that are not surrounded by residents, and not accessed by a dangerous tight, one lane road, and do not have high end vineyards very close.

Also, per the attached Exclusion Zone map, hopefully the Ragle Ranch area will be excluded from any type of Cannabis growing. We have many nearby residences, narrow road and just do not need or want Cannabis growing in our area.

Thank you in advance,

Ken Freeman
Tel: +1415 310-5077
www.freemanwinery.com



RAGLE RANCH AREA EXCLUSION ZONE
BLACKBERRY RD
OCCIDENTAL RD
HWY 116
1,000 ft
GRATON RD
OCCIDENTAL RD
COFFEE LN
BARLOW LN
MILL STATION RD
GREEN HILL RD
CHERRY RIDGE RD
MILL STATION RD
1,000 ft
OCCIDENTAL RD
MONTGOMERY RD
FERGUSON RD
HWY 116
RAGLE RANCH PARK
FURLONG ROAD
SEBASTOPOL
GRANDVIEW RD
FERGUSON RD
BODEGA HWY
SEBASTOPOL
1,000 ft
FURLONG ROAD
1,000 ft
BODEGA HWY
SEBASTOPOL
PARCEL SIZE <10 ACRES
EXCLUSION ZONE

From:	Christina Rivera
To:	McCall Miller; Crystal Acker
Cc:	Tasha Levitt
Subject:	FW: Well Ordinance Amendments and Cannabis Permitting
Date:	Friday, March 17, 2023 1:59:36 PM

Just FYI.

From: Mary Plimpton <mbplimpton@gmail.com>
Sent: Thursday, March 16, 2023 6:31 PM
To: Jennifer Klein <Jennifer.Klein@sonoma-county.org>; PermitSonoma-Wells-PublicInput <PermitSonoma-Wells-PublicInput@sonoma-county.org>
Cc: Tennis Wick <Tennis.Wick@sonoma-county.org>; Christina Rivera <Christina.Rivera@sonoma-county.org>; Nathan Quarles <Nathan.Quarles@sonoma-county.org>; Robert Pennington <Robert.Pennington@sonoma-county.org>
Subject: Well Ordinance Amendments and Cannabis Permitting

EXTERNAL

County Counsel Klein and Permit Sonoma Staff,

As you write the amendments to the well drilling ordinance, I hope you are also considering the following:

At what point will you link County permitting of cannabis to this issue? At what point might it be reasonable to point out to the Supervisors that aggressive pursuit of expansion of a very water-thirsty crop is contrary to the Public Interest, writ large.

I have property in Franz Valley near the county line with Napa County.
Franz Valley is designated Water Zone 3 (marginal groundwater).
Our area plan specifies 20-acre minimum parcel size.
A 30-acre parcel was allowed to be split into 3 10-acre parcels and sold to an entity (Creative Waves) affiliated with Cannacraft.
A consortium of tenant “pharmers” filed applications for 11 ministerial permits to plant cannabis.
A well was permitted on each of the 10-acre parcels.

The wells are in close proximity to a tiny tributary stream into Franz Creek which is part of the Russian River Watershed.
The ministerial permits for cultivation of cannabis were put on hold.
The property owner (and their consortium) have, reportedly, planted hemp which I understand to be equally water-thirsty.

This winter/spring's welcome rains notwithstanding, I am concerned that the cultivation of hemp (and eventually, perhaps, cannabis) may imperil not only our community's groundwater but also the riparian habitat of Franz Creek.

If wells go dry, according to proposed language that I have read, property owners may not be permitted to drill deeper. What options would we have for water - and who would bear the costs?

Just wanted to be sure this is on your radar as you compose the amendments to the well drilling ordinance.

Thank you for your consideration
Mary Plimpton
8425 Franz Valley School Road

From:	rob@damazioexcavating.com
To:	Cannabis
Subject:	Attn Krystal Akers
Date:	Friday, March 17, 2023 10:33:10 PM

EXTERNAL

Hello,
We recently took part in the Webinar on March 8, and wanted to continue the conversation.

We live in the Hessel area of Sebastopol on 1.24 acres. About 1.5 to 2 years ago the county shut down an illegal grow operation that was right next door to our house. The illegal grow was on .89 acres and they literally had hundreds of plants that butted right up to the fence that we share that we had to put up to create separation.
The houses in our area are not evenly spaced and we live in one of the oldest homes in the area so our house was literally 20 feet from their hundreds of plants, not just our property but our **actual house**. During this time, we used to see men that were living in the backyard in trailers to guard and cultivate the crop and on a few occasions they were armed with rifles. They also had dogs that could be dangerous as they attacked and killed a smaller dog on our street. Our view outside our window that we paid a lot of money for was no longer pretty scenery, but a sea of plastic tents. Every fall there was a smell in our home for months that burned our eyes for especially when it got hot out. This was so stressful for our whole family.
The county eventually shut it down …Thankfully.

Now we understand that the county of Sonoma is preparing an EIR review, and are considering lessening the acreage requirements for growing marijuana commercially. We have been listening to many videos on the county site and are very concerned at what might be proposed. We also don't understand who gets to decide this? Does the community get to decide, do we get to vote on it? Is it your office that gets to decide? Are you only listening to the farmers? We only saw zoom meetings in our Hessel area that were with the Hessel Farmers Grange but nothing from the rest of us residents. Will you take our concerns into consideration?

We heard a lot of the farmers talk about equity and all the money they have invested in this area. We too have invested a lot of money in this area and are concerned this will affect our property values as we plan to sell our home as part of our retirement investment. Will this be looked as part of the Environmental Report?

We own a construction company in Sonoma County. We do everything on the up and up, pay very high taxation and follow all the regulations. We listened to the farmers complaining about having to follow regulations and pay taxes. Why should they be any different than any other small business in this county?

We also are not allowed to run our small business out of our house. Why? Because residents don't want to look at our 17 plus pieces of heavy equipment. It is unsightly to them and we understand that. It would change the neighborhood if we did so. Our heavy equipment does not require us to guard it with guns and mean dogs. It also does not smell. We instead run our business in the areas that county deems proper to ensure the sanctity of our neighborhood and everyone's right to live in peace on their properties.

We hope that in this Environmental Report you consider things like setbacks from people's actual homes and not just their properties! We hope you look at what this could possibly do to our property valuesl We hope that you look at how this could change our neighborhoods. We live in RR and our houses are not that far apart. Prior to the county shutting down the operation we felt as though we lived on top of a pot farm!

Again we hope you consider all residents rights and concerns about our properties and our way of life.

Thank you, Rob and Jeannie Damazio

DAMAZIO EXCAVATING
GENERAL ENGINEERING • GRADING • SITE WORK
PAVING • EXCAVATING • SEPTIC • PUMP & WELL

Office: 707-789-9998 ~ Cell: 707-591-4425
Fax: 707-789-9997
P.O. Box 751088, Petaluma CA 94975
rob@damazioexcavating.com
CLSB License 928048

From: anil arora
To: Cannabis
Cc: Ann Arora
Subject: Franz Valley - Request to be designated an Exclusion Zone for commercial cannabis
Date: Sunday, March 19, 2023 4:55:35 PM

EXTERNAL

Please add our names Ann Arora and Anil Arora of 9800 Franz Valley School Rd to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial

Franz Valley* asks to be classified as an Exclusion Zone for Commercial Cannabis.

With other Sonoma County neighborhoods, Franz Valley supports cultivation and processing of County-permitted commercial cannabis on designated commercial and industrial zoned land where the following criteria are met: The cultivation and processing are not in impaired watersheds; do not create noise and odor nuisances for residents; do not negatively impact existing conventional legacy agricultural activities; are not in high risk fire zones or areas without fire safe roads; are not in public view; and are in safe proximity to Emergency Responders.

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Criteria supporting Franz Valley as an Exclusion Zone:

Water:

- FV is Water Zone 3/marginal
- Wells/groundwater, rainfall and catchment ponds are the only sources of water for both residential use and for agricultural requirements.
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- Cannabis requires high amounts of water, significantly more than any crops that are or have ever been raised in Franz Valley.
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    - In other California counties and in other states, there are reports of water table depletion and of water theft associated with cultivation of cannabis.
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Cannabis appears to be a crime magnet.

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- Franz Valley is a steep-sided box canyon. We are concerned the known noxious odor of cannabis could be trapped, recirculated to accumulate and spread widely throughout the valley.
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- The aggressive fencing associated with cannabis grows may disrupt normal wildlife movement.
- We are also concerned about “crop protection” (depredation) permits that might be requested to kill wildlife that roam onto cannabis properties.
- Please see the Wildlife Scoping Document, submitted separately.

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- Franz Valley is within the Mayacama-to-Berryessa climate impact study zone
- Cultivation of cannabis within this zone may be incompatible with or otherwise disrupt this study.
    - https://databasin.org/documents/documents/f33f44b1f55d4900b00c6ffe3467905f/

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- West/NW: The ridge above/W of Franz Valley Road
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The Franz Valley neighborhood is in Sonoma County, despite most of its postal service being provided through Calistoga/Napa County.

Franz Valley is primarily within the Northern Sonoma County Fire Protection District.
It is bordered on the E by the Napa County line.
It is adjacent to and shares a ridge with the south of Knights Valley.
On its western edge, it abuts and includes the Pepperwood Preserve.
To the southwest, it is in the Sonoma County Fire Protection District and abuts Mountain Home Ranch Road.
For many years, Franz Valley proper has been divided along its county roads (Franz Valley Road and Franz Valley School Road) between Sonoma County Supervisorial Districts 1 and 4.

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and

- Franz Valley School Road at junction with Petrified Forest Road (in Napa County).

Franz Valley Road and Franz Valley School Road and the valley itself were identified to be a scenic corridor. The Valley is a scenic gem, incompatible with commercial land uses which are disallowed in this area by the Franz Valley Area Plan.

The community consists of approximately 100 properties ranging from less than 5 acres (grandfathered) to upwards of 100 acres.
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Franz Valley is a patchwork of County-designated land use zones, including RR, AR, and DA.

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Valley does or did so with a tacit agreement to accept in the future either a public nuisance or a public threat:

- A public nuisance in the form of, among others, noxious odor impacts on quality of life and/or potential impacts on nearby crops.
- A public threat in the form of, among others, groundwater depletion and increased risk of crime.

We are aware of and do not object to small grows for personal use. However, we carry deep concerns about public nuisances and threats in the event that commercial-scale cannabis operations are permitted in our unique valley.

To reiterate:
We the undersigned residents and property owners of Franz Valley believe that commercial cannabis is incompatible with the traditional ethos of the Franz Valley community and with the characterizations of the Franz Valley Area Plan / Sonoma 2020 General Plan. We respectfully ask that you accept and confirm our request that Franz Valley be designated a Commercial Cannabis Exclusion Zone.

Thank you.
Ann & Anil Arora

From:	Craig Blencowe
To:	Cannabis; Crystal Acker
Subject:	EIR Cannabis--Scoping Comments
Date:	Sunday, March 19, 2023 2:39:29 PM

EXTERNAL

19 March 2023

Ladies and Gentlemen:

In response to the "Notice of Preparation and Program EIR Public Scoping", let me state that I have no problem with either the use, or the growing of cannabis per se. Nor do I consider myself a NIMBY relative to this subject.

However, I would like to request that the EIR address two significant items:

1. If cannabis is classified as a legitimate agriculture product, it would presumably fall under California's 1981 Right to Farm law, which states under Section 3482.5 of the CA Civil Code:

(a) (1) No agricultural activity, operation, or facility, or appurtenances thereof, conducted or maintained for commercial purposes, and in a manner consistent with proper and accepted customs and standards, as established and followed by similar agricultural operations in the same locality, shall be or become a nuisance, private or public, due to any changed condition in or about the locality, after it has been in operation for more than three years if it was not a nuisance at the time it began.

The EIR should address how cannabis would dovetail into this law. When considering the odor, crime, and other related negative aspects, it is realistic to believe that cannabis may indeed be considered a "nuisance" at the outset, and thereby not be covered under the Right to Farm law.

2. The EIR should consider water use, not only in terms of volume, but also relative to time of year. Using water in January is not the same as water use in September. In fact, even if cannabis were not an issue, the county needs to critically evaluate the future demands and impacts from all sources on what is most likely to be a dwindling future water supply (the current wet season notwithstanding).

Thank you for your consideration.

Regards,

Craig Blencowe

2333 Mill Creek Ln., Healdsburg

From: Glenys Wilbur
To: Cannabis
Subject: Cannabis exclusion zone
Date: Sunday, March 19, 2023 5:25:23 PM

EXTERNAL

Please add our name to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis

John and Glenys Wilbur
4130 Sylvester Lane
Calistoga, CA 95409

From: Jim
To: Cannabis
Subject: Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date: Sunday, March 19, 2023 5:18:14 PM

EXTERNAL

Please add my name to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.
Regards,
James Bareuther
8507 Franz Valley School Rd
Calistoga, CA 94515

Sent from my iPad

From: Lisa Weger
To: Cannabis; Crystal Acker
Subject: CANNABIS CULTIVATION
Date: Sunday, March 19, 2023 3:40:23 PM
Attachments: CANNABIS CULTIVATION.docx

EXTERNAL

Dear Cannabis,

Attached is my letter for inclusion with the cannabis EIR Scoping comments. I do hope the EIR addresses these comments.

Regards,
Lisa Weger

March 19, 2023

To: cannabis@sonoma-county.org

Subject: EIR Cannabis / Scoping Comments – recommendations for study

Dear Cannabis Sonoma County,

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update:

PROTECTING NEIGHBORS

It is reasonable to anticipate that cannabis cultivation shall not adversely affect the health, safety, or general welfare of persons at the cultivation site or at any nearby residence by creating dust, glare, heat, noise, noxious gasses, odor, smoke, traffic, or vibration, by any means and most particularly by the use or storage of hazardous materials, processes, products or wastes. Cannabis cultivation shall not subject residents of neighboring parcels who are of normal sensitivity to reasonably objectionable odors.

The Scope of the EIR should specifically address each and everyone of the above listed neighborly concerns clearly answering the question-- Will cannabis cultivation by a neighbor provoke dust, glare, heat, noise, noxious gasses, odor, smoke, traffic, or vibration?

The scope of the EIR should specifically address if cannabis cultivation as proposed in the Scope document (without setbacks or garden size limitations) subjects neighbors to objectionable odors, then what remedies if any, shall said neighbors have to restore the (pre-Cannabis cultivation) enjoyment of their homes and property?

The EIR should propose specific mitigations to eliminate any and all concerning adverse impacts. The EIR should also address who will pay for such mitigations?

WATER

The existing Water Plan for Sonoma county is decades old. Prior to, or in coordination with, the preparation of the EIR the Sonoma Co. Water Plan must updated. Without such an update the EIR would prima facie, be deficient in that it would be unable to accurately evaluate the amount of water available for new cannabis cultivation.

The scope of a Water Plan update should include, at a minimum, the number of residences both built as well as planned and permitted and the estimated consumption of water for household use in 2023 for Sonoma Co. Additionally, the current consumption for Industrial use, for currently permitted Agricultural use and whatever other uses that are legal and draw upon the water resources of Sonoma county must be calculated and incorporated as a baseline of water consumption in the EIR.

Upon updating the current use of water in Sonoma Co, the EIR must address and enumerate the sources of water available to meet Sonoma County's existing needs. In doing this analysis the EIR should address the possibility of a continued long term drought resulting from climate changes that may actually reduce the amount of water currently available.

The EIR must specifically address the amounts of water that would be needed for each acre of Cannabis cultivation for a growing season.

Finally, the EIR must specifically determine, given the limitations of water as a resource, and given how much water needs to be retained in the rivers and as ground water, how much "currently unused" water is available and how many acres of Cannabis would that support during a drought period.

CANNABIS AS AN AGRICULTURAL PRODUCT

Sonoma County has a vibrant agricultural community supported by among others products grapes, dairy, vegetables, and olive trees. The EIR should explore what defines an agricultural product. It has been asserted that anything that grows in the ground is an agricultural product.   Such an assertion seems simplistic.

Why do most Sonoma County residents consider vineyards, dairies, gardens or trees as welcome neighbors. Most often Ag is seen as a good and reasonable neighbor. That is why the “Right to Farm” law exists. It is to protect good neighbors that enhance our quality of life. If Ag were actually noxious or dangerous, California residents would rise up and repeal the Right to Farm law.

Prior to concluding that cannabis should be considered an Agricultural product, because it is grown in dirt, the EIR must explore and determine if it is a “good neighbor” that enhances the quality of life for the residents of Sonoma county.   It is well known that cannabis cultivation and sale provokes repeated and often violent crime.

The EIR must analyze current county statistics regarding the crime associated with cannabis. Upon determining the incidence of violent crime associated with cannabis cultivation and sale the EIR must compare this data to the violent crime associated with the cultivation of grapes, the making of wine, the raising and milking of dairy cows.

Upon thoroughly addressing how much and what type of crime we experience in Sonoma Co. which is associated with cannabis cultivation, the EIR must address if, in fact, cannabis cultivation is significantly more likely to provoke violent crime than growing grapes, cows or olive trees.

If indeed cannabis cultivation is linked to higher rates of violent crime than other Agricultural endeavors, then the EIR must address how cannabis cultivation could be considered a good neighbor? How could it be eligible for the heightened protections that accompany the agricultural designation?   These questions must be addressed in the EIR.

I look forward to the answers to the questions posed in my letter.

Best Regards,
Lisa Weger
Healdsburg CA

From:	Mary Plimpton
To:	Anil Arora
Cc:	Cannabis; Ann Arora
Subject:	Re: Franz Valley - Request to be designated an Exclusion Zone for commercial cannabis
Date:	Sunday, March 19, 2023 5:19:01 PM

EXTERNAL

THANK YOU!!!
Mary

On Mar 19, 2023, at 4:55 PM, anil arora <aarora@gmail.com> wrote:

Please add our names Ann Arora and Anil Arora of 9800 Franz Valley School Rd to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial

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Thank you.
Ann & Anil Arora

From:	Mary Plimpton
To:	Crystal Acker; Cannabis
Subject:	Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date:	Sunday, March 19, 2023 3:35:34 PM
Attachments:	FV Exclusion Zone.docx

EXTERNAL

Ms. Acker

This reaffirms our request - as outlined in our August 2021 “small group” presentation - to designate Franz Valley an Exclusion Zone for commercial cannabis. While cannabis may be suited to industrial and commercial zones, it is inappropriate, a threat, to our neighborhood.

Thank you for your consideration.

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  - In other California counties and in other states, there are reports of water table depletion and of water theft associated with cultivation of cannabis.
- The incomes of several decades-long, even generations-long, Franz Valley property owners come from conventional crops, including apples and wine grapes. We are concerned about the depletion of our water table, threats to our wells and to conventional heritage existing crops if commercial cannabis cultivation is permitted.
  - We have similar concerns about water usage for cultivation of what we understand to be equally "thirsty" (but unregulated) hemp.

Risk to prior existing commercial agricultural crops:

- Franz Valley is many decades-long home to several acres of grapes. Some vineyards abut property recently acquired by a company that organized a consortium of tenant farmers with the intent to plant cannabis.
    - Vineyard owners are concerned about terpene tainting of valuable wine grapes; water table depletion; water and soil pollution; and the possibility of challenges to standard vineyard practices.

Riparian Health:

- Franz Creek is in the Russian River watershed and is home to
    - rare and endangered freshwater shrimp
    - steelhead trout and fingerlings
    - California brown newts
- We are concerned that earth grading associated with commercial cannabis cultivation, as well as the potential for surface water run-off from these operations, will impact the health of the riparian corridor.

High Fire Risk area:

- Franz Valley is in the footprint of historic catastrophic fires including the Kincade (2019), the Tubbs (2017) and the Hanly (1964); earlier fires also burned through Franz Valley.
- If topography is destiny, as it appears to be, then fires will burn through Franz Valley in the future.
    - Franz Valley is remote from firefighting assistance.

Narrow, winding roads, limited access, challenging to evacuate:

- In many places through and in/out of Franz Valley, the roads cannot fully accommodate 2 conventional passenger cars passing, much less emergency vehicles. One vehicle must at least partially leave the roadway.
    - Shoulders are limited to non-existent, and there are no engineered turn-outs.
- Evacuation during the Tubbs Fire was accomplished in part due to the heroic actions of our Volunteer Fire Chief leading out evacuees, cutting and removing downed limbs from the roadway.
- In 2021, a private farm road (unpaved) - part of a network of historic shared private farm roads long used as emergency exits – was blocked at the fence line with the proposed cannabis grow.

Franz Valley is remote from first responders:

Because most Franz Valley postal addresses have a Calistoga (Napa County) zip code, it is not unusual for delays in responses to calls for assistance due to jurisdictional questions.

- Law Enforcement

  Cannabis appears to be a crime magnet.
    - In Franz Valley, the closest law enforcement may come from Calistoga (Napa County) with a response time of about 20 minutes. Responses from Santa Rosa are in excess of 30 minutes.

        - Individuals have experienced hostile interactions with workers on proposed commercial grow site (APC21-0072-0082), including trespass, destruction of private property, and bullying.
- Fire Protection
    - Northern Sonoma County Fire Protection District responds from Geyserville, approx 35 minutes away.
- Other Emergency Responders (eg medical and vehicular)
    - Responses are complicated and may be delayed by County Line and jurisdiction issues.

Franz Valley has spotty and problematic cell and internet service:

- There are cell service shadows throughout Franz Valley.
- Franz Valley has neither cable nor fiber: Access to internet is spotty and inconsistent.
- These increase community vulnerability and risk.

Odor and Air quality

- Franz Valley is a steep-sided box canyon. We are concerned the known noxious odor of cannabis could be trapped, recirculated to accumulate and spread widely throughout the valley.
    - Residents/owners expect the right to enjoy our properties.

Wildlife

Pepperwood Preserve occupies much of the western ridge of Franz Valley. https://www.pepperwoodpreserve.org/ Franz Valley is a wildlife corridor to the Preserve.

- The aggressive fencing associated with cannabis grows may disrupt normal wildlife movement.
- We are also concerned about "crop protection" (depredation) permits that might be requested to kill wildlife that roam onto cannabis properties.
- Please see the Wildlife Scoping Document, submitted separately.

Climate impact study zone

- Franz Valley is within the Mayacama-to-Berryessa climate impact study zone
- Cultivation of cannabis within this zone may be incompatible with or otherwise disrupt this study.
    - https://databasin.org/documents/documents/f33f44b1f55d4900b00c6ffe3467905f/

***"Franz Valley" Defined**
"Franz Valley" is a "Rural Community/Neighborhood" located within the larger area covered by the "Franz Valley Area Plan."

For purposes of this Exclusion Zone request, the boundaries of "Franz Valley" are

- West/NW: The ridge above/W of Franz Valley Road
    - Include Pepperwood Preserve
- East/NE:
    - Top of Oat Hill (the ridge between Franz Valley and the SE edge of Knights Valley) to the Napa County line
- East/SE: Napa County line
- South/SW: Napa County line
- FV Road (Pepperwood Preserve)

Franz Valley is a small steep-sided box canyon of a valley, separate and distinct from Knights Valley and the Napa Valley, and distinct as well from the Mark West Springs area.

The Franz Valley neighborhood is in Sonoma County, despite its most of its postal service being provided through Calistoga/Napa County.

Franz Valley is primarily within the Northern Sonoma County Fire Protection District.
It is bordered on the E by the Napa County line.
It is adjacent to and shares a ridge with the south of Knights Valley.
On its western edge, it abuts and includes the Pepperwood Preserve.
To the southwest, it is in the Sonoma County Fire Protection District and abuts Mountain Home Ranch Road.
For many years, Franz Valley proper has been divided along its county roads (Franz Valley Road and Franz Valley School Road) between Sonoma County Supervisorial Districts 1 and 4.

Franz Valley is accessed by

- Franz Valley Road at two points
    - at junction of Franz Valley Road at Mark West Springs/Porter Creek Roads (at Safari West)
    - at junction of Franz Valley Road at Hwy 128 (in Knights Valley)

and

- Franz Valley School Road at junction with Petrified Forest Road (in Napa County).

Franz Valley Road and Franz Valley School Road and the valley itself were identified to be a scenic corridor. The Valley is a scenic gem, incompatible with commercial land uses which are disallowed in this area by the Franz Valley Area Plan.

The community consists of approximately 100 properties ranging from less than 5 acres (grandfathered) to upwards of 100 acres.
While most of the properties are owned by full-time permanent residents, some are held by second-home owners, and a very few are short-term rentals (Air B&B, VRBO).

Franz Valley is a patchwork of County-designated land use zones, including RR, AR, and DA.

A 30+ acre property at 8400 Franz Valley School Road has been divided into three 10+-acre parcels. In May 2021, the Sonoma County Dept of Agriculture mistakenly (due to their subsequently-acknowledged misinterpretation of regulations) accepted paperwork and fees for 11 ministerial applications, each for cultivation of 10,000 sq ft of cannabis on the above-referenced three 10+ acre parcels. These applications were put on hold pursuant to the County's moratorium on the ministerial issuance of cumulative small cannabis cultivation permits. (Parcel numbers 120-150-053, -054, -055 / APC numbers 21-0072 through -0082)
It has been reported that these parcels have been planted with hemp which we understand is also water-thirsty.

While Franz Valley is a rural area and residents are comfortable with traditional rural activities, no one already living in Franz Valley or who recently purchased residential property in Franz Valley does or did so with a tacit agreement to accept in the future either a public nuisance or a public threat:

- A public nuisance in the form of, among others, noxious odor impacts on quality of life and/or potential impacts on nearby crops.
- A public threat in the form of, among others, groundwater depletion and increased risk of crime.

We are aware of and do not object to small grows for personal use. However, we carry deep concerns about public nuisances and threats in the event that commercial-scale cannabis operations are permitted in our unique valley.

To reiterate:
We the undersigned residents and property owners of Franz Valley believe that commercial cannabis is incompatible with the traditional ethos of the Franz Valley community and with the characterizations of the Franz Valley Area Plan / Sonoma 2020 General Plan. We respectfully ask that you accept and confirm our request that Franz Valley be designated a Commercial Cannabis Exclusion Zone.

Donelan Family Wines
8400 Franz Valley School Road

Nancy Graalman
7775 Franz Valley Road

Al Kellogg and Family
7771 Franz Valley Road

Betsy Lawer
Lawer Family Wines & Vineyard Properties
8910 Franz Valley School Road

Sarah Lawer
9200 Franz Valley School Road

Ken Parr
Michele Parr
8410 Franz Valley School Road

Robert Piziali
Kathy Piziali
7799 Franz Valley Road

Hal Plimpton
Mary Plimpton
8425 Franz Valley School Road

Jon Saler
June Saler
8020 Franz Valley Road

Richard Spratling
Tamara Spratling
8197 Franz Valley Road

Greg Swisher
Valerie Swisher
8310 Franz Valley Road

Galen Torneby
Eniko Torneby
8300 Franz Valley School Road

From:	Adam Messner
To:	Cannabis
Cc:	Plimpton Mary; Allison Rhodes
Subject:	Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date:	Monday, March 20, 2023 9:47:54 AM

Hello Sonoma County Policy Makers,

My family, Adam, Allison, Max (12 years old) and Coco (9 years old), would like our names added to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.

The negative impacts from water consumption, chemical effluence and odor are all negative externalities that would outweigh any potential benefits from the addition of this crop to our community.

--
Adam Messner
8170 Franz Valley School Road

From:	Chris Gralapp
To:	Crystal Acker; Cannabis
Subject:	Comment on NOP for Cannabis EIR
Date:	Monday, March 20, 2023 6:11:19 PM
Attachments:	Cannabis EIR Scoping letter.docx

EXTERNAL

March 20, 2023

Via email to:

Sonoma County Supervising Planner **crystal.acker@sonoma-county.org**
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance**--Designation of Bennett Valley as an Exclusion Zone

Dear Crystal Acker,

In response to the **Notice of Preparation of the EIR Cannabis** / Scoping Process, I request the EIR address these areas of importance:

1) **Analyze water scarcity**—Bennett Valley (BV) is situated in a Class 3 area. Many wells have dried up or have been altered by drought, and it is necessary to assess availability of water for thirsty cannabis operations.

2) **Analyze transportation corridors**—narrow roads and increasing vehicular accidents are a byproduct of increased commercial activity in the Valley.

3) Assess the impact of commercial cannabis operations on the health of the **Matanzas Creek Riparian Zone** specific to its 100-year floodwater assessment and the 2023 Matanzas Creek Dam Restoration Project.

4) Analyze the impacts of commercial cannabis operations in regards to the **scenic character** and **protected viewshed status** for Bennett Valley, with special attention to aesthetic incompatibilities and violations of the visual natural resources protected as part of the **view shed protections from the roads, residences and parks**

5) Analyze the nine development policy guidelines as approved by the County in 1979, and included in the Bennett Valley Area Plan: 1) **Land Use**; 2) **Housing**; 3) **Conservation of Resources**; 4) **Open Space**; 5) **Public Safety**; 6) **Circulation**; 7) **Scenic Corridor**; 8) **Public Services**; 9) **Transportation**

6) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to **fire safety**, including the designation of much of Bennett Valley as a **high fire severity zone 3** by CalFire and other public agencies

Bennett Valley is a planning unit that should be designated as an **exclusion zone**.

Thank you,

Chris Gralapp, Bennett Valley Homeowner

March 20, 2023

<u>Via email to:</u>
Sonoma County Supervising Planner **crystal.acker@sonoma-county.org**
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance**--Designation of Bennett Valley as an Exclusion Zone

Dear Crystal Acker,

In response to the **Notice of Preparation of the EIR Cannabis** / Scoping Process, I would like to suggest areas of importance to address in the EIR:

1) **Analyze water scarcity**—Bennett Valley (BV) is situated in a Class 3 area. Many wells have dried up or have been altered by drought, and it is necessary to assess availability of water for thirsty cannabis operations.

2) **Analyze transportation corridors**—narrow roads and increasing vehicular accidents are a byproduct of increased commercial activity in the Valley.

3) Assess the impact of commercial cannabis operations on the health of the **Matanzas Creek Riparian Zone** specific to its 100-year floodwater assessment and the 2023 Matanzas Creek Dam Restoration Project.

4) Analyze the impacts of commercial cannabis operations in regards to the **scenic character** and **protected viewshed status** for Bennett Valley, with special attention to aesthetic incompatibilities and violations of the visual natural resources protected as part of the **view shed protections from the roads, residences and parks**

5) Analyze the nine development policy guidelines as approved by the County in 1979, and included in the Bennett Valley Area Plan: 1) **Land Use**; 2) **Housing**; 3) **Conservation of Resources**; 4) **Open Space**; 5) **Public Safety**; 6) **Circulation**; 7) **Scenic Corridor**; 8) **Public Services**; 9) **Transportation**

6) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to **fire safety**, including the designation of much of Bennett Valley as a **high fire severity zone 3** by CalFire and other public agencies

Bennett Valley has been a planning unit that should be designated as an exclusion zone.

Thank you,

Chris Gralapp
Bennett Valley Homeowner

From: Gerald Phillips
To: Cannabis
Subject: Franz Valley Exclusion of Cannibis Cultivation
Date: Monday, March 20, 2023 11:56:33 AM

EXTERNAL

Dear Sirs; We wish to add our names to the list of families in the Franz Valley Corridor to ban Cannibis as a crop in this Corrodor. Thank you.

Marcia and Gerald Phillips 9520 Franz Valley School Road , Calistoga, CA 94515
707-942-5591 jermar123@gmail.com

From: Grace B.G
To: Cannabis
Cc: Crystal Acker
Subject: EIR Cannabis / Scoping Letter for Cannabis Ordinance
Date: Monday, March 20, 2023 1:05:44 PM
Attachments: CannabisScoping_GBG.pdf

EXTERNAL

Dear Sonoma County Staff:

There are several environmental elements required by CEQA. The focus of our comments are on studying *air quality* & *land use/planning inclusive of compatibility with existing communities* and cumulative impacts for Sonoma County's comprehensive cannabis update.

The County must analyze all of the aggregated impacts of all of the foreseeable development and activities. Without this analysis, the environmental review will remain incomplete and the Project cannot lawfully be approved. The County must study and establish the proper neighborhood separation criteria to safeguard neighbors from negative impacts of indoor and outdoor cannabis cultivation. Criteria must be objective and measurable to assess impacts.

1. **Air Quality and Odor:**

   a. Adequately analyze and mitigate the potential to create objectionable odors.

      Cannabis cultivation and production sites generate significant odors impacting nearby residents and other sensitive receptors. As acknowledged by Sonoma County in the SMND, unlike other types of agriculture, cannabis cultivation and processing operations "generate distinctive odors that adversely affect people" that can be "reminiscent of skunks, rotting lemons, and sulfur." It also acknowledged that cannabis cultivation "can generate particularly strong odors" compared to other agricultural land uses).

   b. Use technical modeling to estimate the odor impacts on receptors at various distances from the cannabis odor emission source. The Yolo County EIR acknowledges that odors at levels of 50,000 odor units or more have been produced at cannabis facilities. Model odor impacts at levels of 50,000 odor units to estimate the impacts of cannabis odors produced by outdoor facilities. Model cannabis odor using the best technological advances.

   c. Analyze and mitigate air quality and odor emissions, specifically, the evaluation of air quality impacts must address operation pollutants, odor emissions, analysis of project-related public health impacts and mitigation measures for significant impacts.

   d. Study cumulative air quality impacts and the potential to emit criteria pollutants, such as NOx and VOC and calculate NOx emissions and the potential impact A Sonoma County staff report to the Planning Commission meeting on March 18, 2021 stated ["...it is possible that cannabis operations would generate NOx emissions exceeding the BAAQMD's significance threshold of an average of 52 pounds per day during construction or operation, contributing to regional ozone pollution." Emphasis added.] Emissions will contribute to worsening the county's air pollution and this already violates state and federal standards for ozone and fine particulate matter and state standards for particulate matter (PM10).

e. Conduct an air emission field sampling study at commercial cannabis cultivation sites, both indoor and outdoor to quantify biogenic-terpene volatile organic compound (VOC) emissions from growing cannabis at cultivation facility exhaust points to estimate a VOC emission rate by a top-down approach.

f. Study odors from cannabis cultivation sites resulting from both indoor and outdoor cultivation areas and include odors from manure fertilizer. The molecules that cause most of the foul odors from cannabis cultivation are aromatic volatile organic compounds called terpenes.

g. Adequately measure cannabis odor from any number of plants to several thousand plants on a 10-acre parcel

h. Adequately measure odor travel in micro-climates in Sonoma County, including unincorporated Sebastopol

i. Analyze cannabis cultivation sites with indoor cultivation and / or outdoor cultivation for cannabis odor during the Spring, Summer, Winter and Fall months - all year round. The County relies on inadequate measures to mitigate odor including erroneous assumptions about the extent and duration of odors and ignores impacts in areas with smaller non-conforming parcels, claiming that impacts would be limited due to large parcel sizes in areas zoned DA, RR, AR, and RRD.

j. Analyze all of the historical and current complaints about cannabis odor in Sonoma County to understand the impacts. Sonoma County ignores the historical record of odor complaints and claims that odors are worst during the two months of harvesting. However, residents living near existing cannabis cultivation sites report experiencing pungent odors five to six months if there is a single harvest, and year-round if multiple harvests.

k. Analyze odor if there are single harvests and multiple harvests. In several cases of existing cannabis cultivation sites, residents located as far as 2,000 feet from the site are significantly impacted by odors year-round.

l. The model further also only estimates odor concentrations at minimum wind speeds of 1.11 mph. This does not allow for localized conditions in which stagnant air can allow odor units to accumulate to much higher levels of concentration compared to when conditions are more windy. The EIR acknowledges these variabilities in weather conditions and other uncontrolled variables such as the qualitative strength of the odor in the Technical Memorandum which highlight the EIR's deficiencies.

A revised environmental analysis must assume that the County will have cannabis applications to the greatest degree allowable; that is that all (or at least most) of existing and eligible cannabis cultivation sites will apply for permits. The document must then be revised to include a comprehensive assessment compliant with BAAQMD guidance of odors caused by the proposed Project. Should the analysis determine that the Project's odor impacts are significant, the EIR must identify feasible mitigation measures to effectively avoid and minimize impacts on sensitive receptors.

2. **Vegetation windbreaks:**
a. Study whether vegetation windbreaks and screening, including thick trees to

mitigate cannabis odors from being a neighborhood nuisance and include various topographies including hillsides. Analyze Sonoma County's reliance on vegetative screening to buffer sensitive receptors from cannabis odors. Sonoma County uses a USDA NRCS 2007 report to support their theory about vegetation windbreaks, which studied tree absorption of animal ammonia from indoor structures, not cannabis odors from a large open-air field. The same agency (NRCS) reports it takes 5 years to start to see benefits, and a vegetation windbreak is at a "fully functional height at 20 years'. However, Sonoma County has chosen to omit this key information with their other windbreak claims. Please study these claims.

i. Analyze the existing use of vegetation as an odor absorber and provide substantiating data given the County currently includes vegetation as a mitigator of odor. There should be a lot of data to analyze.

b. Study prevailing winds to assess how far odor extends onto neighboring properties. Analyze existing grow sites, both indoor and outdoor cultivation to understand wind patterns and odor dispersion.

3. **Vapor-Phase Systems (Fog Systems)**: Study Vapor-Phase systems, both for indoor and outdoor grow sites: Sonoma County recommends the cannabis cultivators to use Vapor-Phase Systems (Fog Systems) to mitigate cannabis odor nuisance without any evidence that this system works for outdoor cannabis cultivation. This requires binding "odor neutralizing chemicals" in the air to every cannabis volatile organic compound -- across an entire acre of open-air canopy which is not an effective mitigation plan.The County also fails to explain that vapor phase systems (Fog) are exclusively used for indoor grows. There is no experience for large, outdoor grows. The effects of long- term human inhalation of the chemicals in the fog mist and related technologies has not been studied, including potential health problems for pregnant women, babies, children, the elderly, and the acute or chronically ill. Please study the impacts of this fog mist to sensitive receptors.

4. **Setbacks to neighboring homes and properties:** Study setbacks from neighboring homes to accurately assess cannabis odor impacts. Ortech, a cannabis consulting company with 40 years of odor management experience, found that uncontrolled cannabis odors can disperse as far as 1,000 m (3,280 feet or more than 0.6 mile) from outdoor (cannabis) farms and more than 300 m (984 feet) from indoor grow facilities. This finding is confirmed through residents' experiences in recent years. Interview residents who have had first-hand experience living next to both indoor and outdoor cannabis cultivations. Interview families who live next to the 885 Montgomery Road cannabis business, for example. This business has been cultivating cannabis indoor and outdoor since 2017, without a land use permit, and neighbors have experienced cannabis odor since then.

5. **Zoning and Parcel Size:**

a. Study the odor impacts of cannabis businesses, both indoor and outdoor cultivation in

AR, RR, RRD and DA zoned properties.

b. Study adjacency where a property zoned DA is adjacent to an AR & RR zoned property and a cannabis business operating on the DA zoned property. AR and RR zoned properties are primarily residential and the EIR must study the compatibility of a cannabis business in these zones.

c. Analyze what size parcel and what minimum setback is required to eliminate odor. For example, a 20 acre minimum and a 1,000 foot setback from the property lines to eliminate the majority of neighborhood complaints.

d. Study Sonoma County's unsubstantiated claims that residents in agricultural and resource zones would have limited exposure due to large parcel sizes. Many DA, RR, AR and RRD parcels are in non-conforming areas. There are many examples of non-conforming parcels in the County.

e. Include a review of existing and eligible cannabis cultivation parcels and analyze how they may impact neighboring residents.

Study solutions that will improve the Cannabis Ordinance and help address neighborhood compatibility. Study extending cannabis setbacks to match those set to schools and parks (1000 foot minimum setback to property line) for up to 1-acre of cannabis cultivation. At a minimum, 1,000-foot setbacks from one-acre cultivation sites to residential property lines should be implemented. Depending upon the size of the grow site and other conditions, setbacks should be further increased to protect rural residents from potential health effects and adverse quality of life impacts.

Sonoma County makes claims supported only with opinions and not supported by scientific data to approve cannabis cultivation inside neighborhoods and keep 100-foot setbacks to residential sensitive receptors unchanged. Please study these claims.

These measures should include overall limits on permit approvals, limits on concentration of permits and approved acreage, exclusion zones in the County's sensitive resource areas, and robust setbacks as the primary mitigation to avoid significant odor as well as other impacts. In addition, the EIR should identify additional measures, such as testing with appropriate equipment (e.g., use of field olfactometers).

We have first-hand experience living adjacent to a 1-acre commercial cannabis business with both indoor and outdoor cannabis cultivation. In 2017, Sonoma County allowed our neighbor to grow thousands of cannabis plants 100 feet from our family and other families in our rural residential neighborhood in Sebastopol. Our bedroom window is less than 500 feet from these pungent plants and the cannabis terpene odors cause respiratory symptoms, including coughing. We also experience eye irritation and nausea and have to close our windows and doors to prevent odor from entering our home. We cannot enjoy our property.

Sonoma County Code currently considers odor from cannabis a nuisance. County Code § 26-88-250 (f) (Health and Safety. Medical cannabis uses shall not create a public nuisance or adversely affect the health or safety of the nearby residents or businesses by creating dust, light, glare, heat, noise, noxious gasses, odor, smoke, traffic, vibration, unsafe conditions or other impacts, or be hazardous due to the use or storage of materials, processes, products, runoff or wastes.)

However, the current Cannabis Ordinance fails to mitigate odor complaints and fails to disclose the extent and severity of a cannabis business's broad-ranging impacts. This approach violates CEQA’s requirement that environmental review encompass all of the activity allowed by the proposed Project. Sonoma County must analyze a cannabis business's numerous environmental impacts, including those affecting land use, transportation and circulation, air quality, biological resources, odor, climate change, public health and safety, and noise. They must consider the full impacts of cannabis cultivation and production and of events that the proposed Project would allow.

Thank you for your attention,
Grace and Robert Guthrie, Anita Lane, Sebastopol

From: john dean
To: Crystal Acker
Subject: Comments on Notice of Preparation of Cannabis EIR
Date: Monday, March 20, 2023 7:32:45 PM
Attachments: canabus 2.pdf

EXTERNAL

Please find attached EIR comments letter

John P Dean
1722 Barlow Lane
Sebastopol CA 95472
360 481 2686
johnpdean@gmail.com

March 20, 2023

Crystal Acker, Supervising Planner
crystal.acker@sonoma-county.org
VIA EMAIL

Re: Sanoma County Comprehensive Cannabis Program Update
Comments on Notice of Preparation

Greetings to persons in charge of Sonoma County Cannabis EIR:

Please include these comments detailing significant effects on the environment by the commercial cultivation of cannabis in the Cannabis Environmental Impact Report being prepared.

An article in The BULWARK, an American Conservative News and Opinion Website, entitled California's Billion-Dollar Weed Boondoggle by A.L Bardach, February 23, 2023, on the World Wide Web at California's Billion-Dollar Weed Boondoggle well documents the environmental problems currently experienced by the County of Santa Barbara in their legal cannabis cultivation program. That article points out real life significant environmental effects of cannabis cultivation in Santa Barbara County which county is similar to Sonoma County so that the same effects are equally applicable to Sonoma County.

The negative impacts of cannabis cultivation set forth in the article include:

Noxious odor affects workers and nearby residents. Noxious odor is a major environmental impact of cannabis cultivation. The odious odor from the blooming plants makes surrounding areas uninhabitable by making people sick or feeling miserable from the odor. It must be kept in mind that the odor is not always immediately unpleasant but when you must live next to a cannabis operation the odor is constant and the annoyance grows with each hour and each day during the blooming season. There is no relief except temporarily to go inside, shut all doors and windows and turn on the air conditioning or other filtering device wasting electricity. This only provides temporary relief and you and your family must eventually go outside and then you cannot enjoy your yard, BBQ area, porch or other nice area to relax and enjoy life. Your life is taken over by the cannabis operation. These are very real and significant negative environmental effects.

You are denied the quiet use and enjoyment of your property which is a time honored right of property ownership. This reduces property values by causing people to sell out and move away further causing others to move into the affected property and suffering the noxious odor. These changes of ownership cause a downward spiral of a good neighborhood into blight. This reduces property taxes which reduces governmental income which affects local government ability to deal with other environmental problems all causing a significant environmental effect. This displacement of people further causes emotional distress of people affected. The new people in turn feel they either need to move out or suffer from the noxious odor both wrenching options. A further environmental effect of noxious odor is such makes people irritated. Irritated people make poor decisions concerning self-help which can cause improper action to stop the odor resulting in police involvement. It also causes complaint calls to the sheriff or Air Pollution Control District which consumes these agencies valuable resources and diverts them from other activities. All of these are significant adverse environmental effect of cannabis cultivation which must be mitigated when cannabis cultivation is close to places where people reside.

The only meaningful mitigation to noxious odor is to scientifically establish the distance the odor travels and establish safe set-back requirements between grow operations and nearby residents and public and private facilities. A preliminary determination can be made by anyone with a normal sense of smell who can detect the odor and notes the distance that odor continues to be noticeable. This then needs to be scientifically verified. The distance over which the odor can be detected is the distance neighboring houses should be from cannabis cultivation sites to achieve mitigation of the environmental effect of odor. It must be kept in mind that the detection of any cannabis odor is an environmental effect because the odor is constant and does not decrease over time. This is unlike most other agricultural odors such as the smell of sulfur or spread manure which dissipate over time. The similar agricultural noxious odors that remain constant are cattle and swine feed lots which are known to be very annoying. Even a slight odor which is constant over time grows increasing obnoxious to people forced to live nearby.

It should be noted that the current Sonoma County practice of allowing cannabis cultivation on any 10-acre or larger parcel without regard to surrounding property lot size, number of neighboring residents and distance from the grow site imposes the maximum negative environmental effect on surrounding residents. This is especially true when permits are issued ministerially without further review of the adverse environmental effects. If the 10 acre minimum is maintained, in order to mitigate the adverse environmental effect of odor, each 10 acre or larger parcel must be analyzed for how many people live nearby, how close they live to the grow site, the surrounding size and use of parcels. Especially when an entire neighborhood is affected, cannabis cultivation should not be allowed. Once this analysis is done and mapped for each 10 acre or larger parcel, permits for cannabis grow sites can be issued ministerially without adverse environmental effect.

Further environmental effects of cannabis cultivation set out in the County of Santa Barbara article include:

Grow shelters cover farm land and cause visual pollution making marijuana cultivation more industrial than agricultural in nature causing the same adverse environmental impact on farming as any industrial use of property;

Regulations of marijuana cultivation are very difficult to enforce so that attempted mitigation of adverse environmental effects are unlikely to be successful;

Local legal marijuana cultivation is not currently and may never be financially viable so that abandoned cultivation sites may litter the landscape and bankrupt growers will petition the government for relief such as conversion to dense residential use of property negatively impacting existing agricultural uses of property;

Sonoma County is unlikely to receive meaningful tax receipts so that enforcement expenses will exceed revenue cost negatively impacting the county budget;

Marijuana cultivation negatively affects local agriculture, the tourist industry and the wine industry by emission of noxious odor, farmland coverage by unsightly grow structures, diversion of agricultural workers and use of scarce resources which will reduce local governmental services;

Marijuana cultivation is a health hazard to workers causing increased health care costs and impact on local health services;

Large-scale commercial marijuana cultivation puts small growers out of business causing increased local poverty and displacement of local farmers;

The marijuana industry may be exerting undue political influence on elected public officials causing corruption and its negative effects;

Marijuana cultivation negatively impacts scarce water resources and increases fire danger interfering with existing farming operations and causing displacement resulting from fires.

An additional significant environment effect of cannabis cultivation in Sonoma County not covered in the Santa Barbara article (probably because of the benign Santa Barbara climate) is that the climate of Sonoma County is not suitable for Cannabis cultivation. GOOGLE ‘climate for growing cannabis’ reveals that the ideal temperature for growing cannabis is 65-80 degrees. Sonoma County is noted for its cool to cold nights and hot days during much of the year and just cold in the winter. This climate is perfect for grapes and apples but poor for Cannabis. These temperature extremes necessitate heated and cooled grow houses for productive cannabis cultivation in Sonoma County with resulting huge amounts of energy expended and greenhouse gas emitted on cannabis cultivation both which are significant adverse environmental effects. The only meaningful mitigation is to require grow houses to construct and utilize solar heat methods but this raises costs to make the whole venture unprofitable compared to locations having a more suitable climate.

Finally, the local consumption of cannabis has adverse environmental effects on our community. These includes, impaired driving, gateway to addiction, difficulty in dealing with and understanding people under the influence of cannabis and the health hazards to the lungs and possibly brain and social and mental harm to the youth. This is not to imply that marijuana should again be criminalized with it many problems. However, the degree to which cultivation of cannabis in Sonoma County increases local use of cannabis is an adverse environmental effect which must be studied with mitigation imposed.

In conclusion cultivation of cannabis in Sonoma County raises many environmental problems which at best can be only partially mitigated. The no project option as mitigation should not be forgotten as perhaps the best environmental solution.

Thank you for your consideration

John P Dean

John P Dean

From:	perryj4@comcast.net
To:	Crystal Acker
Cc:	nrchrdsn@sonic.net
Subject:	Penngrove recommendations for EIR Scoping
Date:	Monday, March 20, 2023 4:41:54 PM

EXTERNAL

Dear Sonoma County Cannabis Committee;
Although it is inconceivable to me that the Board, with or without an EIR, would allow ***any type*** of commercial cannabis cultivation in the **Penngrove** neighborhood (which is in a Rural Residential Zoning District and included in the **Penngrove Area Plan**), in an abundance of caution I am providing these comments.
As you are undoubtedly aware, the current Cannabis Ordinance restricts any type of commercial cultivation in the Rural Residential Zoning District (RR District) I urge that this prohibition continue and that it be made clear from the beginning of this process that the RR districts are off limits to ***any*** type of commercial cannabis cultivation. This has not mattered when the adjoining property is zoned DA 20 (only 5 acres) as in the 8105 Davis Lane, APN: APC17-0011, Cannabis grow that has been in operation but not permitted for the last TWO years.
Each grower has filed a security plan, however in the case of 8105 Davis Lane this plan has been clearly violated with no repercussions to the grower. The security plans MUST be respected and enforced.
We ask that the following residential neighborhood be designated as an Exclusion Zone: **Bounded by Davis Lane to East Railroad Ave. to Petaluma Hill Road to Adobe Road back to Davis Lane.**
Also, analyze neighborhood areas and designate all neighborhood areas as exclusion zones where any residential neighborhood meets any one of the following criteria:
(1) residential neighborhoods that relies on a mutual water system
(2) residential neighborhoods and areas in the Rural Residential Zoning District where any parcel is less than 10 acres **and/or adjacent to AG Zoned property**
(3) neighborhoods and areas whose CC&Rs are inconsistent with or do not allow cannabis cultivation, **Penngrove has a Specific Plan that is being violated.**
(4) areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.
(5) areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought. **The State Ground Water study zones must be consulted. The requested exclusion zone are in Area 3 &4 Water zones.**
(6) areas that are in a high fire or very high severity zone designated by any competent authority such as the Board of Forestry, Sonoma County Community Wildfire Protection Plan, or the Public Utilities Commission.
(7) areas where commercial cannabis activity is detrimental to the residential character of a neighborhood.
(8) areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together.
(9) areas in traditional agriculture-zoned area's that are now primarily residential in nature. • Areas where the scenic vistas or character are to be preserved.
(10) areas where law enforcement is inadequate because average response times are more than 20 minutes.
(11) areas where there is strong local resistance to commercial cannabis activity.
(12) areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.
Every neighbor should be provided due process. Individuals who receive a permit to grow should only be given permission only after it has been determined that their growing does not jeopardize the "health, safety, peace, comfort or welfare of the neighborhood or the general public" **(SCC 26-92-070(a))**.
Thank you for your consideration
Thank You
Joseph & Barbara Perry
8175 Davis Lane, Penngrove
707-477-3862

From: Lisa Boyadjieff
To: Cannabis
Subject: Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date: Monday, March 20, 2023 3:39:33 PM

I would like to add my name to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.

Lisa Boyadjieff
8540 and 8470 Franz Valley School Rd.

Thank you,
Lisa Boyadjieff

From: Mary Plimpton
To: Adam & Allison Messner-Rhodes
Cc: Cannabis; Allison Rhodes
Subject: Re: Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date: Monday, March 20, 2023 12:47:28 PM

EXTERNAL

TERRIFIC!!!
THANK YOU!!!

> On Mar 20, 2023, at 9:47 AM, Adam Messner <adam.messner@gmail.com> wrote:
>
> Hello Sonoma County Policy Makers,
>
> My family, Adam, Allison, Max (12 years old) and Coco (9 years old), would like our names added to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.
>
> The negative impacts from water consumption, chemical effluence and odor are all negative externalities that would outweigh any potential benefits from the addition of this crop to our community.
>
> --
> Adam Messner
> 8170 Franz Valley School Road

From:	Mindy Barrett
To:	Cannabis
Subject:	Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date:	Monday, March 20, 2023 6:26:59 AM

Please add our names to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.

Mindy Barrett
Brad Barrett
8465 Franz Valley School Rd.

From: Patti Pritchard
To: Cannabis
Subject: Fwd: Franz Valley - Request to be designated an Exclusion Zone for commercial cannabis
Date: Monday, March 20, 2023 2:45:00 PM

EXTERNAL

Please add our names to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.

Patricia Pritchard
Donald Pritchard
3725 Franz Valley Road

-----Original Message-----
From: Mary Plimpton <mbplimpton@gmail.com>
To: PatrPritcha@aol.com
Sent: Sun, Mar 19, 2023 4:30 pm
Subject: Franz Valley - Request to be designated an Exclusion Zone for commercial cannabis

View this email in your browser

Request to Designate Franz Valley an Exclusion Zone for Commercial Cannabis

The following document has been sent to Permit Sonoma's Cannabis Project.

If you share this viewpoint, and if your name does not appear at the bottom of the document, below, please consider adding your name/FV address:
Send an email to: cannabis@sonoma-county.org
Subject: Cannabis EIR/Scoping Comments for Exclusion

Zone for Franz Valley

State that you would like to add your name (include FV address) to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis

You may have different perspectives/opinions about commercial cannabis in Franz Valley. This is the time to make your viewpoint known to the County, and we urge you to do so by

Sending an email to cannabis@sonoma-county.org

Subject: Cannabis EIR/Franz Valley

Indicate your name/FV address

Outline your position

ALL COMMENTS MUST BE RECEIVED BY THE COUNTY NOT LATER THAN 5:00p ON THURSDAY, MARCH 23.

If you pick up this email after the deadline, you might want to send an email anyway. It can't hurt to try.

Here is what has been sent to Permit Sonoma:

.....

Franz Valley* asks to be classified as an Exclusion Zone for Commercial Cannabis.

With other Sonoma County neighborhoods, Franz Valley supports cultivation and processing of County-permitted commercial cannabis on designated commercial and industrial zoned land where the following criteria are met: The cultivation and processing are not in impaired watersheds; do not create noise and odor nuisances for residents; do not negatively impact existing conventional legacy agricultural activities; are not in high risk fire zones or areas without fire safe roads; are not in public view; and are in safe proximity to Emergency Responders.

This echoes Sonoma County's Cannabis Code

Sonoma County Cannabis Code

- Sec. 26-88-250 Commercial cannabis uses
  - Sec. 26-88-250 (f) Health and Safety
    - Commercial cannabis activity shall not create a public nuisance or adversely affect the health or safety of the nearby residents or businesses by creating

dust, light, glare, heat, noise, noxious gasses, odor, smoke, traffic, vibration, unsafe conditions or other impacts, or be hazardous due to the use or storage of materials, processes, products, runoff or wastes.

Criteria supporting Franz Valley as an Exclusion Zone:

Water:

- FV is Water Zone 3/marginal
- Wells/groundwater, rainfall and catchment ponds are the only sources of water for both residential use and for agricultural requirements.
    - The region has been in Extreme Drought and – current exceptional rainfall notwithstanding – under on-going threat that drought is the new normal.
- Cannabis requires high amounts of water, significantly more than any crops that are or have ever been raised in Franz Valley.
    - Over the last few (very dry) years in Sonoma County, there were multiple, credible allegations of water theft to support cannabis grows.
    - In other California counties and in other states, there are reports of water table depletion and of water theft associated with cultivation of cannabis.
- The incomes of several decades-long, even generations-long, Franz Valley property owners come from conventional crops, including apples and wine grapes. We are concerned about the depletion of our water table, threats to our wells and to conventional heritage existing crops if commercial cannabis cultivation is permitted.
    - We have similar concerns about water usage for cultivation of what we understand to be equally “thirsty” (but unregulated) hemp.

Risk to prior existing commercial agricultural crops:

- Franz Valley is many decades-long home to several acres of grapes. Some vineyards abut property recently acquired by a company that organized a consortium of tenant farmers with the intent to plant cannabis.
    - Vineyard owners are concerned about terpene tainting of valuable wine grapes; water table depletion; water and soil pollution; and the possibility of challenges to standard vineyard practices.

Riparian Health:

- Franz Creek is in the Russian River watershed and is home to
    - rare and endangered freshwater shrimp
    - steelhead trout and fingerlings
    - California brown newts

We are concerned that earth grading associated with commercial cannabis cultivation, as well as the potential for surface water run-off from these operations, will impact the health of the riparian corridor.

High Fire Risk area:

- Franz Valley is in the footprint of historic catastrophic fires including the Kincade (2019), the Tubbs (2017) and the Hanly (1964); earlier fires also burned through Franz Valley.
- If topography is destiny, as it appears to be, then fires will burn through Franz Valley in the future.
    - Franz Valley is remote from firefighting assistance.

Narrow, winding roads, limited access, challenging to evacuate:

- In many places through and in/out of Franz Valley, the roads cannot fully accommodate 2 conventional passenger cars passing, much less emergency vehicles. One vehicle must at least partially leave the roadway.
    - Shoulders are limited to non-existent, and there are no engineered turn-outs.
- Evacuation during the Tubbs Fire was accomplished in part due to the heroic actions of our Volunteer Fire Chief leading out evacuees, cutting and removing downed limbs from the roadway.
- In 2021, a private farm road (unpaved) - part of a network of historic shared private farm roads long used as emergency exits – was blocked at the fence line with the proposed cannabis grow.

Franz Valley is remote from first responders:
Because most Franz Valley postal addresses have a Calistoga (Napa County) zip code, it is not unusual for delays in responses to calls for assistance due to jurisdictional questions.

- Law Enforcement

Cannabis appears to be a crime magnet.

- In Franz Valley, the closest law enforcement may come from Calistoga (Napa County) with a response time of about 20 minutes. Responses from Santa Rosa are in excess of 30 minutes.
    - Individuals have experienced hostile interactions with workers on proposed commercial grow site (APC21-0072-0082), including trespass, destruction of private property, and bullying.

- Fire Protection
    - Northern Sonoma County Fire Protection District responds from Geyserville, approx 35 minutes away.
- Other Emergency Responders (eg medical and vehicular)

Responses are complicated and may be delayed by County Line and jurisdiction issues.

Franz Valley has spotty and problematic cell and internet service:

- There are cell service shadows throughout Franz Valley.
- Franz Valley has neither cable nor fiber: Access to internet is spotty and inconsistent.
- These increase community vulnerability and risk.

Odor and Air quality

- Franz Valley is a steep-sided box canyon. We are concerned the known noxious odor of cannabis could be trapped, recirculated to accumulate and spread widely throughout the valley.
  - Residents/owners expect the right to enjoy our properties.

Wildlife
Pepperwood Preserve occupies much of the western ridge of Franz Valley. https://www.pepperwoodpreserve.org/ Franz Valley is a wildlife corridor to the Preserve.

- The aggressive fencing associated with cannabis grows may disrupt normal wildlife movement.
- We are also concerned about “crop protection” (depredation) permits that might be requested to kill wildlife that roam onto cannabis properties.
- Please see the Wildlife Scoping Document, submitted separately.

Climate impact study zone

- Franz Valley is within the Mayacama-to-Berryessa climate impact study zone
- Cultivation of cannabis within this zone may be incompatible with or otherwise disrupt this study.
  - https://databasin.org/documents/documents/f33f44b1f55d4900b00c6ffe3467905f/

***"Franz Valley” Defined**
"Franz Valley" is a “Rural Community/Neighborhood” located within the larger area covered by the “Franz Valley Area Plan.”

For purposes of this Exclusion Zone request, the boundaries of “Franz Valley” are

- West/NW: The ridge above/W of Franz Valley Road

    - Include Pepperwood Preserve
- East/NE:
    - Top of Oat Hill (the ridge between Franz Valley and the SE edge of Knights Valley) to the Napa County line
- East/SE: Napa County line
- South/SW: Napa County line
- FV Road (Pepperwood Preserve)

Franz Valley is a small steep-sided box canyon of a valley, separate and distinct from Knights Valley and the Napa Valley, and distinct as well from the Mark West Springs area.

The Franz Valley neighborhood is in Sonoma County, despite most of its postal service being provided through Calistoga/Napa County.

Franz Valley is primarily within the Northern Sonoma County Fire Protection District.
It is bordered on the E by the Napa County line.
It is adjacent to and shares a ridge with the south of Knights Valley.
On its western edge, it abuts and includes the Pepperwood Preserve.
To the southwest, it is in the Sonoma County Fire Protection District and abuts Mountain Home Ranch Road.
For many years, Franz Valley proper has been divided along its county roads (Franz Valley Road and Franz Valley School Road) between Sonoma County Supervisorial Districts 1 and 4.

Franz Valley is accessed by

- Franz Valley Road at two points
    - at junction of Franz Valley Road at Mark West Springs/Porter Creek Roads (at Safari West)
    - at junction of Franz Valley Road at Hwy 128 (in Knights Valley)

and

- Franz Valley School Road at junction with Petrified Forest Road (in Napa County).

Franz Valley Road and Franz Valley School Road and the valley itself were identified to be a scenic corridor. The Valley is a scenic gem, incompatible with commercial land uses which are disallowed in this area by the Franz Valley Area Plan.

The community consists of approximately 100 properties ranging from less than 5 acres (grandfathered) to upwards of 100 acres.
While most of the properties are owned by full-time permanent residents, some are held by second-home owners, and a very few are short-term rentals (Air B&B, VRBO).

Franz Valley is a patchwork of County-designated land use zones, including RR, AR, and DA.

A 30+ acre property at 8400 Franz Valley School Road has been divided into three 10+-acre parcels. In May 2021, the Sonoma County Dept of Agriculture mistakenly (due to their subsequently-acknowledged misinterpretation of regulations) accepted paperwork and fees for 11 ministerial applications, each for cultivation of 10,000 sq ft of cannabis on the above-referenced three 10+ acre parcels. These applications were put on hold pursuant to the County's moratorium on the ministerial issuance of cumulative small cannabis cultivation permits.
(Parcel numbers 120-150-053, -054, -055 / APC numbers 21-0072 through -0082)
It has been reported that these parcels have been planted with hemp which we understand is also water-thirsty.

While Franz Valley is a rural area and residents are comfortable with traditional rural activities, no one already living in Franz Valley or who recently purchased residential property in Franz Valley does or did so with a tacit agreement to accept in the future either a public nuisance or a public threat:

- A public nuisance in the form of, among others, noxious odor impacts on quality of life and/or potential impacts on nearby crops.
- A public threat in the form of, among others, groundwater depletion and increased risk of crime.

We are aware of and do not object to small grows for personal use. However, we carry deep concerns about public nuisances and threats in the event that commercial-scale cannabis operations are permitted in our unique valley.

To reiterate:
We the undersigned residents and property owners of Franz Valley believe that commercial cannabis is incompatible with the traditional ethos of the Franz Valley community and with the characterizations of the Franz Valley Area Plan / Sonoma 2020 General Plan. We respectfully ask that you accept and confirm our request that Franz Valley be designated a Commercial Cannabis Exclusion Zone.

Donelan Family Wines
8400 Franz Valley School Road

Nancy Graalman
7775 Franz Valley Road

Al Kellogg and Family
7771 Franz Valley Road

Betsy Lawer
Lawer Family Wines & Vineyard Properties
8910 Franz Valley School Road

Sarah Lawer
9200 Franz Valley School Road

Ken Parr
Michele Parr
8410 Franz Valley School Road

Robert Piziali
Kathy Piziali
7799 Franz Valley Road

Hal Plimpton
Mary Plimpton
8425 Franz Valley School Road

Jon Saler
June Saler
8020 Franz Valley Road

Richard Spratling
Tamara Spratling
8197 Franz Valley Road

Greg Swisher
Valerie Swisher
8310 Franz Valley Road

Galen Torneby
Eniko Torneby
8300 Franz Valley School Road

Our mailing address is:
FV COPE
418 Viewpark Ct
Mill Valley, CA 94941-4706

From: Grace B.G
To: Cannabis
Cc: Crystal Acker
Subject: Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zones
Date: Monday, March 20, 2023 3:14:03 PM
Attachments: EIR presentation 2023-03.pptx.pdf

EXTERNAL

Dear Sonoma County Staff and Ms. Acker:

The Sonoma County Cannabis Ordinance is failing rural residents for many reasons. One reason is due to incompatible commercial cultivation sites being too close to rural residential neighborhoods and causing unintended consequences such as pungent odor, noise and light pollution. The Cannabis Ordinance is also failing growers who spend money setting up their businesses in incompatible areas of the County.

It is evident that the needs and desires of rural residents and growers are fundamentally incompatible. An EIR that studies the impacts of commercial cannabis cultivation in unincorporated Sonoma County should include studying exclusion zones.

To address this issue, this scoping document requires studying and establishing “criteria and mapping of Exclusion Zones” in the Ragle Ranch and Freestone Gold Ridge area of unincorporated Sonoma County (View 2, page 4)

The map is an outline of the areas to be excluded. Study the actual parcel data in these areas and, as necessary, add other smaller parcel areas into these exclusion zones to eliminate the negative impacts of commercial cannabis cultivation.

Please see comments in this attached PDF regarding EIR Cannabis Scoping for an Exclusion Zone in the Ragle Ranch area.

Thank you,

Robert Guthrie, Sebastopol

Subject: Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zones

Dear Crystal Acker, Cannabis Sonoma County

Our Sonoma County Cannabis Ordinance is failing rural residents for many reasons. One reason is due to incompatible commercial cultivation sites being too close to rural residential neighborhoods and causing unintended consequences such as pungent odor, noise and light pollution. The Cannabis Ordinance is also failing growers who spend money setting up their businesses in incompatible areas of the County.

It is evident that the needs and desires of rural residents and growers are fundamentally incompatible. An EIR that studies the impacts of commercial cannabis cultivation in unincorporated Sonoma County should include studying exclusion zones.

To address this issue, this scoping document requires studying and establishing "criteria and mapping of Exclusion Zones" in the Ragle Ranch and Freestone Gold Ridge area of unincorporated Sonoma County (View 2, page 4)

The map is an outline of the areas to be excluded. Study the actual parcel data in these areas and as necessary add other smaller parcel-ized areas into these exclusion zone to eliminate the negative impacts of commercial cannabis cultivation.

Thank you,

Robert Guthrie, Sebastopol

The County must study and establish reasonable safeguards at the border of an exclusion zone so as to avoid impacts and conflicts due to cannabis odor, noise, light pollution and increased traffic, for example.

The County must study cannabis operations already in existence within these boundaries. There should be no grandfathering of such operations when there is clear evidence that odor, noise, light pollution are impacting neighboring residents. The County must study and establish a reasonable timeframe to cease such operations given the adverse environmental impacts to neighboring residents.

The County must study appropriate places to dry and process cannabis and exclude areas with the following:

(a)   Areas where commercial cannabis activity is detrimental to the residential character of neighborhoods;

(b)   Residential neighborhoods and areas where the primary residential nature is to be preserved, especially where four or more continuous parcels under 10 acres in size are grouped together

(c)   Areas where the scenic character is to be preserved;

(d)   Areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.

(e)   Areas that are located in a high fire zones

(f)   Areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought, areas where water availability has not been verified.

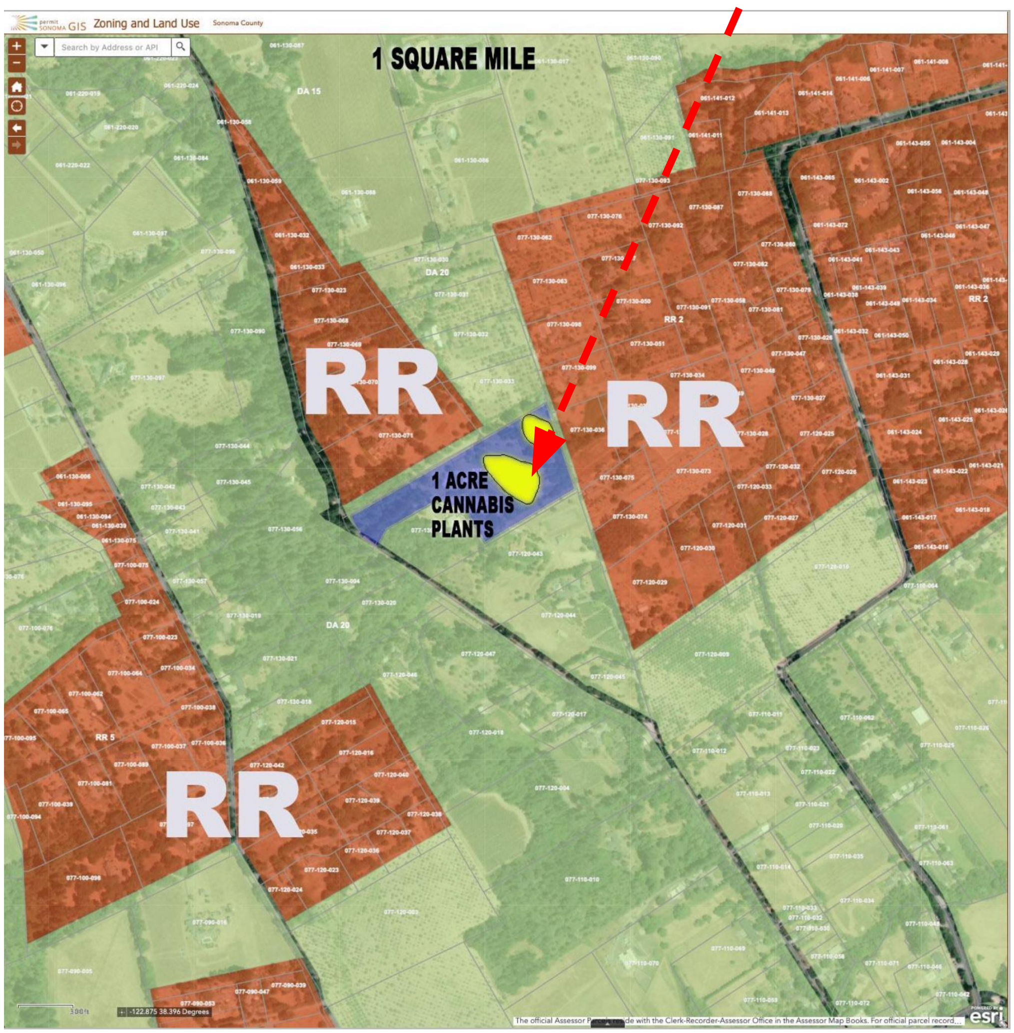
(g)   Areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

View 1: Analyze neighborhoods in unincorporated Sonoma County for compatibility with cannabis businesses given the many non-conforming zones

- Analyze DA-zoned properties operating a commercial cannabis business adjacent to an entire Rural Residential neighborhood and the impacts including odor, light, noise, traffic pollution

The below map is a real example of a commercial cannabis business located in a rural, residential neighborhood.

885 Montgomery Road
Commercial cannabis company

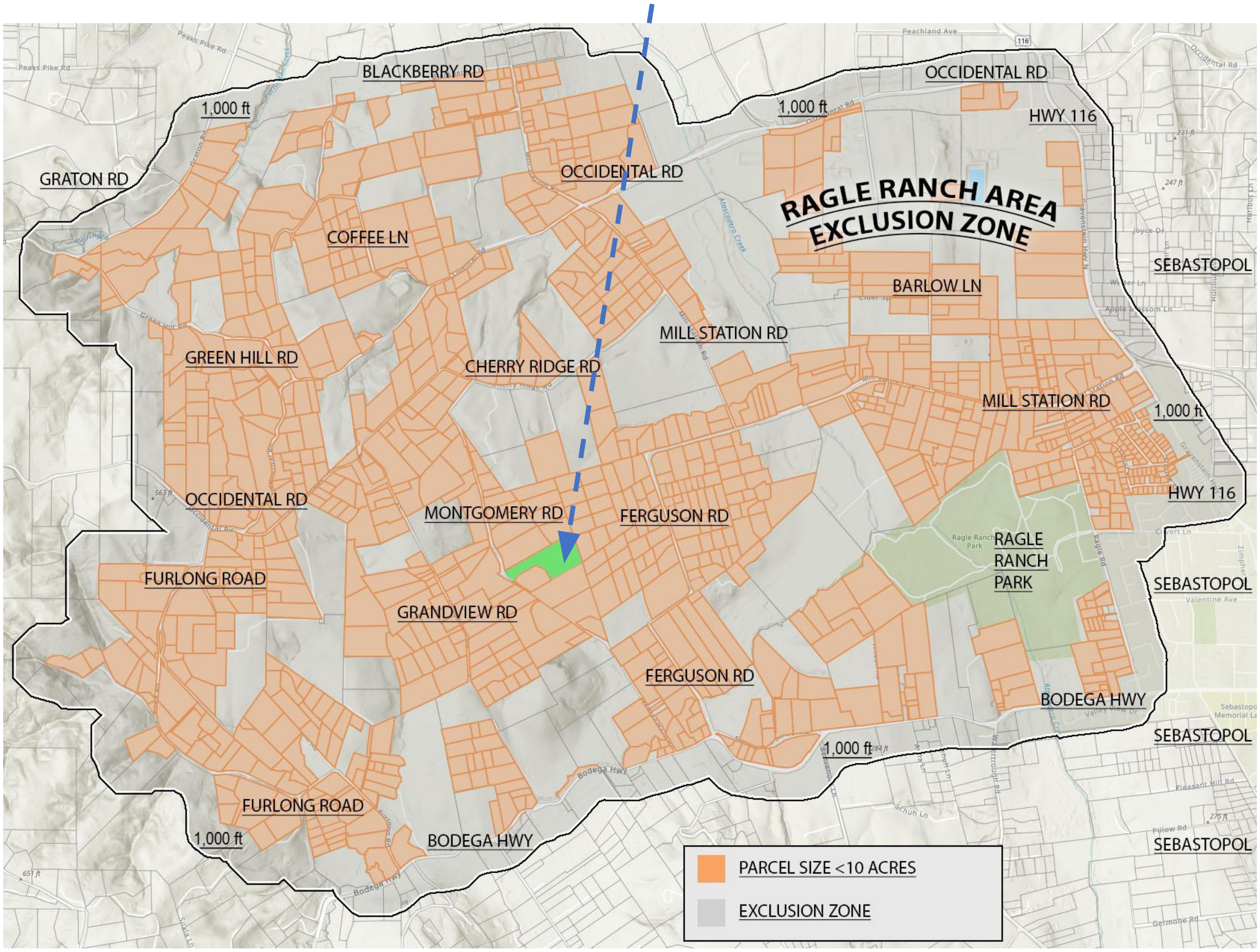


View 2: Real example of an active commercial cannabis business inside a dense neighborhood

Analyze properties under 10 acres surrounded by a 10 acre commercial cannabis business and the impacts in rural residential neighborhoods

Properties under 10 acres in size

885 Montgomery Road
Outdoor and indoor
Commercial cannabis cultivation



3 miles

Windbreaks and vegetation: Study their effectiveness in preventing cannabis odor from emanating to neighboring properties

- Sonoma County claims in permit approval recommendation that the existing trees and shrubs prevent the cannabis odor from being a nuisance to justify their 100-foot setback for outdoor cultivation
- Research windbreaks and trees to determine if they prevent cannabis odor from escaping cultivation sites onto neighboring properties

885 Montgomery Road
Outdoor
Commercial cannabis cultivation

Indoor cannabis cultivation setbacks

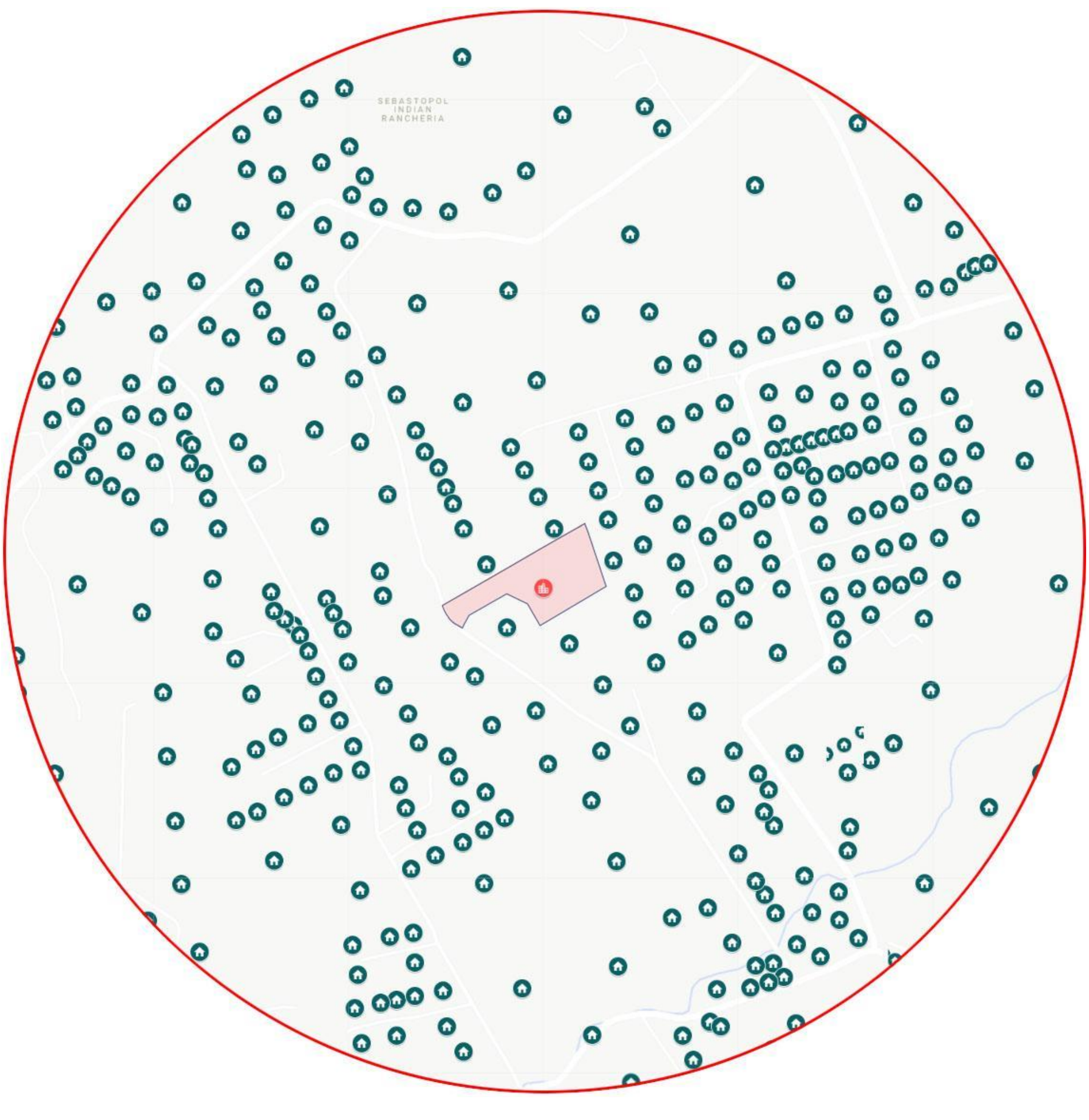
- Sonoma County cannabis ordinance omits setbacks for:
  - Indoor cultivation
  - Commercial-use bathrooms
  - Chemical discharge in leach fields & proximity to wells
  - Employee break areas

  - Investigate the impacts of inhaling cannabis volatile organic compounds released from indoor and outdoor cultivation
  - Investigate what setbacks are needed to prevent odor from escaping onto neighboring properties

885 Montgomery Road
Outdoor
Commercial cannabis cultivation

Analyze neighborhood density in unincorporated Sonoma County to assess where cannabis businesses would have the least impact or no impact to residential homes

- 1 mile radius
- Sonoma County claims on the permit approval recommendation for a cannabis permit that the neighborhood is not dense and mostly rural



From: William Binder
To: Cannabis
Subject: Cannabis EIR/Franz Valley
Date: Monday, March 20, 2023 10:14:56 AM

Hello,

We would like to add our names to the list of signatories requesting that Franz Valley be designated an Exclusion Zone for commercial cannabis.

Thank you,

William and Emily Binder
3205 Franz Valley Rd.
Santa Rosa, CA 95404

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Cc:	Susan Gorin; David Rabbitt; Chris Coursey; Lynda Hopkins; James Gore
Subject:	NOP of EIR Cannabis / Scoping Comments for Environmental Concerns
Date:	Tuesday, March 21, 2023 11:48:34 AM

EXTERNAL

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update. The comments focus on scoping for **Environmental Concerns**.

In general, there should be an overriding goal that the updated Ordinance requires the highest Environmental Sustainability standards. The County should study and establish standards that assure cannabis operations are environmentally sustainable and meet Sonoma County climate goals. These includes 100% renewable energy; Greenhouse Gas neutral; water sustainable used (no groundwater overdraft, no streamflow depletion, no net use of water, no cultivation in water scarce areas); hazardous fertilizers and waste do not pollute the environment and are properly disposed of; air quality is not compromised; and negative cumulative impacts are not allowed.

The study should analyze the ESG issues that have caused cannabis to be deemed NOT appropriate for ESG investing. See Evan Mills article " ESG Risk is a Buzzkill for Investors" in The Journal of Impact and ESG (Environment Social Governance) Investing, which identifies specific examples of the scope of the problems: **Environmental** issues including but not limited to pollution from pesticide use, water use, land-use change, waste production, volatile organic compound (VOC) releases to the air, and solvents used to produce extracts; **Social** issues include irresponsible use and unintended health impacts among adult consumers (or if illegally used by children), potential impacts of boom-and-bust industrial development on communities, good-neighbor considerations such as light pollution and nuisance odor releases, at least 23 health and safety and hazards for cannabis workers; **Governance** issues include inadequate racial balance in company ownership and workforce, disclosing and mitigating diverse ESG risks, unethical engagement with regulators, and efforts to greenwash product offerings and the associated legal risks these actions can trigger. Sonoma County should study and address these issues in the final Ordinance.

Specific to each CEQA category:

1. Energy – Study the requirement for 100% renewal energy. With SCP this should be achievable with little or no added cost.

    1. Study the intensive electrical demand of growing cannabis

2. Greenhouse Gas Emissions - In accordance with local and state goals, study the requirement that the overall cannabis program be GHG neutral.

3. Transportation – Transportation is one of the biggest drivers of GHG emissions. In accordance with local and state goals to reduce total Vehicle Miles Traveled (VMT), study how and where cannabis should be grown to achieve such goal.

4. Air Quality- significant air quality and odor problems have been noted around California. This is one of the major problems and complaints

    1. Analyze odor emission impacts on adjacent or nearby residents

    2. Modeling should be performed at various distances and under different wind conditions. Odor levels of 50,000 odor units have been produced at cannabis operations, requiring the study of methods to eliminate the impacts on others at such levels.

    3. Study requiring no odor to leave cannabis property. Uncontrolled cannabis odors can disperse well over 1000 ft. Determine the proper setbacks.
    4. Study implementing an Odor Abatement provision into the ordinance similar to the agreement reached in Santa Barbara County between the Growers and the SB citizen coalition. In the spirit of being good neighbors, these two opposite parties came together and worked out a binding contractual agreement, above and beyond what their County's Ordinance requires. There is no reason such terms could not be incorporated into our revised ordinance:

       The mutual goal of their agreement is simple and clearly stated on page 1 of the Contract: "*to advance their collective efforts to prevent cannabis operations from causing adverse community odor impacts, to advance the development and swift implementation of advanced and evolving best available odor control technologies (BACT) and science-based objective odor monitoring technologies, to ensure timely and effective responses to odor episodes, and to promote transparency and cooperation between cannabis operators, the public, and the Coalition".* Sounds very reasonable

       The key points of the agreement:

       - **Best Technology**: Growers employ and update Best Available Control Technology (BACT) for odor control. Both for odor control and monitoring
       - **No odor areas**: (Publicly Accessible Locations (PAL), which includes parks, businesses, day care centers, youth centers, schools, churches, and homes. Residential parcels that are within 1,000 feet measured from the property line.
         - Pursue the mutual goal that no significant odor be detectable beyond the operation's property line
       - **Measurable standards** and technology to enable objective measurement and data-driven control of cannabis odor. The Parties acknowledge the importance of a numerical standard of an Odor Causing Compound. The Parties believe it is feasible to define such a numerical Odor Detection Threshold
       - **Formal process** to report and correct odor problems. Set timeline to resolved
       - **Defined steps**: 4 levels of response to solve odor complains. Each level more involved to correct the problem.

    5. Study what an "Odor abatement plan" (OAP) would look like. Consider requirements for setbacks and buffers, low odor strains, vegetative screens, restrictions on the length and time of harvests, etc.

6. Study the requirement to use the best technologies available to eliminate odor exposure. Carbon scrubbers have been shown to be highly effective at capturing cannabis odors in the greenhouse, thereby reducing community odor exposure. They are inherently superior to vapor phase systems that emit chemical deodorants into the air. Carbon scrubbers have been shown to eliminate 84% of the "skunky" smell of cannabis.

5. Utilities and Service Systems - Analyze impacts to public services such as landfill costs resulting from disposal of waste from the various cannabis operations.
6. Hazards and Hazardous Materials – Including Public Health issues!
    1. Study cannabis emissions and the effects on the environment and people. Research has shown Cannabis emits potent VOCs called terpenes that, when mixed with nitrogen oxide and sunlight, form ozone-degrading aerosols. William Vizuete, associate professor at the University of North Carolina's Gillings School of Public Health has developed air quality model to better understand how commercial cannabis cultivation affects the atmosphere. His research showed that cannabis plants produce volatile organic compounds or VOCs that can produce harmful pollutants.
    2. Cannabis cultivation produces Beta Myrcene terpenes that is a known carcinogen and is listed under Proposition 65. The FDA has banned it as a food additive. Environmental exposure is included and the required warning under Proposition 65 must be made prior to exposure. Analyze how Sonoma County EIR and Ordinance will comply with these laws.
    3. Noxious odor effect both workers and nearby residents. Study and establish safe set-back requirements between grow operations and nearby residents and, public and private facilities.
    4. Marijuana cultivation can be a health hazard to workers. Analyze what safeguards are required to protect their health. For reference see Los Angeles Times entitled "Legal Weed – Broken Promises". They reported on the risks and safety abuses throughout the State relating to cannabis production including the safety and health risks to those being hired to work in that industry.

7. Water- The recent rains are a welcome relief, but our officials continue to recommend caution long term. Sonoma County Crop report acknowledges the problem: The USDA designates Sonoma County as "D4: Extraordinary Drought" with 2021 considered Sonoma County's worst drought year on record. Along with 3 of last 4 years that have been the driest on record. Sonoma County has not updated its water studies for decades, does not understand the impacts of the new norm of global warming/droughts, the effects of increased population growth and uses, and does not know the cumulative impacts. Now consider that cannabis is one of the thirstiest crops (3 to 6 times more than grapes depending on the study. Other research found the water-hungry crop requires almost 22 liters of water per plant a day during the growing season, which adds up to three billion liters per square kilometer of greenhouse-grown plants. During the low flow period, irrigation demands for cultivation can exceed the amount of water flowing in a river, leaving little water to sustain aquatic life.). These two facts point to a long conflict and challenge with growing cannabis in Sonoma County.
    1. The County should analyze the current water availability and usage levels by area, to assure rural residential wells and wildlife will not be impacted. Analyze prohibiting cannabis in water scare areas. Analyze prohibiting cannabis in areas where fish and wildlife would be impacted. Most rural residences are on wells with minimal water use compared to cannabis. The residences can't afford large users with the financial resources to drill deeper wells adjacent to residential wells
    2. Analysis which areas have inadequate water supply, including mutual water

systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought.

3. Approximately 30% of Sonoma Growers have applied for drought relief recently. This would indicate unsustainable areas. Analyze which watersheds / areas these growers are in and consider disallowing cultivation, including the process to terminate such permits. The growers own actions point to an unsustainable environmental and economic use.
4. Study disallowing cannabis in the "Public Trust Review Areas" identified in the recent Well Ordinance update process. These areas have been acknowledged as water compromised, therefore inappropriate for a water intense crop like cannabis.

8. Land Use and Planning: specifically Ministerial permitting: The scoping document calls for this fast track permitting process, which removes public input. This process should not be allowed or only allowed in rare circumstances under the strictest criteria. Since no public input is allowed, the EIR study should look at setting standards that are stricter than what the general ordinance allows under the normal "use permit" process (full review with public comment). For example, the setbacks should be larger (i.e.: 1500 setback verse 1000), the parcel size is larger (i.e.: 20 verse 10 acres), there should be no residential homes nearby (i.e. adjoining such parcel). Further, areas with no impact to residences like industrial zoned land (where all city services are available) should be studied for ministerial permitting.

The Sonoma County EIR study and final Ordinance must successfully address these issues. Only then will Sonoma County citizens' rights to health, safety and peaceful enjoyment of their homes be ensured.

Thank you

Neighbors of West County (NOW)

Bill Krawetz

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Subject:	NOP of EIR Cannabis / Scoping Comments for Water
Date:	Tuesday, March 21, 2023 3:32:37 PM

EXTERNAL

Date: March 21, 2023

To: **cannabis@sonoma-county.org**, **crystal.acker@sonoma-county.org**

CC: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, James.Gore<James.Gore@sonoma-county.org>

Subject: NOP of EIR Cannabis / Scoping Comments for **Water**

Dear Crystal Acker, Cannabis Sonoma County and Board of Supervisors

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update. The comments focus on scoping for **Water**.

In support of the County current work in developing the draft cannabis ordinance framework, the "Hydrology and Water Quality" CEQA element study should include the following items. In general, since there are many uses of our one water supply, it is necessary to understand cumulative impacts of all these uses to properly measure the effects of adding commercial cannabis cultivation to the mix.

SCOPING – WATER RESOURCES ELEMENT

1. Water Supply:
    a. Potter Dam: Study the various future possibilities of the loss of water capacity from Potter Valley Dam and Lake Mendocino. Include estimated flow and water supply reliability from Lake Mendocino if diversion from the Eel River is terminated or reduced and the effects on existing and any new water users in the Upper Russian River. Investigate all the various scenarios concerning water diversion capacity into the East Branch of the Russian River including PG and E's surrender of the broken hydro power facility, the failure of

the Potter Valley Project and removal of all infrastructures including Lake Pillsbury.

b. Drought scenarios: Include a science based analysis of drought year water availability in the water element of the EIR. Areas to be considered for cultivation should be based on dry years, not average year conditions. Ascertain the historical average used and compare the historical average to drought models. Using several forecast models ascertain if the historical average is now likely inappropriate due to climate change. Scientifically establish a drought year benchmark analysis which is an important factor combined with projections of current and future water needs for all users county-wide
c. Sustainable Groundwater Management Act: Scientifically address future sustainability in compliance with the Sustainable Groundwater Management Act. Scientifically determine and identify other aquifers in the fractured geology of Sonoma County. Note that the SGM plans did not use drought year forecasts and were heavily criticized by the public. Use a worst case scenario and hope it doesn't happen.
d. Identify and map areas not on public water, locate and map areas in the groundwater basins. Scientifically determine where water use will not adversely impact environmental needs.
e. Identify existing wells (40,000) and their impact on groundwater, steam flow and aquifer replenishment. The current work to update the Well ordinance for "public trust resource areas" provides a good starting point of some areas that are water challenged and not suitable for cannabis.

2. Water demands:
    a. Baseline: Scientifically determine the existing baseline conditions including all cannabis permits already issued, all operators growing in the Penalty Relief Program, and all pending and reasonably foreseeable future permits. Prepare a baseline document identifying all known cannabis

cultivation and processing operations: PRP operations, existing cannabis permits and applications in process by square footage of cultivation type, location, intensity, zoning code, and Groundwater Zone 1, 2, 3 or 4.

b. Basic requirements of a site to study:
    i. Net zero water plans. On-site water to meet all uses on a sustainable basis.
    ii. Ground water quantity: Establish minimum production quantity standards. Establish site testing rules to assure adequate supply before allowing grow.
    iii. Groundwater monitoring plan required to assure sustainability on an on-going basis.
    iv. Groundwater zones 3 & 4: Since water already scarce in these zones, study excluding any cultivation without special review.

c. Impacted watersheds: Identify and map the already impacted watersheds. Scientifically identify if an acreage cap for cannabis cultivation be set in these watersheds. Scientifically ascertain whether cultivation should be prohibited in the impacted watersheds.
    i. Identify and map the 43 established sub-watersheds in the Russian River region. Scientifically determine the effect of additional users in these watersheds.

d. Diversion ponds: Scientifically identify the impacts of the construction of catchment ponds and their effect on stream flow and recharge of the aquifers. Scientifically determine how many catchment ponds could be allowed in an area without affecting replenishment and future health of the underlying aquifer and downstream flows.

e. Other users: Evaluate all constraints on the water supply by all uses and users. Sonoma County Water Agency (SCWA) supplies Marin County. A portion of Mendocino County users also draw from the same water sources.
    i. Housing Growth: Analysis must include the competing water demands required to support new housing growth. Sonoma County must not only consider the growth of its population but also those regions (Marin and Mendocino) that are support by the same water

basins (Russian River and others water sources that support such region). Based on ABAG housing allocations for Sonoma and Marin Counties as well as Mendocino County areas (Ukiah +), our water supply will need to support 62K new users over the 2023-2031 period. Calculations as follows.

Sonoma County (ABAG allocation 2023-2031) a = 14,562 housing units /~39K people)
North Marin County Water district (ABAG allocation 2023-2031) b =5,659 housing units /~15K people)
Marin Municipal Water district (25% ABAG allocation 2023-2031) c, d =2,187 housing units /~6K people) – likely too low!
Mendocino County supplied by RR water basin (2023-2031) e = ~1K housing units/ ~2K people

Note a- Based on ABAG's final RHNA report. Housing units are per the report. People determined at 2.7 per housing units (per report)
Note b – Water provided by Sonoma County Water Agency
Note c – Water provided by Sonoma County Water Agency. MCWD estimates 25% of needs provided by SCWA
Note d- MMWD area has been allocated 8746 Housing units in total. Currently 75% of water needs are met by Mtn. Tam watershed. Not realistic to assume this watershed could increase supply, so likely the 2,187 units under count the true need.
Note e - Ukiah (16K population) & surround areas draw water from Lake Mendo and RR. Assume 20K population growing 1% per year over 8 years, or ~ 2K

ii. Identify other residential, police protection, fire protection and agricultural users in the unincorporated areas and their present and future needs assessed.

f. National Marine Fisheries Service : Address NMFS concerns:
   i. Develop requirements to prevent impacts to ESA-listed salmonids and their habitat.
   ii. Study and understand the linkage between ground and surface water usage and its impact on wildlife.
   iii. "while we understand that the current Update applies only to cannabis cultivation, NMFS recommends the County also update their well ordinance and permitting procedures to apply this requirement (i.e., require a net zero water plan, or a hydrogeological analysis confirming streamflow depletion impacts are unlikely) to all permit applications for near-stream wells"

g. In addition, scientifically identify all users with any water rights so they can be evaluated as a draw on our overall water "system". Scientifically and accurately reach a conclusion about how much total water is available and how much can be used for new users in the unincorporated areas.

Scientifically determine how many new water uses can be allowed based on the best accounting of assumed water supply. Climate change and drought may have altered these assumptions and an analysis of the existing usages and cumulative impacts needs to be a part of the EIR.

h. Identify and map areas where public water and sewer storm water drainage are located. Prepare an environmental or regional setting document that fully addresses existing conditions, especially as related to public utilities, groundwater, surface water, and public safety services. Identify water availability and current water allocations based on historic records as well as a continued drought scenario, and define the capacity of fire and police services to address additional commercial development in high fire severity zones and remote areas accessed by legal fire safe roads.
i. Identify and map the locations in which cannabis growers have applied for drought relief (through DCC and others). Approximately 30% of the multi-tenant growers are under the drought relief program. Their actions point to these areas being unsustainable and being inappropriate for cannabis cultivation.
j. Once these areas meeting the criteria listed above are identified and mapped, scientifically assess how much suitable land can be projected as reasonably necessary to meet current and future demand (20 years for a General Plan). Study placing a hard cap on number of growers and acreage

The General Plan last revised in 2004, is now out of date and the cannabis EIR cannot rely on the water element in it. This water resources element must be re-visited and up-dated accordingly. A complete scientific analysis of water resources for the cannabis EIR not only provides guidance for cannabis but can also serve as an update to the General Plan.

Thanks
Neighbors of West County (NOW)
Bill Krawetz

From:	concerned citizens
To:	Cannabis; Crystal Acker
Cc:	David Rabbitt; Lynda Hopkins; district4; Susan Gorin; district3
Subject:	Notice of Preparation (NOP) of EIR Cannabis / Scoping Comments for Exclusion Zones- Bloomfield 2023
Date:	Tuesday, March 21, 2023 12:09:09 PM
Attachments:	2023-Exclusion Zone Comments-Bloomfield.pdf Letter to Open Space.pdf American Badger - Bloomfield property and area 2021.pdf

Dear Ms. Acker, Board of Supervisor and County Staff,

This reaffirms our request - as outlined in our December 2021 Draft Exclusion Zone submitted for Scoping the EIR- to designate Bloomfield an Exclusion Zone for commercial cannabis. While cannabis may be suited to industrial and commercial zones, it is inappropriate, a threat, to our community and ecosystem.

Thank you for your consideration.

CCOBloomfield Members Veva Edelson and Vi Strain

SCOPING COMMENTS FOR
BLOOMFIELD AREA EXCLUSION ZONE
NOTICE OF PREPARATION FOR CANNABIS EIR

In the County Summary Report of the Cannabis Program Update Study Session dated 9/28/21, there is a policy Option to expand opportunities for economic growth within the industry (cannabis). This policy considers a zone change to allow cottage-sized cultivation in the AR and RR Zone Districts. A cottage grow is defined as allowing up to 500 square feet of indoor cultivation, up to 2,500 square feet of mixed light cultivation or up to 25 mature plants for outdoor cultivation. The rationale for this zone change is it “would allow small farmers in rural residential areas to enter the market and would allow local residents to supplement income opportunities.”

Policy change proposals such as the proposal above see residential land use through the lens of cannabis rather than through the lens of what the majority of residential homeowners seek when locating in Sonoma County residential areas.

Supervisor David Rabbitt has said, the County has allowed significant parcelization of the County lands in proximity to Agriculturally zoned lands. There are many neighborhoods and residential areas throughout the County, as living in the County environment is desirable for many reasons as shown below:

*Some families move to larger county parcels to have enough land so their children can participate in Future Farmers of American (FFA) programs. The children raise animals on the property and learn life lessons in doing so through this program.

*Other families want to grow their own food and have incredible gardens and can and preserve the fruits of their labor.

*A few families home school their children sometimes in neighborhood groups and/or supplement their education in rural School Districts.

*Avid gardeners want additional land to create the landscape of their dreams with ponds or a myriad of special plant and trees.

*Families who want their children to experience horse ownership can find a parcel large enough to keep their horse close by and take it out for a ride on coastal trails.

The majority of rural parcel denizens have family oriented goals when locating outside of cities on larger parcels.

Commercial Cannabis does not fit into this picture and it is contrary to rural residential current and desired uses. It is a drug not compatible with residential uses where families reside.

The Notice of Preparation Document dated February 6, 2023 includes under Project Description, reference to the Cannabis Program Framework as shown in the next paragraph

The Cannabis Program Update Framework adopted via Resolution No 22-0888 shows criteria for and mapping of exclusion zones. We request the Board of Supervisors analyze the creation of exclusion zones where commercial cannabis cultivation, processing and sale of cannabis is prohibited. Analyze designating specific areas as exclusion zones in the ordinance. Following is Bloomfield's request for what to analyze and request and support to create an exclusion zone.

BLOOMFIELD SETTING

From its inception in the 1850's Bloomfield had a core of smaller lots created in a typical grid pattern. The lots varied from .5 to 1.5 to 10 acres. The initial plan included a school site, community park and cemetery which all exist today. The school has been redeveloped into a private residence. There is also a ball diamond and a walking trail around the cemetery now. There is a restaurant, a Masonic Hall and a building used for community events located within the community. When Sonoma County created zoning it respected this development pattern with RR zoning in the central portion of town. There are over 300 people in town and ranch families in the outskirts

The Olympia House Rehab is close to Bloomfield. The location surrounded by dairy lands and a small rural community provides a rural sanctuary aspect to the location of the Olympia House Rehab. If potential clients and families of clients and professional doctors helping said clients, find out that the small town of Bloomfield is also home to a large scale commercial cannabis growing operation could that cause them to not consider Olympia House Rehab as a safe and secure rural setting for an addict to receive treatment.

Commercial Cannabis close to a rehab facility and a rural residential community should not be allowed. A 1000' foot buffer is no real buffer at all and is an inappropriate intrusion of a drug where people are vulnerable and families live.

Following are recommendations for the Bloomfield area:

1.We recommend Sonoma County analyze and develop provisions for the creation of residential exclusion zones where commercial cultivation, processing and sale of cannabis is prohibited. Develop information to be analyzed through the environmental review in enough depth to allow creation of exclusion zones without further review and hearings.

2. We recommend the Bloomfield area be designated an exclusion zone and an analysis be conducted to determine the extent of a setback necessary to mitigate potential impact and conflicts with cannabis operations in the vicinity of Bloomfield. Bloomfield is primarily residential in character with predominantly Rural Residential zoning. Properties surrounding Bloomfield are various Agricultural zones.

3. A map is attached with a tentative rough outline of the areas to consider for an exclusion zone. We request the County study the actual parcel data in the Bloomfield area and as necessary, add other parcelized areas into the study of an exclusion zone boundary. Consider the inclusion of other nearby uses such as the Olympia House Rehab property and out buildings in case the facility may also wish to become part of an exclusion zone. Include in the analysis a minimum of 1000 feet from residential property lines and a greater distance depending on local conditions. In Bloomfield there are circumstances that create a need for a greater setback as follows:

a. Bloomfield is downwind of the Petaluma Wind Gap of the Estero Americano. Winds from the West are consistent and of greater intensity than in other areas. Any Commercial Cannabis to the West of Bloomfield could have significant impacts on the community re:

*Odor from cannabis plants. Air quality including cannabis and chemical drift should not cross residential property lines,

*Wildland fires - study wind driven and other potential fire scenarios of cannabis operations locating in close proximity to rural residential development. Study how a potential wildland fire in different scenarios might spread under different weather, fuel, wind and ignition point scenarios exposing people and/or structures to a significant risk of loss, injury or death. This is especially critical for rural residential developments such as Bloomfield being downwind and also in an area with inadequate roads and evacuation routes on which a fire truck and evacuating residents could not pass.

b.Study potential significant impact on residents quality of life and use of property regarding emergency response to potential crime and non-compliance with conditions of approval including placing residents in the position of having to monitor compliance of a use rather than the County monitoring compliance with conditions of approval.

c. Study noise, energy use, lighting and other similar potential impacts that are not typical in residential uses. Include use of generators, 24 hr operations, night lighting that diminishes dark skies, unsightly opaque fencing. Take a look at the

Bloomfield Cemetery metal fencing with a sharp angle at the top to see the result of fencing not in keeping with the community or surrounding agricultural uses and is view obscuring what was once a long-range handsome view at the high point in Bloomfield. It is also in view from the Petaluma/Valley Ford Highway which is designated a Scenic Route.

d. Study Bloomfield roads and other rural substandard roads where even two cars cannot pass on any road. Such substandard roads that would be shared with commercial cannabis operations do not meet any safe standard. Additionally, a fire truck heading to a fire and cars evacuating from fire danger could not pass on any street in Bloomfield. Develop criteria and standards to preclude new proposed uses on substandard roads.

4. Cannabis operations that may already exist within the proposed boundary should not be grandfathered in, no new permits should be approved or extensions of existing permits granted.

5. There are at least 67 water wells in Bloomfield and that does not include the wells of larger rural parcels close-by. The surrounding land has traditionally been used for grazing and has only had cattle watering spots in a few areas. The Neve Brothers green house operation water consumption is unknown. The community is concerned about over-draft of ground water and asks the ground water issue be studied in this general area. It was not part of the recent ground water study the County conducted per State regulations.

6. Consider there is a strong local resistance to commercial cannabis activity and residents have determined it will be detrimental to the residential character of the neighborhood and areas as described in the reason why residents have settled in Bloomfield described on page one of this memo. We also have a petition with with 343 signatures showing support of an exclusion zone here: https://sign.moveon.org/petitions/save-historic-bloomfield-from-commercial-cannabis?share=4406c3a2-862b-4e76-91df-cd61b62a1bea&source=email-share-button&utm_medium=&utm_source=email

7. Bloomfield fronts on the Petaluma/Valley Ford Scenic Highway and is the route to Bodega Bay and other coastal destination places. It is a beautiful area that opens to the Big Valley just beyond Bloomfield with rolling hills on both the North and South and the Estero American generally along the Highway in the valley between the hills. It is an area viewed by multitudes of visitors to Sonoma County and worth protecting for its scenic character. The only blemish is the junkyard at Bloomfield Rd that the County has not closed down even after years of community requests to make it a priority for cleanup.

8. Ensure that an exclusion area boundary include the upland grasslands surrounding Bloomfield that are an important wildlife corridor that also connects two known female Badger sets and provides much needed hunting area for

juvenile American Badgers. Protect the Springs and other features supporting wildlife such as the Red Legged Frog.

Thank you for your consideration: CCOBloomfield members Veva Edelson and Vi Strain

Exhibit A
Map of Bloomfield showing 1000 ft buffer zone to be included in exclusion zone.

Exhibit B and C are letters from an Environmental Biologist and a Naturalist describing the Upland Grassland wildlife corridor and its biologic importance to the ecosystem of the area. They will be found as attachments in the email.

Sandra Etchell **Environmental & Wildlife Biology**
6646 Church Street, Petaluma, CA 94952 **(707) 396-2299**

February 13, 2021

Sonoma County Open Space District

RE: Wildlife Species, Habitat and Corridors in Bloomfield

Dear Director:

As a longtime Bloomfield resident and biologist with 25 years of experience surveying for special status plant and wildlife species for both small- and large-scale infrastructure projects, I am very familiar with the various habitats and wildlife that occur in Bloomfield proper and the vicinity.

The whole area provides habitat for the California red-legged frog (CRLF), a federally listed threatened species, and a State listed species of special concern. There are three California Natural Diversity Database (CNDDB) records within the Bloomfield area (records 742, 743 and 845) and there are six records within a five-mile radius. Critical habitat is approximately 3.25 miles west of Bloomfield. The CRLF is known to occur in the Estero Americano watershed and Bloomfield has a network of drainages.

American badger burrows are present in and around the property. Adjacent homeowners have encountered them on occasion. American badgers are a State species of special concern and may likely be eligible for candidate threatened if science-based population counts were conducted.

The undeveloped rangeland present within the 6405 Cockrill Street parcels have provided sustainable wildlife corridor and wildlife usage probably for centuries with little incursion from anthropogenic disturbances other than cattle and/or sheep grazing. The value of maintaining this important habitat for wildlife use, rather than converting it to an agricultural monoculture, is of primary to concern for the residents of Bloomfield.

The 6405 Cockerill Street parcels consist primarily of non-native grassland consistent with the surrounding rangelands. There appear to be some shallow wetlands in the upper portion of the property and some more significant wetlands along the north eastern boundary. These are associated with a small drainage that runs east-west along the property line.

In summary, the parcels provide high quality wildlife habitat and wildlife corridor connectivity for not only the special status species that are known to occur there, but for numerous other species of amphibians, reptiles, birds, and mammals. The conversion of this property would cause habitat fragmentation and diminish wildlife use. In fact, agricultural practices such as the use of pesticides, destruction of burrowing rodents that cause crop damage, and numerous other pest management techniques would greatly decrease the use of the property by wildlife. We would like to see it remain as it has been for centuries, sustainably grazed.

Should you have any questions regarding this letter, please do not hesitate to contact me at (707) 396-2299.

Sincerely,

Sandra Etchell
Wildlife Biologist

American Badger (*Taxidea taxus*) – Sonoma County
Susan Kirks, Naturalist

American Badger (*Taxidea taxus*) is a CA Species of Concern since 1987, with diminishing and fragmented habitat in California and Sonoma County. Badger is a keystone species in California. In Sonoma County, we have 2 primary small sustaining population areas – South Sonoma County in the 2nd District and West Sonoma County in the 5th District. The habitat type is grassland, upland and coastal. A West Petaluma natal territory and habitat (Paula Lane) acquired and conserved as open space in 2012 has recorded activity of over 100 years' duration. This land is also in a regularly traversed wildlife corridor, identified and documented by Paula Lane Action Network (PLAN) over 14 years of observation of living/deceased species.

An additional connecting, longstanding wildlife corridor extends west from the Paula Lane area in Petaluma along Bodega Avenue and Bodega Highway to the coast. Land character in the corridor is upland grassland, hills, with agriculture and rural and agricultural residential development.

Bloomfield is relevant for its location in the Bodega Highway corridor, with open space and grassland habitat supporting multiple species, including American Badger. (See Bloomfield Wildlife Inventory.)

The Bloomfield property (APN #s 027-020-010, 027-020-009) is in proximity to at least one nearby natal territory (possibly two, not yet confirmed). A January 2021 site visit confirmed active use by badger of the Bloomfield property. Residents have photo-documented the species. The grassland habitat supports a significant prey base of pocket gophers, with quiet, undisturbed open space, absence of human encroachment, and the ability for natural movement.

Bloomfield is also a connecting wildlife movement area south toward Tomales/Bolinas and extending west toward the Sonoma County coast.

Contributions of the Bloomfield property to American Badger survival in Sonoma County include:
- habitat for foraging.
- movement through the corridor.
- the unique feature of potential for restoration and enhancement to encourage territory selection by a dispersing juvenile female badger from the above-mentioned established natal territory.

In addressing impacts of climate change and supporting both species survival and biodiversity, conservationists are well advised to think and proactively address how to support establishment of new natal territories in Sonoma County. In my experience, monitoring habitat and identifying natal territories and badger habitat and movement in Sonoma County, few properties remain that could be considered for a dispersing juvenile female badger's territory establishment. The Bloomfield property is a candidate for this possibility. Habitat restoration and enhancement and documenting these efforts over time could inform the ability for duplicating the effort in identified appropriate locations for American Badger in California.

The Paula Lane property mentioned herein also serves as a model for sensitivity to American Badger seasonal needs and behaviors, natal territory protection, and adding elements for public appreciation and appropriate access via a High Use-Low Impact Project Design, for community engagement.

Residents in Bloomfield and immediately adjacent to the property being considered for open space and conservation, have documented several adult female species utilizing this and adjacent properties for giving birth and safely raising young or nesting and safely raising young. These include Black-tailed deer, Coyote, Bobcat, Red-tailed Hawk and Great Horned Owl. Observations such as this are relevant, as adult female species must be appropriately selective for natal territories and time needed for raising their young.

In grassland habitat such as the Bloomfield property, inter-relationships of species exist, competing for prey, a delicate balance in Nature. Also, passive cooperation in this upland ecosystem of California Red-Legged Frog and American Badger is an available research topic while supporting both a Threatened species and Species of Concern.

For added habitat restoration and potential, I understand the Bloomfield property may exhibit wetland characteristics and contain areas appropriate for wetland restoration.

An American Badger seasonal assessment over Autumn, Winter, Spring and Summer for 2 years would further document the badger's use of the Bloomfield property. Such an assessment would be advised to be carried out in conjunction with a California Red-Legged Frog assessment. California Red-Legged Frog (*Rayna draytonii*) (CLRF), a CA Threatened species, can coexist with American Badger in upland habitat areas. The deep foraged prey holes and abandoned badger burrows enhance CLRF habitat. In upland habitat, CLRF will access "downed woody vegetation, leaf litter, and small mammal burrows that provide protection from predators and prevent desiccation (drying) of California red-legged frogs." (USFWS, 2011). A goal of the badger assessment would be to identify 1-2 appropriate areas for habitat enhancement to create habitat character for dispersing juvenile female badger consideration and selection.

An additional educational enhancement about wildlife corridors and their importance in our changing climate and climate action would be the connection between the West Petaluma habitat area and the corridor extending to the Sonoma County coast, with the potential for two badger sanctuaries, supporting multiple other species, in south Sonoma County. Preservation of upland grassland habitat, coexisting with agricultural activities, would be educational and contribute to conservation.

(Photos courtesy of Vi Strain and _______.)

(Susan Kirks is a Naturalist with 21 years of field study and observation experience for American Badger in Sonoma and Marin Counties and the San Francisco Bay Area. She consults with property owners, agencies and organizations to educate about badgers and their life cycles, behaviors and habitat needs. Ms. Kirks led the effort for the acquisition and conservation of the Paula Lane open space property, a natal territory for American Badger, in West Petaluma, and also serves as President of the Madrone Audubon Society, the Sonoma County Chapter of National Audubon. She created the High Use-Low Impact project design, compatible with protecting sensitive habitat areas and appropriate public access, a climate action-related public access model for open space and parkland.)

From:	craigspencerharrison@gmail.com
To:	Crystal Acker
Cc:	Cannabis
Subject:	Bennett Valley Residents for Safe Development Scoping for Cannabis EIR
Date:	Tuesday, March 21, 2023 12:09:40 PM
Attachments:	BVRSD Scoping.pdf Attachment 2 Health and Safety Letter.pdf

EXTERNAL

Please see attached comments by Bennett Valley Residents for Safe Development on scoping for the cannabis EIR.

Craig S. Harrison

Bennett Valley Residents for
Safe Development

March 21, 2023

VIA ELECTRONIC MAIL

Crystal Acker, PRMD Supervising Planner crystal.acker@sonoma-county.org

Re: Scoping for Cannabis EIR

These comments are submitted on behalf of Bennett Valley Residents for Safe Development, located in Bennett Valley. The project description is so vague and ambiguous that we have no genuine opportunity to identify the specific issues that should be studied. These comments are based on our best guesses, but we should not have to guess. We reserve the right to raise additional issues for study at any time after we have a better idea of the specifics of the project.

I. Exclusion Zone for Bennett Valley.

The EIR study all aspects of designating all of Bennett Valley within the Bennett Valley Area Plan as an exclusion zone ("combining district overlay zone") that forbids the commercial cultivation, processing, or sale of cannabis. This request has also been made by the Bennett Valley Community Association, Bennett Valley Grange, Bennet Ridge Community Association, and Bennett Valley Grape Growers.

We incorporate by reference our recommendations about establishing exclusion and inclusion zones throughout the county that we submitted on December 17, 2021. We resubmitted these when formal scoping began. Those comments stated that applying our recommended approach would be better for neighborhoods, the cannabis industry, and the Sonoma County government. Exclusion zones have long been an option in the cannabis ordinance, and Bennett Valley residents will continue to strongly resist commercial cannabis activity here with or without an exclusion zone.

The EIR should study not only the concept and a mechanism to create exclusion and inclusion zones, but also specifically include sufficient study of Bennett Valley so that the ordinance can designate it as an exclusion zone without further CEQA study or any administrative processes (e.g., petitioning).

An exclusion zone would mitigate and avoid most environmental impacts of cannabis activities in Bennett Valley. If Bennett Valley in not declared an exclusion zone, the following impacts of cannabis on this pristine area need to be studied:

- Air quality modeling to ascertain air quality degradation in this valley that has thermal inversions and still air much of the summer. The modeling must include a sensitivity analysis of various acreages of cannabis crops.
- The effects of cannabis cultivation on the riparian habitat of the Matanzas Creek watershed where five species of state or federally threatened and endangered species reside: California giant salamander, California freshwater shrimp, red-bellied newt, red-legged frog, and yellow-legged frog.
- Wildfire risks from cannabis operations in an area that is mostly designated as high or very high fire risk. Include in the study an analysis of fires that started at grow sites in Sonoma County.
- Conflicts with the Bennett Valley Area Plan, including Land Use Policy 3 (development shall be coordinated with the public's ability to provide police and other needed services.) and Land Use Policy 5 (development, including appurtenances greater than 200 square feet, shall be reviewed for site design and consistency with development guidelines)
- The visual blight from hoophouses and greenhouses from various distances, including blight caused by light pollution and how these conflict with the policies of the Bennett Valley Area Plan regarding scenic vistas, scenic corridors, views from parks, etc.

Residents of Bennett Valley have forcefully resisted commercial cannabis projects since the original ordinance was adopted in 2016. By our count, there have been 17 attempts to cultivate within the Bennett Valley Area Plan. There has been resistance to each one, and today only one survives. The 55 acre property at 3803 Matanzas Creek Lane where a cannabis grow was attempted sold in late 2022 for $1.75 million, $200,000 less that its purchase price in early 2017. With transaction costs, the loss exceeded $300,000. The attitude of Bennett Valley residents will not change, and any future projects will be opposed by all available means. “Come to Bennett Valley to grow marijuana and lose your shirt” is the local motto. Many potential growers hail from other counties or states, and are not informed by realtors of the resistance to growing in Bennett Valley. Thus, establishing an exclusion zone in Bennett Valley benefits potential growers whose time, money, and efforts would be better spent elsewhere.

II. Proposition 65 Carcinogens.

Countywide, analyze whether outdoor cultivation complies with Proposition 65 regarding the presence of THC and beta-myrcene, listed carcinogens. Beta-myrcene averages 20% of total terpene content in cannabis. What remedies and mitigations are available to ordinary citizens who are exposed to these carcinogens in their homes without their permission?

III. Sonoma County’s Inability to Enforce its Ordinance.

Any mitigation must be feasible and enforceable. In this regard, analyze the county’s record since 2017 in implementing the cannabis ordinance and enforcing mitigations provisions that supposedly protect residents (Attachment 1 provides 26 specific examples). While many mitigation provisions in the current ordinance are feasible, they are not enforceable because the county lacks the will or perhaps even the intention of enforcing them. The DEIR must realistically assess staff and support required to enforce the revised ordinance. This is especially crucial because the supervisors have lowered cannabis fees to such an extent that general funds must pay for enforcement. Less revenue suggests county enforcement efforts will be weaker in the future than they have been since 2017. The ordinance should have a mechanism for ensuring that enforcement is funded. The premise of the ordinance is that the rules will be followed and enforced, and if it is not the entire program should be terminated because the mitigations required by CEQA are unenforceable.

IV. Restrictions on potency of cannabis products cultivated, manufactured, or sold in Sonoma County.

Analyze forbidding the cultivation, manufacture, or sale of cannabis or cannabis products above various levels of THC, such as 15%, 40% or 50%. Marijuana plants are being bred to produce higher and higher concentrations of THC. In the 1960s, levels were less than 2% and in the 1990s it was 5%. By 2015, it was over 20%. "Dabs" can concentrate THC to as much as 95- 99% THC, a level of potency that can be highly addictive and has a huge negative health impact on users. Many similar studies have been published in peer-reviewed journals and are summarized in Neighborhood Coalition Letter to Sonoma County Administrator (March 13, 2023) "Impact of Cannabis on Health and Safety of Sonoma County Residents" (Attachment 2).

In addition, the county should study whether cannabis products sold in Sonoma County should contain warnings that it is safer to smoke tobacco than cannabis, as concluded in the peer-reviewed study by the Department of Radiology, Ottawa Hospital, Canada, Radiology by Luke Murtha et al., Chest CT Findings in Marijuana Smokers. It should also study whether cannabis products should warn older cannabis users that the University of California San Diego School of Medicine has published a study in the Journal of the American Geriatrics Society that emergency room visits by Californians over the age of 65 for cannabis-related concerns have skyrocketed nearly 3200% in recent years.

V. Economic study of cannabis industry.

The Framework for the revised cannabis ordinance (March 2022) includes an economic analysis "to help inform relevant policy decisions." This analysis should include a robust and credible financial and economic analysis of grows of various sizes and types (outdoor, indoor, mixed light) and competition from other counties and mega-growers in California to estimate the number of acres or projects that the county might permit. Analyze the amount of total projected cannabis consumption within California as compared to the amount being grown already and the amount that would be permitted to be grown in Sonoma County.

The price for outdoor cultivated cannabis is in freefall, and industry experts think that is the new normal. If the economics of outdoor cultivation in Sonoma County are marginal, analyze whether the economic benefits of outdoor cannabis cultivation justify the negative impacts on residents and the environment.

The cannabis industry has successfully lobbied for significant state and county tax reductions. The economic study should determine if cannabis cultivation pays for itself with reduced revenues.

Analyze the impact of canna-tourism on the current revenue from the Transit Occupancy Tax. Napa County concluded that canna-tourism would undermine existing tourism and harm its tax base.

Thank you for the opportunity to submit these comments on scoping.

Sincerely,

Craig S. Harrison
For Bennett Valley Residents for Safe Development

Attachment 1. Because Sonoma County Irresponsibly Implements its Cannabis Ordinance, Mitigations in the CEQA Process Are Unenforceable (March 2023).

Attachment 2. Impact of Cannabis on Health and Safety of Sonoma County Residents.

cc: cannabis@sonoma-county.org

Attachment 1

Because Sonoma County Irresponsibly Implements its Cannabis Ordinance, Mitigations in the CEQA Process Are Unenforceable.

March 2023

Introduction. Sonoma County has irresponsibly implemented its cannabis ordinance since 2017. The 26 case studies outlined below reveal that for six years county officials have twisted any sensible interpretation of the ordinance into decisions that invariably favor growers over neighbors. The county protects the cannabis industry at the expense of ordinary residents and the environment who are harmed by the refusal or failure of county officials to properly implement the law. For this reason, it is questionable that any mitigations in the EIR for the revised cannabis ordinance are truly enforceable and qualified.

County officials essentially seek to find ambiguity in a "Stop sign," and invent twisted ways of reasoning to justify why they can allow growers to violate county and state requirements. This harms the environment and residents. Their decision making is ad hoc, opaque, arbitrary, capricious, and contrary to law. The county's approach to most anyone who objects to a grower not complying with the cannabis ordinance or state law is "sue me'" One supervisor captured the attitude when he said in a public meeting "if you don't like it, you can move somewhere else." The county knows that few residents can afford to file expensive suits to ask a judge to provide adult supervision. This behavior is corrosive to the public trust.

County officials have allowed growers to cultivate without having required state licenses that are required for legal sales (examples 4, 6, 7, 8, 11, 12, 13, 17). This violates California law, making the county an enabler or partner through tax receipts of black-market sales. PRMD and the Department of Agriculture refuse to destroy illegal plants that they find, and allow growers to transport them in movable plastic tubs to other locations where they can be harvested and sold on the black market (example 23). This behavior undermines Proposition 64 and the stated intent of the cannabis ordinance—to foster **legal** activity.

County officials have allowed or even encouraged growers to cultivate more acreage or plants than allowed in their permits (examples 4, 6, 7, 10, 11, 12, 13). They allow and even approve sites in blatant violation of the state SRA Fire Safe Regulations (examples 4, 9, 18, 19, 22). They ignore or defer action for years on code violations with respect to grading, cutting trees, lighting, electric wiring, greenhouses, and water hauling (examples 1, 4, 7, 15, 16, 17, 19, 22, 25, 26). They have allowed cultivation on a site that was ineligible under the ordinance because it was too close to a park (example 8) and on sites that are plainly visible from parks (examples 4, 19). They have allowed cultivation in the critical habitat of an endangered salamander. They have allowed cultivations that violate setback standards (examples 19, 21), and where a grower lacked a valid easement that is required under a conditional use permit (example 7). In the midst of the most terrible drought in memory, the county is still approving new cannabis grows, a water thirsty plant, when farmers are having to sell livestock, cut back in crop planting.

There are many plausible explanations for the county's poor implementation: (1) PRMD and the Department of Agriculture are overwhelmed and have inadequate staff or financial resources; (2) the cannabis program officials, county counsel, PRMD, and the Department of Agriculture lack the will to enforce the law because they desperately want a failing program to succeed; and (3) county staff are incompetent. It doesn't matter which explanation, or which combination of explanations, is correct. The end result is identical for residents and the environment who are harmed by marijuana cultivation. Sonoma County officials cannot be trusted to protect the environment or its residents and proffered mitigations in the DEIR are likely to be illusory and unenforceable.

Penalty Relief Program. The temporary code enforcement penalty relief program (PRP) was instigated in 2017 with little notice to or involvement from the public. The PRP has explicit requirements that county officials frequently ignore or overrule without legal authority. Building code, grading, nuisance, and other violations are not addressed until a permit decision is made, a period now of four years and counting. The authorizing ordinance does not empower the county to ignore illegal greenhouses, wiring, grading, tree removal, or other code violations. Growers had to commence cultivation by July 5, 2017 and were explicitly forbidden to increase the size of their grow after that date. Yet many growers cheat brazenly, and officials look the other way or refuse to assess meaningful penalties. The county could easily investigate many violations using satellite imagery from the comfort of the office and at the expense of the grower. Dozens of growers got a "get out of jail free card" for the first growing season in 2017 by submitting one-page PRP forms without even a fig leaf of an application for a permit, let alone submitting any of the required reports. When confronted, county officials took no action to shut down the illegal grows.

What follows are 24 examples of problems with the implementation of this program. One could write a treatise on this subject. Additional information on any of the examples is available on request.

Example 1. **885 Montgomery Road, Sebastopol (UPC18-0001).** Since July 2017, the non-resident owner of a ten-acre parcel near Sebastopol has allowed a third-party company to grow about an acre of commercial marijuana. Forty-seven properties surround the cannabis business within a 1,000-foot radius, and seven of them border the flag lot on all sides. Thousands of outdoor plants are located just a few feet from gardens, barbeques, a horse dressage arena, and homes. The stench, noise, and fear of an armed conflict has made the lives of neighbors miserable. One family tried to sell their home and failed. Some wear masks when they spend more than fifteen minutes outside to avoid feeling nauseous or getting a headache.[1] For a year, county officials have ignored neighbor complaints about odor, noise, night light pollution, and security cameras trained on neighboring homes. The county failed, neglected, and refused to verify false statements in the grower's Penalty Relief Application Form -- that they had 38,484

[1] Fuller, 'Dead Skunk' Stench from Marijuana Farms Outrages Californians, New York Times (December 22, 2018). What it's Like to Live 100 feet from 15,000 Cannabis Plants? North Bay Biz (Dec. 3, 2020).

square feet of cannabis cultivation. The operator secretly denuded, graded, and terraced an acre of hillside in June 2017, without a county grading permit to create their initial outdoor cannabis cultivation site. No outdoor cannabis plants existed until mid-July, 2017. The county refused to shut down the operator after receiving evidence that the operator never qualified for the PRP. The county has allowed the grower to conduct indoor cultivation in three structures that lack building permits, exposing neighbors to fire risks. The operator has harvested at least 4 outdoor crops and at least 15 indoor crops without a county permit. County officials tricked the CalCannabis to issue the operator a temporary state license to allow it to sell cannabis. For almost four years, the county has shown no desire to stop activities that are ruining the ability of neighborhood residents to enjoy their property. This failure to enforce the law is causing significant environmental harm. County officials have for 48 months refused to hold a hearing to decide whether to issue a permit, thereby allowing the growers to make millions while neighbors suffer.

Example 2. 1700 Barlow Lane (APC20-0079 and APC20-0080). From March 2020 and continuing into 2021, the neighbors surrounding 1700 Barlow Lane alerted Permit Sonoma Code Enforcement and the Department of Agriculture as to why two ministerial cannabis applications should be denied based on at least 10 witnessed and evidenced code violations. The Department of Agriculture and Code Enforcement issued one ground disturbance violation with no monetary fine, and overlooked the other violations in order to issue one permit. "Zoning Permits for Cannabis Cultivation - Guidelines for Ministerial Review" are the county's guidelines that provide a checklist that county staff must use to determine consistency with the Zoning Code. The guidelines state, "To the extent a project deviates from such standards and regulations in a manner that would require Staff to exercise judgment to determine whether the project conforms to the standards and regulations, the project may be subject to discretionary review and additional analysis under CEQA." County Staff exercised judgment or deliberation in determining whether the project conforms to the standards and regulations throughout the application process. The county failed to require additional environmental analysis, in violation of the cannabis ordinance, its own guidelines, and CEQA. This failure to enforce the law is allowing significant environmental harm to occur.

Example 3. **3062 Adobe Road, Petaluma (UPC18-0018).** Sonoma County's enforcement of its marijuana cultivation program is so poor that four families in Petaluma had to file a federal Racketeer Influenced and Corrupt Organizations Act (RICO) suit to shut down a grow that was wreaking havoc on their homes. They suffered noxious odors that caused significant breathing problems, including to a young paraplegic who uses a breathing tube and an asthmatic.[2] The illegal grow was reported to the county in April 2018, and the county sent a notice ordering the company to cease all cannabis activities on May 29, 2018. Yet in late August marijuana was still being grown and causing environmental problems for neighbors. The county settled the case after the RICO suit was filed by agreeing to let the grow continue until November 1st when the growers agreed to pay the county a $400,000 penalty. The penalty seemed to be a bribe that

[2] Julie Johnson, "Neighbors file federal lawsuit to shut down Sonoma County cannabis grower." Press Democrat (Aug. 31, 2018).

allowed the grower to sell millions of dollars of marijuana on the black market at the expense of neighbors who endured several more months of environmental harm. The county lacks the will or the legal tools to shut down an illegal grow for six months,[3] harming residents and the environment.

Example 4. **2260 Los Alamos Road, Santa Rosa (UPC18-0037).** For 48 months, the county has allowed the applicant to grow marijuana without complying with the cannabis ordinance. Satellite images indicate the small grow in June 2017 more than doubled to 47,000 square feet in October 2017, then to 69,000 square feet in 2018, and then to 80,600 square feet in 2019. Satellite images also confirmed unpermitted tree removal between February-May 2018, which is prohibited by the cannabis ordinance. Despite submitting an application that omitted ten required items, the county allowed the grower to continue past the June 2018 deadline required for a complete application. The county took a month to declare the application incomplete, and then extended the deadline another month. The county eventually sent a cease-and-desist letter, but the grower appealed. By this time, satellite imagery shows he had illegally removed mature trees to expand his cultivation site in 2018, illegally expanded to 1.5 acres in 2018 and then almost 2 acres in 2019. The satellite images were provided to the county and the county could have assessed $280,000 in penalties, but instead allowed him to continue growing.

In addition, he was allowed to grow without a state license for well over a year, so any sales were on the black market. This application was solely for using surface water, which according to the application could support maximum of 1 acre of cultivation. He had 2 wells supposedly only for domestic use. He did not provide a hydro-geo report (this is in water scarce zone 4), yet the county has granted his request to drill a third well. Although it is not supposed to be used for cannabis irrigation, the county did not confirm the well monitoring logs. Despite being shown satellite images showing the illegal constructions of a 3,000 square foot likely drying and processing structure, the county refused to cite him. He exceeded the one-acre limit, and paid taxes on only 35,000 square feet of cannabis for four years despite the Agriculture Commissioner being aware of the increased canopy size. He also violated the ordinance by the canopy being plainly visible from the entrance of Hood Mountain Regional Park. A county official confirmed the visibility but said it was insignificant.

The county performed a road evaluation and applied outdated regulations despite being informed that his operation is in violation of the state Fire Safe Regulations. The access road Los Alamos Road is 5 miles dead end to the private access via Weems Road. The Fire Safe Regulations limit dead-end roads to a maximum of 1 mile (or ½ mile when they serve any parcel less than 20 acres, which is the case here), and require 20-foot-wide roads. Los Alamos Road narrows to 12 feet wide for the last mile before Weems Road enters it. Weems Road is also only 12 feet wide. Thus, this site would not be permitted under state law. This has been pointed out to the county on several occasions since 2018, yet the county continues to allow it to operate in this remote, fire-prone area which burned in the 2020 Glass Fire.

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[3] Julie Johnson, "Petaluma-area cannabis farm whose neighbors sued agrees to shut down." Press Democrat (Aug. 31, 2018).

Despite all of these transgressions, the county has refused to terminate this operation or even hold a public hearing after more than 5 years. The county is eager to cater to illegal growers at the expense of the environment and neighbors.

Example 5. **1737 Wood Road, Fulton (UPC17-0034).** The Board of Zoning Adjustments Staff Report (December 12, 2019), page 11, states that this project "is exempt from the provisions of the CEQA" because "the project will be rejected or disapproved by the County of Sonoma." Page 2 of the Staff Report explains:

> The applicant cannot obtain the necessary federal permits for the project. The project site is located within designated Critical Habitat for the California Tiger Salamander, a federal-listed and state-listed Threatened species for which Incidental Take Permits are required from all state and federal agencies with jurisdiction over the California Tiger Salamander. The applicant does not have and cannot obtain the required permits due to Federal policy preventing Take Permit issuance for cannabis (a controlled substance) operations.

In addition (page 2),

> The project includes structures located within the 100-foot setback from designated wetlands required by the Sonoma County General Plan and California State Waterboard Cannabis Cultivation Policy. No verified wetland delineation has been submitted with this application and the applicant is unable to obtain a determination from the U.S. Army Corps of Engineers due to Federal laws pertaining to cannabis as a controlled substance.

The Board of Zoning Adjustments denied the permit application in December 2019, but the cannabis cultivation project has continued for 20 months pending an appeal hearing that the County refuses to schedule. A nearby resident testified at the Board of Zoning Adjustments hearing that the hoop houses are located on what was vernal pools until the applicant graded it without a permit. This whole area is a riparian corridor, with many vernal pools.

In comments to the Planning Commission (March 16, 2021) on proposed revisions to the cannabis ordinance, neighbor Katie Moore wrote "When I complained to one county official about the impact of the smell on my home and property value, I was told 'this is here to stay. If you don't like it, then move.'" The county official was Supervisor Gore.

Example 6. **4050 Grange Road, Santa Rosa (UPC17-0085).** This Bennett Valley property seems to have been allowed in the Penalty Relief Program under false pretenses. It was conveyed to Bennett Rosa LLC in late August 2017. The operator, Sonoma Grange Farms LLC, claimed on its Penalty Relief Application forms that the grow began June 30, two months before Bennett Rosa LLC owned the land and just before the July 5 deadline for eligibility. None of the LLCs were registered with the Secretary of State before mid-July. John Chen, who pled guilty in 2012 to six felonies related to defrauding the state and environmental crimes, owns the property and the operating company through his alter ego LLCs. Satellite imagery shows that the grow on the adjacent 4.9-acre parcel (4065 Grange Road) had not begun on July 9, 2017. The county allowed the 2018 harvest to be sold despite an absence of a state license, so any marijuana sold was on the black market. The Department of Agriculture conducted a compliance inspection on June 11, 2020. The report for that inspection notes for this property

> there were two mixed light hoop houses. The permit is for outdoor cultivation only. I also noticed an indoor grow in one of the barns, and noticed that the other barn was also equipped for indoor operations. There was a tremendous amount of garbage and debris on the property …My estimate of the total square footage of canopy is 20,000 sq. ft. Well over the 10,647 sq. ft. allowed under the penalty relief agreement. They DO NOT have a valid state license with the CDFA for that site. There are no porta-potties or bathrooms on site ….

The Department of Agriculture failed to shut down the site for non-compliance with the terms of the penalty relief agreement, including having twice the allowable amount of marijuana and having mixed light and indoor grows. Failing to have a state license violates state law. Despite these egregious violations, the county issued "no penalties" in 2020. A letter dated April 13, 2021 informed the grower that it owed the county almost $45,000, much of it apparently since 2017. Under the Penalty Relief Program, the owner and operator are required to be current. Even with this and other chronic transgressions and violations of law, the county as of June 2021 would not remove this project from the Penalty Relief Program but instead described the status as "on hold." The county's failure to enforce not only allows environmental harm, it encourages growers to ignore regulatory requirements because there are no serious consequences for violations.

Example 7. **4065 Grange Road, Santa Rosa (UPC17-0082).** The County allowed the 2018 harvest of this Bennett Valley property to be sold despite the fact that the growers lack State licenses and any marijuana sold without a license was on the black market. Despite the likelihood that this grow was improperly allowed in the Penalty Relief Program under false pretenses (see Example 5), the Board of Zoning Adjustments approved a conditional use permit in November 2019. The permit includes Condition 35, which requires the owner and operator to show it has a valid access easement within 90 days. This has never been done, and may be impossible to accomplish. Nevertheless, the operator grew marijuana again in 2020. A neighbor compliant prompted the Department of Agriculture to conduct a compliance inspection on June 11, 2020. The report for that inspection notes for this property

> there "were no METRC tags on any of the plants and my estimate is that there will be approximately 6000 sq. ft. of canopy at maturity. Their license is for 5000 sq. ft. The plants were directly under the drip line of the oak trees which had been severely cut back. There are no porta-potties on site.

The Department of Agriculture failed to shut down the site for non-compliance with the terms of the conditional use permit. Other violations of the county ordinance include cutting down trees without a permit and planting more marijuana than the permit allows. Failing to tag the plants violates state law, which is intended to discourage black market sales by tracking individual plants. Despite these violations, the county issued "no penalties." The county's failure to enforce not only allows environmental harm, it encourages growers to do so because there are no serious consequences for violations.

Example 8. **8105 Davis Lane, Penngrove (APC17-0011).** This vacant non-conforming 5.5-acre property is zoned diversified agriculture and is contiguous to agricultural (AR) and residential-zoned parcels. No one in the unincorporated residential neighborhood of small properties engages in commercial agriculture. An investor in Sebastopol leased the parcel in mid-2017, and without advance notice to surrounding neighbors, or any opportunity for them to object in a public hearing, the county issued a "ministerial" permit in February 2018. The permit allows the investor to grow commercial marijuana outdoors because the applicant merely satisfied a short list of perfunctory requirements. The neighbors had no opportunity to protest beforehand or appeal afterwards, and the only remedy was expensive litigation. The operators have no house on site, so an invader could easily mistake the home of an innocent neighbor as a location of large amounts of cash or marijuana. The majority of the risks and undesirable effects, such as loss of property value and noxious odors, are all borne by the neighbors. The supervisors increased the minimum lot size of commercial grows to ten acres in October 2018, but did nothing to void this permit or discontinue future use of similar ministerial permits. During 2019 the operator purchased the property and was "grandfathered" to continue operations although they were required get a conditional use permit; that process would allow for neighborhood objections to be considered. The operator applied for a use permit in 2020, and the County allowed the owner to grow while waiting for a Board of Zoning Adjustments hearing to decide whether to issue a use permit. They harvested two crops during 2020, and because they lack a state license any sales would have been on the black market. At last report, the assigned county planner indicated that the operator is waiting for ordinance revisions before choosing to continue the BZA process. Residents have no justice and must endure foul smells without due process, contrary to SCC § 26-92-070(a) (use cannot be not detrimental to the health, safety, peace, comfort or welfare of the neighborhood or the general public). There is great apprehension that the permit might be not only renewed in 2021 but extended for 5 years.

Example 9. **3803 Matanzas Creek Lane, Santa Rosa** (**UPC17-065).** This Bennett Valley property was purchased by Chicago investors in February 2017 who immediately began cultivating marijuana under the county's Penalty Relief Program. In September 2017, Permit Sonoma issued a Notice of Violation to the owner for building a greenhouse without a permit and did nothing to resolve it for a year. The county should have shut the project down on January 1, 2018 because the property was not setback 1,000 feet from a park as required by § 26-88-254(f)(3). On March 4, 2018, senior county officials, including the director of Permit Sonoma and Supervisor Susan Gorin, were asked to consult the county's Cannabis Site Evaluation Map and confirm that this parcel was categorically ineligible for cultivation. They agreed. For the next five months the county did nothing to stop the owner from growing marijuana while the county considered the owner's silly argument that North Sonoma Mountain Regional Park isn't really a "park." On July 31, 2018, Permit Sonoma sent a notice of violation to the operator. The grower continued to cultivate and harvest marijuana. On September 10, 2018 Permit Sonoma sent a "Notice & Order—Unlawful Commercial Medical Cannabis Use" to the owner and demanded the marijuana be removed within seven days. The owner appealed and the process dragged out until the owner harvested his entire marijuana crop. Then Permit Sonoma rescinded its Notice and Order because a revised ordinance took effect in November 2018 that allows the setback from parks to be relaxed. County staff secretly decided that this project qualified for the relaxation without public participation. There was no explanation as to why a parcel that was ineligible in January 2018 could now qualify for the PRP that had a deadline of July 5, 2017 to qualify. For four years, neighbors experienced the environmental harm and threats to safety caused by excess traffic on an 11-foot-wide narrow lane that violates CalFire's SRA Fire Safe regulations. In July 2021 the owners suddenly withdrew their permit application after subjecting neighbors to an illegal grow for four years.

Example 10. **5730 Bodega Avenue, Petaluma Dairy Belt.** In 2020 the Department of Agriculture issued sixteen ministerial permits to seven different applicants for up to 10,000 square feet of outdoor cultivation on each of four contiguous parcels. The maximum that is allowed is 40,000 square feet. An aerial photograph of the site taken on October 11, 2020 shows 93,954 square feet of outdoor cultivation and 127,489 square feet of mixed light cultivation, for a total area under cultivation of 221,443 square feet. While the county has issued notices of violation for some of this, it ignored, even after a site visit, 93,954 square feet of unpermitted outdoor cannabis. The county facilitated the grower receiving a state license, and the piecemeal process fails to comply with environmental review under CEQA. The county and CalCannabis were notified of these violations by letter dated January 8, 2021, and officials have neither responded to the letter nor done anything to alleviate the environmental harm.

Example 11. **4235 Spring Hill Rd, Petaluma Dairy Belt (APN 022-240-007/008/009, 022-260-003).**

In June 2020 the county issued 4 ministerial permits to growers working in concert, using a piecemealing approach to avoid environmental review under CEQA. The Department of Agriculture encourages this approach. The permits and licenses issued for this property allow a maximum of 160,000 square feet of outdoor grow, yet a photograph shows the total area under cultivation to be 249,541 square feet, of which 181,503 is mixed light cultivation for which there are no permits or licenses. In October 2020, the county issued notices of violation for 17 unpermitted hoop houses on three of these parcels and cited the owners for failing to obtain building or fire department permits for the hoop houses. Yet the county ignored the fact that mixed light cultivation was not authorized on this property. It also ignored violations on an adjacent parcel where 66,480 square feet of outdoor cannabis was being cultivated in plain sight on a parcel permitted for a maximum of 40,000 square feet. The county and CalCannabis were notified of these violations by letter dated January 8, 2021, and officials have neither responded to the letter nor done anything to alleviate the environmental harm. The cultivation continues today.

Example 12. **3215 Middle Two Rock Road**, **Petaluma Dairy Belt (APN 021-160-011**). This grower is operating under the PRP, which entitles him to grow, without a permit, until the county acts on the permit application on the condition that the grower not cultivate more cannabis than would be allowed under the permit for which it has applied. The grower has applied for a cannabis use permit authorizing 10,000 square feet of mixed light cultivation, and currently holds a provisional state license for medium outdoor cultivation. The grower lacks a state license for indoor or mixed light cultivation. A photograph shows 18,356 square feet of mixed light cultivation, a state law violation because he lacks a license for it and a violation of the PRP because he is growing almost double the amount allowed by the permit for which he has applied. The county and CalCannabis were notified of these violations by letter dated January 8, 2021, and officials have neither responded to the letter nor done anything to alleviate the environmental harm. The cultivation continues today.

Example 13. **334 Purvine Road, Petaluma Dairy Belt.** San Francisco investors purchased this 37-acre property in a peaceful stretch of the Petaluma Dairy Belt in June 2017. The grower holds a state medium outdoor license, which authorizes up to one acre of outdoor cultivation, and a county permit for 28,560 square feet of outdoor grow. The county permit provides for maximum total cultivation of 39,536 square feet. A photograph shows outdoor cultivation consisting of 45,374 square feet and total cultivation of 48,824 square feet, including 3,451 square feet of unlicensed indoor and mixed light cultivation. This grower has previously ignored applicable law. In 2019, the Sonoma County Superior Court issued a preliminary injunction prohibiting the grower from cultivating cannabis without a permit and license, which was upheld on appeal. The county and CalCannabis were notified of these violations by letter dated January 8, 2021, and officials have neither responded to the letter nor done anything to alleviate the environmental harm. The cultivation continues today.

Example 14. **7900 Petaluma Hill Road, Penngrove (UPC18-0025).** The growers at this site cultivated and harvested marijuana in 2018. On March 11, 2019, Permit Sonoma notified the operator that the site is located within designated critical habitat for the endangered California tiger salamander, and the applicants could not get incidental take permits from the federal and

state agencies. The applicants withdrew their permit proposal in mid-2019. An unsightly wooden fence that surrounds the 1-acre grow setback 200 feet from Petaluma Hill Road continues to blight the otherwise scenic landscape almost three years later. This failure of county officials to enforce the law is allowing environmental and aesthetic harm to occur.

Example 15. **6583 St. Helena Road, Santa Rosa (UPC17-0043).** For over eighteen months, neighbors of this grow were fearful for their safety due to the growers' possession of firearms and threats of home invasions. The county issued notices of violation for three illegally-constructed greenhouses and unpermitted electrical installations in September 2017, but did little to resolve them. The electrical violations could have caused wildfires in an area designated by CalFire to be a very high fire hazard zone. The growers installed unpermitted high-intensity electric lights without coverings. On foggy nights the illumination appears to be a wildfire. On one occasion, three fire departments deployed for a false alarm. In August, three men were arrested for kidnapping and attempted murder there.[4] They had a rifle on the premises, contrary to the ordinance. The county issued a notice to the operator to stop growing in August 2018, and the operator appealed. A hearing was held in September 2018, and an agreement was reached to shut down the grow. It took over eighteen months to resolve an intolerable situation during which the environment and residents were damaged.

Example 16. **7777 Cougar Lane, Santa Rosa** (no cannabis application). Since at least 2008 the owner has been reported multiple times for illegal construction and electrical violations. The Fire Marshall, Sheriff, and Permit Sonoma could see the illegal activity but refused to act without a warrant. In 2011, at the urging of Supervisor Brown, Permit Sonoma ordered the unpermitted construction to be removed, but the county never enforced the order. Similar complaints were filed in 2013 but the county failed again to act. The county issued citations for illegal construction in February 2018 and for illegal cannabis in May 2018 and the marijuana was then removed. The owner failed to appear for a hearing on his illegal construction in September 2018 but there was still no abatement. Finally, in 2019 the county required him to remove the unpermitted structures, and although he dismantled them, he left the trash on the site. The county's countenance of unlawful behavior for a decade has been an invitation to illegal marijuana grows.

Example 17. 5364 Palmer Creek, Healdsburg (UPC17-0067). Since the purchase of the property in June 2016, the operator has never had a legal source of water yet is now completing his second harvest season. Contrary to § 26-88-250(g)(10) and the PRP, the operator exclusively used trucked water. The operator has been hauling recycled waste water day and night and a commercial potable water supplier has been delivering water daily to the grow. Residents have been reporting violations to code enforcement since November 2017. The county allowed the operation to continue unabated until recent complaints resulted in an agreement to shut down. The county allowed the 2017 harvest to be sold despite the fact that the grower has no state license so any sales were on the black market in violation of California and federal law. While the environmental harm may have stopped, the county allowed it to occur for years.

Example 18. 6699 Palmer Creek Road, Healdsburg (UPC18-0046). The BZA on June 24, 2021 voted 3-2 to approve a large-scale cannabis cultivation facility requiring extensive construction and grading in the Class 4, Mill Creek designated watershed. Although the County acknowledges the 2-mile dead-end private access road narrows to just 9 feet wide and was shown to fail to meet almost all of the stated and required SRA Fire Safe § 1273 Regulations, the project was still approved. The BZA approval has been appealed based on failure to show an

[4] Susan Minichiello, Three men arrested for kidnapping, attempted murder at Santa Rosa marijuana farm (Aug. 13 2018).

adequate water supply in a Class 4 watershed and the access road's clear substandard safety access requirement to "provide for safe access for emergency wildfire equipment and civilian evacuation concurrently" per SRA Fire Safe Regulation § 1273.00, Intent.

Example 19. 2274 Wellspring Road, Santa Rosa (various zoning permits).

Since about 2019 the Commissioner of Agriculture has issued at least 4-5 ministerial permits for a total of 1 acre of marijuana cultivation here. In spring 2021, the grower constructed hoop houses without a building or electrical permit that caused light pollution at neighboring properties. This violated the cannabis ordinance and the Bennett Valley Area Plan's requirements for design review (p. 22) that apply to any agricultural appurtenance greater than 200 square feet.

The large, ugly, industrial cannabis facility is clearly visible from the Sonoma Mountain trail in North Sonoma Mountain Regional Park at an area designated as "Bennett Valley Overlook," a violation of § 26-88-254(f)(6) ("Outdoor cultivation areas shall not be visible from a public right of way") and § 26-88-254(f)(21) ("No outdoor or mixed light cultivation sites located on parcels adjacent to public parks shall be visible from trails or public access points") of the Cannabis Ordinance. See imbedded image.

The access road appears to violate the SRA Fire Safe Regulations, which require the access road to be at least 20 feet wide and "provide for two-way traffic flow to support emergency vehicle and civilian egress," which is required for access to any commercial development. § 1273.01(a). The access to the site is by definition a road and not a driveway pursuant to the definitions in § 1271.00.

The use of multiple ministerial permits that total an acre instead of the conditional use permit process is also piecemealing to avoid environmental review, which violates the California Environmental Quality Act.

Example 20. **2108 Schaeffer Road, Sebastopol (ZPC17-0009).** This 2.4-acre property that is zoned DA had been used to cultivate marijuana long before the 2016 Cannabis Ordinance was adopted. It has had innumerable building code violations for years. The county allowed the growers to continue to cultivate under the protections of the PRP when they applied for a commercial cannabis permit. The property has only a 21-foot setback when the zoning code requires 50 feet, and this defect cannot be cured. The county failed to act responsibly to shut down the grow immediately. In late 2018, the county stated it would tell the operator that the permit will be denied. While this is now shut down, the neighbors were subjected to an illegal marijuana grow for two years since the Cannabis Ordinance was adopted while the environment suffered. Much of the property remains a mess, and the county has failed to make the owner clean it up or to do so itself.

Example 21. **5000 Lakeville Highway, Petaluma (UPC17-0023).** For about two years, residents on a small lane were subjected to noxious marijuana odors. The grower was operating within the 300-foot setback to a home, contrary to law. Code enforcement officers failed, neglected, and refused to shut down the grow because it was in the "penalty relief program" which allows growers to operate without a permit or complying with regulations. The neighbors were also exposed to vicious dogs that got loose when a security gate was left open. Contrary to the ordinance, they illuminated bright lights on many nights when no one at Permit Sonoma was on duty. Permit Sonoma does not investigate complaints on weekends, holidays, or between 5 PM in the evening and 8 AM in the morning, while growers operate constantly. It took almost two years for Permit Sonoma to shut down the grow, during which time neighbors and the environment suffered the consequences.

Example 22. 2000 Los Alamos Road (UPC17-0041). This remote property was also in the Penalty Relief Program since July 2017, operating an indoor cannabis grow in a barn that was illegally converted without electrical permits to an indoor grow facility. Indoor grows use a very large amount of electricity. This location is in a very high fire hazard zone, almost burned in the 2017 Nuns Fire, and did burn in the 2020 Glass Fire. The County chose to bypass the Board of Zoning Adjustments and scheduled its public hearing directly with the Board of Supervisors on May 25, 2021. At that public hearing, the Fire Marshall stated - incorrectly - that the access roads, Los Alamos Road and McCormick Road, both met the state SRA Fire safe Regulations. The Fire Marshall, Permit Sonoma, and the County Supervisors were aware that Los Alamos Road was 5.6 miles dead-end to where the private road entered, far in excess of the ½ mile limit under the state regulations, and that it was only 12 feet wide for the upper mile, far less than the 20-foot requirement, yet the Fire Marshall presented the case as it meeting the regulations. McCormick Road is only 10-12 feet wide yet the Fire Marshall granted the entire 0.4-mile-long road an "exception" to the required 20-foot width, saying that by adding a turnout in the middle and one turnaround at the dead-end provided the "same practical effect" as a 20-foot-wide road in ensuring "safe concurrent fire apparatus ingress and civilian evacuation." Such use of the exception process for an entire road completely circumvents the intent of the state fire safe regulations, which is consistent with the county's history of refusing to follow these state regulations. This site is in water scarce zone 4 at the headwaters of Santa Rosa Creek, home to endangered Coho salmon and steelhead trout. This permit was approved 5-0 by the County Supervisors with a 12-fold increase over what was in the original application, and allows a new greenhouse to border the regional park. Such an indoor grow will use electricity equivalent to 160 new homes (based on numbers provided by the county). Approving this very high energy use in a remote, fire prone area is outrageous both for its impact on increasing wildfire risk as well as it being in full violation of state law in the SRA fire safe regulations.

Example 23. Refusal to Destroy or Seize Illegal Marijuana Plants.

The following letter was published in the Press Democrat on July 24, 2021:

Aiding the black market

EDITOR: Sonoma County supervisors made a good decision two months ago to conduct a full environmental impact report to understand where and how much cannabis can be grown without impacts to the environment (e.g., water), residents and fire danger.

Meanwhile, the county rightly works to eliminate illegal cannabis grows. However, I was shocked to learn that the county does not have a program to destroy illegal plants. Rather, the grower is allowed to remove the illegal plants before the county reinspects a few days later. As most of these plants are grown in pots or bags of soil, the grower can merely put them in a truck and transport them to another illegal grow site. I applaud the efforts to shut down illegal cannabis grows, but the illegal plants must be destroyed.

This practice by the county supports the continuance of the black market and, in reality, makes the county's efforts to eradicate illegal grows like a game of whack-a mole.

DEBORAH EPPSTEIN
Santa Rosa

Initially the editorial page editor refused to print the letter because he could not believe this is true. He agreed to publish the letter after fact checking information from supervisors and PRMD. Once again, the county is aiding and abetting the black market, contrary to its own stated goals of using the cannabis ordinance as a vehicle to eliminate illegal cultivation. The county's cannabis policies are incoherent.

Example 24. Nonpayment of Cannabis Taxes.

The county has had a policy since 2018 of allowing cannabis permit applicants and permit holders to be behind in the payment of various cannabis taxes, often for months or even years. This violates the cannabis ordinance and Penalty Relief Program requirements, yet the county essentially extended interest-free loans to cultivators. No such relief is provided to ordinary citizens if they get behind on, e.g., property taxes.

Example 25. Illegal Water Hauling in the Dairy Belt During Worst Drought in a Millennium.

Insight Group, a private investigator, filed a report dated September 4, 2021 containing 16 photographs showing water being pumped from city hydrants into a truck marked "Petaluma Creamery" and delivered to Sonoma Hills Farm at 334 Purvine, a cannabis operation. Another report dated October 2021 shows the same truck hauling water to cannabis grows at Valley Ford Farms LLC, 1400 Valley Ford Freestone Road, Bodega and Diggit Gardens LLC, Potter Family Farms LLC, Rain Gardens LLC, Wild Heart Farms LLC at 4835 and 3803 Springhill Road, Petaluma. Hauling water to these grows violates the current cannabis ordinance. The reports were provided to supervisors and PRMD, and no action was ever taken. PRMD rarely undertakes its own investigations (its investigators operate more or less Monday-Friday, 8:30- 4 PM, excluding holidays), and it discredits investigations undertaken by private citizens.

Example 26. Illegal Water Hauling in Santa Rosa During Worst Drought in a Millennium.

Beginning in June 2021, numerous eye witnesses on Scotland Court, Santa Rosa, saw a white pick-up truck with a water tank on a trailer and an additional tank in the bed draw water using a "construction meter" from a hydrant at the corner of Scotland Drive and Scotland Court. Water was taken daily, often multiple times a day and transported to 2260 Los Alamos Road. This is a cannabis cultivation operation owned by Patrick Bransford that is called Castle Rock Ridge, Inc. One nearby resident followed the pickup truck on Los Alamos Road and watched the driver open the gate and turn onto Weeks Ranch Road (a private road so he could not follow). This is the entrance to the cannabis operation at 2260 Los Alamos Road.

The neighbor contacted Permit Sonoma and the Agriculture Department, who administer the cannabis program. The Agriculture Department was assigned to investigate. The Deputy Agricultural Commissioner, told two neighbors that unless they catch the grower red-handed, the county will not pursue this. Given the agency's estimated response time of at least an hour after any report, enforcement is impossible. County officials said that eye witness accounts and photographic evidence at hydrants and on public roads leading to cannabis grows is insufficient evidence to instigate an investigation despite the immense amounts of unauthorized water that were delivered. The Agriculture Department inspected the site on September 29, 2021 and observed that there was still water in the pond during the severe drought (very unlikely without water deliveries). They refused to test the water to confirm whether it was surface water or city water. Inspections are scheduled to alert growers to prepare for them, so growers can easily avoid engaging in illegal activities when the inspectors are present. The Agriculture Department invented excuses for the water deliveries, suggesting that it was for firefighting. This statement is not only ridiculous, it reveals a credulous attitude that is inappropriate for a regulatory agency whose primary duty is to protect the public. At one point the Agriculture Department suggested that the interested public might trespass on the property to obtain photographs of the trucked water being offloaded.

The County Board of Supervisors ignored this documented information on illegal water hauling, ignoring public letters and statements from eye witnesses, and instead taking the grower's word that nothing illegal had been done. The Supervisors approved a five-year permit for the cultivation site at 2260 Los Alamos Road. This is NOT enforcement.

Conclusion. Sonoma County has a dismal record of protecting the environment and its residents when they implement the cannabis ordinance. The county is in the process of amending the cannabis ordinance, which may occur in 2024. Amending the ordinance is irrelevant to how county officials have implemented it for four years and will continue to implement it. Sonoma County officials cannot be trusted to protect the environment or its residents and any mitigations in the DEIR are likely to be illusory because they will not be enforced.

March 13, 2023

Honorable Christina Rivera
Sonoma County Administrator
600 Administration Drive
Santa Rosa, California 95403

Re: Impact of Cannabis on Health and Safety of Sonoma County Residents

Dear Ms. Rivera:

Congratulations on your appointment as Sonoma County's Administrator. In your new role, the Neighborhood Coalition of Sonoma County respectfully requests you address the urgent issues surrounding the impact of cannabis on the health and welfare of Sonoma County residents. The County's robust support for the cannabis industry is undeniable. The County's focus, however, appears to be on the economics of the substance and providing financial support to growers and sellers, while ignoring the dark underbelly of cannabis and the risks posed to the public by its production and use.

As you undoubtedly are aware, Proposition 64 created The California Marijuana Tax Fund with designated funding, including annual funding as follows: (1) $2 Million to the UC San Diego Center for Medical Cannabis Research; (2) $10 Million to California universities for research as to the impact and implementation of Proposition 64; (3) $3 Million to the CHP to develop protocols for assessment of driving under the influence of cannabis; and (4) $50 Million for grants to local health departments and community-based nonprofits supporting, among other issues, mental health treatment and substance use disorder treatment.

In addition to the earmarked funds, Proposition 64 directs the remaining funds be dedicated as follows: (1) 60% to youth programs, including drug education, prevention, and treatment; (2) 20% to prevent and alleviate environmental damage from illegal marijuana producers; and (3) 20% to programs designed to reduce driving under the influence of marijuana and for a grant program designed to reduce negative impacts on health or safety resulting from the proposition.

The plentiful funding available through Proposition 64 Public Health and Safety Grant Program requires no local or matching funds. Nevertheless, we are not aware of the County's accessing these funds in any significant way to address rapidly emerging and serious public health risks inextricably entwined with the cannabis industry, an industry the County leaders so wholeheartedly support. These risks clearly were foreseen by the topics identified in Proposition 64's specification of funding coverage. And yet, what is the County doing to educate youth and the public about drug prevention and treatment? Similarly, what is the County doing to prevent and alleviate environmental damage from cannabis production? Finally, what is the County doing to ensure the safety of its citizens from the crime resulting from the presence of the cannabis production?

So, you may ask, why are we alarmed? A few select examples underscore the accuracy of the damage and risks that concerned the Proposition 64 drafters.

Health -

The Press Democrat reported a study by the Southern Illinois School of Medicine[1] detailing reports to the nation's poison control centers of more than 7000 cases of children eating marijuana edibles between 2017 and 2021, climbing from about 200 to more than 3000 per year. More than half of those cases involved toddlers, ages 2 and 3, and more than 90% got the edibles at home. Nearly 600 children were admitted to critical care units with depressed breathing or even coma. Almost twice as many were admitted to non-critical care units and more than a third were seen in emergency rooms.

The health risks of marijuana to children are not limited to directly ingesting it. Not surprisingly, secondhand marijuana smoke contains many of the same cancer-causing toxins as secondhand tobacco smoke according to Brooke Hoots, a Centers for Disease Control and Prevention epidemiologist. According to the CDC, the substance within marijuana that causes a "high" — tetrahydrocannabinol, or THC — can be passed to young children from secondhand smoke. Researchers in New York City found about one-third of parents surveyed reported marijuana smells in their home while children were there, according to an article published in January 2021. It took years for the world to understand the damage to children from secondhand tobacco smoke. Clearly secondhand marijuana smoke presents similar, if not more harmful, risks to children.

These reports are exemplary of the types of risks about which it falls on the County to pro-actively educate and warn the public in order to protect its youngest citizens from the fallout of the County's embrace of cannabis.

The negative consequences of cannabis use among our youth has been documented and presents immediate concerns for our County's teen and young adult population with ramifications impacting the entire County. According to a recent article in the Wall Street Journal[2], "Young people are especially vulnerable to cannabis's effects because their brains are still developing," a conclusion confirmed by a study reviewing scans of teenagers' brains before and after they

[1] See The Press Democrat, January 8, 2023

[2] Cannabis and the Violent Crime Surge, Allysia Finley, June 6, 2022, Wall Street Journal

started using pot. “They found that parts of the brain involved in decision making and morality judgments were altered in pot users compared to nonusers.” The article goes on to detail further concerns which mandate action by our public health officials.

On the other end of the age spectrum, a new University of California San Diego School of Medicine study has identified a sharp increase in cannabis-related emergency department visits among the elderly.

“The study, published Jan. 9, 2023 in the *Journal of the American Geriatrics Society* , identified a 1,808% relative increase in the rate of cannabis-related trips to the emergency department among California adults ages 65 and older from 2005 to 2019. Researchers used a trend analysis of data from the Department of Healthcare Access and Information and found that cannabis-related emergency department visits went from a total of 366 in 2005 to 12,167 in 2019.
The significant increase is particularly troublesome to geriatricians, given that older adults are at a higher risk for adverse health effects associated with psychoactive substances, including cannabis. The study highlights that cannabis use among older adults can lead to unintended consequences that require emergency care for a variety of reasons. Cannabis can slow reaction time and impair attention, which may lead to injuries and falls; increase the risk for psychosis, delirium and paranoia; exacerbate cardiovascular and pulmonary diseases and interact with other prescription medications.”[3]

In that study, the author noted, “We know from work in alcohol that older adults are more likely to make a change in substance use if they see that it is linked to an undesirable medical symptom or outcome — so linking cannabis use similarly could help with behavioral change,” said Alison Moore, MD, MPH, co-author of the study and chief of the Division of Geriatrics, Gerontology, and Palliative Care in the Department of Medicine at UC San Diego School of Medicine. As with young children, this study underscores the need for the County’s public health agencies to pro-actively educate the public, and particularly older adults, about the risks of cannabis in order to avert these medical crises.

In regard to adults of all ages, the deleterious effects of cannabis on the cardiovascular health of adults were recently reported by researchers who concluded, "Thus, there is growing evidence from both laboratory and population studies that cannabis consumption may be harmful for cardiovascular health." [4]

The impact of cannabis on mental health is similarly alarming. “Overall, use of higher potency cannabis, relative to lower potency cannabis, was associated with an increased risk of psychosis and CUD. Evidence varied for depression and anxiety. The association of cannabis potency with CUD and psychosis highlights its relevance in health-care settings, and for public health

[3] Tiffany Kary 1/23/23 Bloomberg Newsletter

[4] Frequent Cannabis Use Tied to Coronary Artery Disease Marlene Busko February 28, 2023
https://www.medscape.com/viewarticle/988902?

guidelines and policies on cannabis sales."[5] These concerns as to increased potency of cannabis permeate the impact of the drug in every aspect of public health as processors and manufacturers develop products and methods for increased potency, seemingly without any oversight or concern as to the impact on public health. To fulfill its duty to protect the public health of its residents, the County must impose limits as to potency of cannabis and marijuana products and disclose to residents the full impact of these products on their physical and mental health.

In all these settings, the County is uniquely capable of providing outreach to the public to warn and prevent these deleterious outcomes from cannabis and can do so at no cost to the County with the Proposition 64 funding. These deep-seated and long-term public health issues require immediate investigation. The County cannot wait for these outcomes to fully manifest themselves before acting. At that point the proverbial horse will be out of the barn.

Environment -

Proposition 64 also provides funding to prevent and alleviate environmental damage from illegal marijuana producers. In this regard, it should be noted the environmental risks of cannabis production do not neatly fit into legal or illegal markets. These risks are profound and diffuse, crossing over environmental abuses ranging from water and land use pollution to greenhouse-gas emissions with a litany of other environmental harm along the way. These are all issues about which the County should be alarmed, and which require investigation and assessment as soon as possible.

Evan Mills, writing in "The Journal of Impact and ESG (Environment Social Governance) Investing"[6], identifies specific examples of the scope of these environmental issues including but not limited to pollution from pesticide use, water use, land-use change, waste production, volatile organic compound (VOC) releases to the air, and solvents used to produce extracts. As to the carbon footprint of cannabis, he reported indoor cannabis cultivation requires significantly more energy input than most products and is on a par with that of even the most energy-intensive industrial materials (cement, zinc, copper, and aluminum). For the legal and illicit cannabis markets combined, a decade ago Mr. Mills estimated the corresponding annual energy and greenhouse-gas emissions equal to that of three million cars nationally, a whopping $6 billion *annual* energy bill. He concluded that given rising demand, the numbers are likely higher today, and that original analysis did not include the full array of emissions. He further estimated demand for energy by cannabis facilities is growing at such a rate that all of California's existing wind energy, for example, could easily end up being, in effect, diverted solely to power cannabis cultivation. These concerns impact the entire state, and more specifically, Sonoma County, where we particularly value our environment and health.

[5] (The Lancet – Psychiatry – Association of Cannabis Potency with Mental Illness and Addiction. – Volume 9, Issue 9, September 2022)

[6] https://evan-mills.medium.com/cannabis-esg-risk-is-a-buzzkill-for-investors-1c9749def519

Again, we believe the County should be immediately taking advantage of the availability of Proposition 64 monies, at no cost to the County, to identify and remediate environmental harm from cannabis operations of all types.

Safety –

The drafters of Proposition 64 also correctly identified safety as among the negative impacts which would flow from its passage and earmarked funds for counties to access to reduce negative impacts on safety resulting from the proposition. The recent headlines underscore the criminality which has flowed from the presence of the cannabis industry in Sonoma County as the robberies of dispensaries have become almost commonplace. While dispensaries in Santa Rosa are charged with providing their own security[7], the criminal element they attract impacts the entire community.[8]

These concerns about safety were recently detailed in a study by the Los Angeles Times entitled "Legal Weed – Broken Promises"[9]. In its extensive investigation, the Times reported on the risks and safety abuses throughout the State relating to cannabis production including the safety and health risks to those being hired to work in that industry. That report included extensive investigation in Northern California. The Times' findings provide ample evidence for the need for the County to avail itself of the Proposition 64 funding in order to mitigate the negative impact of cannabis on our County and to keep its citizens safe.

Conclusion -

These concerns and examples are the proverbial tips of the icebergs which the County must navigate if it is to fulfill its duty to protect the health and safety of its citizens as well as to protect our environment from harm as a result of the passage of Proposition 64. The immediate access to these funds and the implementation of the information and programs flowing from those actions dovetail with the County's undertaking revision of its health ordinance on April 4, 2023. Fortunately, the funding for the County to accomplish those objectives is provided without cost by The California Marijuana Tax Fund. Those monies should allow the County to delve deeply into these issues to identify them, educate people about them, and to prevent, or at least limit, the harm foreseen by Proposition 64 and the legalization of cannabis.

We ask that you, as the new navigator for the County's ship of state, navigate those icebergs by aggressively seeking solutions to these problems using that funding to insure the health and safety of our County and its citizens.

Neighborhood Coalition
Nancy and Brantly Richardson, Communications Directors
SonomaNeighborhoodCoalition@gmail.com

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[7] Santa Rosa City Ordinance 2017-025-G. Security
[8] See Santa Rosa Press Democrat 1/19/23 and 2/4/23 front page articles; also see
[9] L.A. Times 10/31/22

From:	Limon, Jessica@Wildlife
To:	Crystal Acker
Cc:	Hultman, Debbie@Wildlife; Chappell, Erin@Wildlife; Weightman, Craig@Wildlife; Stokes, Wesley@Wildlife; Galli, Emily@Wildlife; OPR State Clearinghouse
Subject:	Sonoma County Comprehensive Cannabis Program Update-SCH2023020144
Date:	Tuesday, March 21, 2023 12:42:02 PM
Attachments:	image001.png image002.png Sonoma County Comprehensive Cannabis Program Update-SCH2023020144-Acker-GALLI03212023.pdf

EXTERNAL

Good afternoon,

Please see the attached letter for your records. If you have any questions, contact Emily Galli, cc'd above.

Thank you,

Jessica Limon
Staff Services Analyst/ Administrative Support Analyst
California Department of Fish and Wildlife – Bay Delta Region

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GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

March 21, 2023

Crystal Acker, Supervising Planner
County of Sonoma
2550 Ventura Avenue
Santa Rosa, CA 95403
Crystal.Acker@sonoma-county.org

Subject: Sonoma County Comprehensive Cannabis Program Update, Notice of Preparation of a Draft Environmental Impact Report, SCH No. 2023020144, Sonoma County

Dear Ms. Acker:

The California Department of Fish and Wildlife (CDFW) received the Notice of Preparation (NOP) of a draft Environmental Impact Report (EIR) from the County of Sonoma (County) for the Sonoma County Comprehensive Cannabis Program Update (Project) pursuant to the California Environmental Quality Act (CEQA) and CEQA Guidelines.[1] CDFW is submitting comments on the NOP to inform Sonoma County, as the CEQA lead agency, of potentially significant impacts to biological resources associated with the Project.

CDFW ROLE

CDFW is California's **Trustee Agency** for fish and wildlife resources and holds those resources in trust by statute for all the people of the State. (Fish & G. Code, §§ 711.7, subd. (a) & 1802; Pub. Resources Code, § 21070; CEQA Guidelines, § 15386, subd. (a)). CDFW, in its trustee capacity, has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species. (*Id.*, § 1802). Similarly, for purposes of CEQA, CDFW is charged by law to provide, as available, biological expertise during public agency environmental review efforts, focusing specifically on projects and related activities that have the potential to adversely affect fish and wildlife resources.

CDFW is also submitting these comments as a **Responsible Agency** under CEQA. (Pub. Resources Code, § 21069; CEQA Guidelines, § 15381). CDFW expects that it may need to exercise regulatory authority over the Project pursuant to the Fish and Game Code. As proposed, for example, the Project may be subject to CDFW's Lake and Streambed Alteration (LSA) regulatory authority. (Fish & G. Code, § 1600 et seq.).

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[1] CEQA is codified in the California Public Resources Code in Section 21000 et seq. The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with Section 15000.

Likewise, to the extent the Project may result in "take," as defined by State law, of any species protected under the California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.), related authorization as provided by the Fish and Game Code will be required.

REGULATORY REQUIREMENTS

California Endangered Species Act

Please be advised that a CESA Incidental Take Permit (ITP) must be obtained if the Project has the potential to result in "take" of plants or animals listed under CESA, either during construction or over the life of the Project. Under CESA, "take" means "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill." (Fish & G. Code, § 86). If the Project will impact CESA listed species, early consultation with CDFW is encouraged, as significant modification to the Project and mitigation measures may be required to obtain an ITP. CDFW's issuance of an ITP is subject to CEQA and to facilitate permit issuance, any such Project modifications and mitigation measures must be incorporated into the EIR's analysis, discussion, and mitigation monitoring and reporting program.

CEQA requires a mandatory finding of significance if a project is likely to substantially impact threatened or endangered species. (Pub. Resources Code, §§ 21001, subd. (c) & 21083; CEQA Guidelines, §§ 15380, 15064 & 15065). In addition, pursuant to CEQA, the lead agency cannot approve a project unless all impacts to the environment are avoided or mitigated to less-than-significant levels, or the lead agency makes and supports findings of overriding consideration for impacts that remain significant despite the implementation of all feasible mitigation. Findings of consideration under CEQA; however, do not eliminate the Project proponent's obligation to comply with the Fish and Game Code.

Lake and Streambed Alteration

CDFW requires an LSA Notification, pursuant to Fish and Game Code section 1600 et seq., for Project activities affecting lakes or streams and/or associated riparian habitat. Notification is required for any activity that may substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank (including associated riparian or wetland resources); or deposit or dispose of material where it may pass into a river, lake, or stream. Work within ephemeral streams, drainage ditches, washes, watercourses with a subsurface flow, and floodplains is generally subject to notification requirements. In addition, infrastructure installed beneath such aquatic features, such as through hydraulic directional drilling, is also generally subject to notification requirements. Therefore, any impact to the mainstems, tributaries, or floodplains or associated riparian habitat caused by the proposed Project will likely require an LSA Notification. CDFW may not execute a final LSA Agreement until it has considered the final EIR and complied with its responsibilities as a responsible agency under CEQA.

Raptors and Other Nesting Birds

CDFW has authority over actions that may result in the disturbance or destruction of active bird nest sites or the unauthorized take of birds. Fish and Game Code sections protecting birds, their eggs, and nests include section 3503 (regarding unlawful take, possession, or needless destruction of the nests or eggs of any bird), section 3503.5 (regarding the take, possession, or destruction of any birds of prey or their nests or eggs), and section 3513 (regarding unlawful take of any migratory nongame bird). Migratory birds are also protected under the federal Migratory Bird Treaty Act.

PROJECT DESCRIPTION SUMMARY

Proponent: Sonoma County

Objective: The Cannabis Program Update would result in a series of zoning changes that may retain, replace, expand on, or eliminate existing provisions of the current cannabis ordinance. The primary goals of the Project are to consider the need for expanded or new cannabis land uses within the unincorporated County, further enhance neighborhood compatibility and environmental protections (which could result in restriction or elimination of cannabis land uses) and streamline the cannabis permitting process. The Cannabis Program Update is currently being developed consistent with County Resolution No. 22-0088, “Cannabis Program Update Framework”. The County proposes to define prohibited versus allowed activities and what authorization is required for allowed activities by right, ministerial zoning permit, discretionary use permit, or business license. The County also proposes a general plan amendment to include cannabis within the definition of agriculture. This proposal would expand ministerial permitting of commercial cannabis cultivation in agricultural and resource zoned areas of the unincorporated county. The Project area consists of all non-coastal General Plan Land Use categories and corresponding Zoning Districts. It would not include the coastal zone.

Location: The Project encompasses all of Sonoma County, California, except for the coastal zone. The County is bordered by Mendocino County to the north, Lake and Napa counties to the east, and the Pacific Ocean to the west.

ENVIRONMENTAL SETTING

Sufficient information for meaningful review regarding the environmental setting is necessary to understand any potentially significant impacts on the environment of the proposed Project and any alternatives identified in the EIR (CEQA Guidelines, §§ 15125

& 15360). CDFW recommends that the CEQA document prepared for the Project provide baseline habitat assessments for special-status plant, fish and wildlife species located and potentially located within the Project area and surrounding lands, including all rare, threatened, or endangered species (CEQA Guidelines, §15380).

Habitat descriptions and species profiles included in the EIR should include robust information from multiple sources, such as aerial imagery; historical and recent survey data; field reconnaissance; scientific literature and reports; the U.S. Fish and Wildlife Service's (USFWS) Information, Planning, and Consultation System; findings from positive occurrence databases such as the California Natural Diversity Database (CNDDB); the California Aquatic Resource Inventory (CARI); and sensitive natural community information available through the Vegetation Classification and Mapping Program (VegCAMP). Only with sufficient data and information from the habitat assessment can the County adequately assess which special-status species are likely to occur in the Project vicinity.

CDFW recommends that prior to Project implementation, surveys be conducted for special-status species with potential to occur, following recommended survey protocols[2] if available.

Botanical surveys[3] for special-status plant species, including those with a California Rare Plant Rank[4], must be conducted during the appropriate season, including the blooming period for all species potentially impacted by the Project within the Project area and adjacent habitats that may be indirectly impacted by, for example, changes to hydrology, and require the identification of reference populations. More than one year of surveys may be necessary given environmental conditions.

IMPACT ANALYSIS AND MITIGATION MEASURES

The CEQA Guidelines (§15126.2) necessitate that the draft EIR discuss all direct and indirect impacts (temporary and permanent) that may occur with implementation of the Project. This includes evaluating and describing impacts such as:

- Changes in hydrology that could alter the timing and magnitude of streamflow both during construction and operation of the Project;

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[2] Survey and monitoring protocols and guidelines are available at https://wildlife.ca.gov/Conservation/Survey-Protocols.
[3] Please refer to CDFW protocols for surveying and evaluating impacts to rare plants, and survey report requirements at https://wildlife.ca.gov/Conservation/Plants
[4] http://www.cnps.org/cnps/rareplants/inventory/

- Potential for "take" of special-status species;
- Potential for impacts to special-status species or sensitive natural communities;
- Loss or modification of breeding, nesting, dispersal and foraging habitat, including vegetation removal, alternation of soils and hydrology, and removal of habitat structural features (e.g., snags, roosts, overhanging banks);
- Encroachments into riparian habitats, drainage ditches, wetlands, or other sensitive areas;
- Permanent and temporary habitat disturbances associated with ground disturbance, noise, lighting, reflection, air pollution, traffic or human presence;
- Obstruction of movement corridors, fish passage, or access to water sources and other core habitat features;
- Water quality impacts resulting from construction and operations of the Project;
- Impacts both from construction and future operation of the Project;
- Impacts to the bed, channel, or bank and effects to other habitat structures, in the reservoirs and creeks downstream of the Project;
- Impacts to bed, channel, or bank and direct effects on fish, wildlife, and their habitat; and
- Impacts as a result of alteration of riparian habitat and resulting impacts to fish, wildlife, and water quality.

The EIR also should identify existing and reasonably foreseeable future projects in the Project vicinity, disclose any cumulative impacts associated with these projects, determine the significance of each cumulative impact, and assess the significance of the Project's contribution to each impact (CEQA Guidelines, §15355). Although a project's impacts may be insignificant individually, its contributions to a cumulative impact may be considerable; a contribution to a significant cumulative impact – e.g., reduction of available habitat for a listed species – should be considered cumulatively considerable without mitigation to minimize or avoid the impact.

Based on the comprehensive analysis of the direct, indirect, and cumulative impacts of the Project, the CEQA Guidelines (§§ 15021, 15063, 15071, 15126.2, 15126.4 & 15370) direct the lead agency to consider and describe all feasible mitigation measures to avoid potentially significant impacts in the draft EIR, and/or mitigate significant impacts of the Project on the environment. This includes a discussion of take avoidance and minimization measures for special-status species, which are recommended to be developed in early consultation with the USFWS=, the National Marine Fisheries Service and CDFW. These measures can then be incorporated as enforceable Project conditions to reduce potential impacts to biological resources to less-than-significant levels.

Fully protected species may not be taken or possessed at any time (Fish and G, Code § 3511). Therefore, the draft EIR is advised to include measures to ensure complete take avoidance of these fully protected species.

COMMENTS AND RECOMMENDATIONS

Comment 1: Differences in Cannabis Grows

Issue: Cannabis cultivations vary in size, type, and extent of environmental impacts. Not all grows are the same; for example, there are significant differences in impacts between outdoor cultivation sites that use conventional agriculture practices and outdoor cultivation sites that grow in pots using imported soils, placed on compacted gravel surfaces within hoop-houses enclosed in fencing and heavily reliant on plastic infrastructure. Differences in cultivation sites increase the potential for varied species and habitat impacts.

Recommendations: The draft EIR should clearly define what infrastructure will constitute an “outdoor” cannabis cultivation site in the context of the Cannabis Program Update. It should distinguish between potential different types of outdoor cultivation sites and include a robust analysis based on cultivation type in order to provide meaningful review of corresponding impacts to fish and wildlife resources. Considerations should include, but not be limited to, use of gravel hardscape, grading, paving, importation of soils, fencing, limited life-span plastic materials and lighting.

Comment 2: Inclusion and Exclusion Zones

Issue: Cannabis cultivation may have a significant adverse effect on species identified as a candidate, sensitive, or special-status species, riparian habitat, and other sensitive natural communities directly or through habitat modifications.

Recommendations: The County should create exclusion zones where cannabis cultivation cannot be eligible for a ministerial permit. To avoid or minimize impacts to species of special concern, riparian habitat, or other sensitive natural communities, exclusion zones should contain areas with CNDDB detections with a buffer zone, wetlands, vernal pools, and other sensitive habitats.

Comment 3: Land Use Planning

Issues: The Project has the potential to expand cultivation areas and increase the potential for species and habitat impacts. Ministerial review may not adequately account for all impacts and may potentially allow individual projects to proceed without appropriate disclosure and avoidance, minimization, and mitigation requirements.

Recommendations: The Cannabis Program Update should establish a current baseline of permitted cannabis cultivation areas and identify where new cannabis cultivation expansion may occur on a map. Geo-spatial analysis should be used at an individual property parcel scale, to exclude ministerial approval of cannabis cultivation within areas with habitat to support special-status species and where special-status species occurrences are documented within the CNDDB. Exclusion area boundaries should be mapped at a parcel scale. In addition, species-specific protective buffer distances should be developed as part of the EIR to limit activities that can occur adjacent to mapped exclusion areas. The Project should exclude Project areas potentially impacting special-status species and their habitat in order to adequately protect these species.

Landscape level impacts should be evaluated with consideration to current and future conservation planning efforts. CDFW recognizes the Sonoma County Agricultural and Open Space District (Sonoma County District) has completed a considerable conservation analysis and planning effort in its 2021 Vital Lands Initiative. The Initiative identifies spatially mapped areas of conservation priorities which includes, but is not limited to, riparian habitat, wetlands, conifer forests, grasslands, shrublands, hardwood forests, and wildlife habitat for movement (connectivity). Those areas with highest conservation priority can be reasonably expected to have high value of fish and wildlife resources. Cannabis cultivation within those areas of highest conservation priority likely have the greatest potential for significant effects to the environment and fish and wildlife. CDFW encourages the County to incorporate conservation planning efforts by the Sonoma County District into its ordinance to the greatest extent feasible. For proposed cannabis cultivation within areas of highest conservation priority identified by the Sonoma County District, CDFW recommends separate Use Permit and individual CEQA analysis. Alternatively, CDFW supports cultivation prohibition in those areas.

Comment 4: Riparian/Wetlands Setbacks

Issue: The Project has the potential to encroach into the riparian zone of rivers, lakes and/or streams such as from development of new buildings and infrastructure as well as, land clearing and grading. Additionally, the Project has potential to increase diversion of surface water and pumping of groundwater for irrigation and also cause the delivery of sediment, nutrients, petroleum products, and pesticides into streams. All of these factors can negatively impact fish and wildlife species.

Evidence the impact would be significant: Riparian trees and vegetation, and associated floodplains, provide many essential benefits to stream and aquatic species habitat (Moyle 2002, CDFW 2007), including thermal protection, cover, and large woody debris. Development adjacent to the riparian zone can result in fragmentation of riparian habitat and decreases in native species abundance and biodiversity (Davies et al. 2001, Hansen et al. 2005, CDFW 2007).

Wastewater discharge and runoff from cannabis cultivation activities, especially water containing pesticides, disinfectants, and/or fertilizers, may enter and alter existing streams or their function and associated riparian habitat on the Project site. Wetlands that are hydrologically connected to surface water may transport pollutants and waste material associated with cannabis cultivation.

Riparian buffers help keep pollutants from entering adjacent waters through a combination of processes including dilution, sequestration by plants and microbes, biodegradation, chemical degradation, volatilization, and entrapment within soil particles. As buffer width increases, the effectiveness of removing pollutants from surface water runoff increases (Castelle et al. 1992). There is substantial evidence showing narrow buffers are considerably less effective in minimizing the effects of adjacent development than wider buffers (Castelle et al. 1992, Brosofske et al. 1997, Dong et al. 1998, Kiffney et al. 2003, Moore et al. 2005).

Recommendations: Riparian and wetland setbacks should be as protective as or more protective than the State Water Board *Cannabis Cultivation Policy – Principals and Guidelines for Cannabis Cultivation* requirements that require the following:

Common Name	Watercourse Class[3]	Distance
Perennial watercourses, waterbodies (e.g. lakes, ponds), or springs[4]	I	150 ft.
Intermittent watercourses or wetlands	II	100 ft.
Ephemeral watercourses	III	50 ft.
Man-made irrigation canals, water supply reservoirs, or hydroelectric canals that support native aquatic species	IV	Established Riparian Vegetation Zone
All other man-made irrigation canals, water supply reservoirs, or hydroelectric canals	IV	N/A

The County should evaluate each cultivation site individually and reserve the right to require greater setbacks in some cases. Protective riparian setbacks should be established that are scientifically based. Evaluation should consider temporal changes in water demand, seasonal variations and both ongoing and future cumulative impacts.

All sites should be evaluated for potential wetland features within the required Biological Resources Assessment. Sites with signs of wetland features should be delineated by a Qualified Professional to determine the appropriate setback distances from constructed/disturbed areas.

A site-specific analysis should discuss all direct and indirect impacts (temporary and permanent), including reasonably foreseeable impacts, that may occur with implementation of the Project (CEQA Guidelines, §§ 15126, 15126.2, & 15358).

Comment 5: Surface and Groundwater Use

Issue: The Project has the potential to deplete streamflow and other surface waters (e.g., wetlands and groundwater dependent ecosystems (GDEs)) from groundwater diversions that are interconnected. Depletion of streamflow from groundwater diversion has the potential to cause significant impacts to listed and special-status species.

Evidence of Impacts: Many Sonoma County tributaries have historically provided sustained perennial flow which supports spring, summer, and fall rearing habitat for naturally producing California freshwater shrimp (*Syncaris pacifica*), Central California Coast Coho salmon (*Oncorhynchus kisutch*), California Coastal Chinook salmon (*Oncorhynchus tshawytscha*) steelhead (*Oncorhynchus mykiss*) and other aquatic species. Available habitat for these species is limited by lack of flow, especially during the summer and early fall periods. The grow season for cannabis cultivation includes summer months (CDFW 2018) during times when stream flows are generally at their lowest (State Water Resources Control Board (SWRCB) 2010). Most Sonoma County fish-bearing tributaries are already subject to large numbers of surface and groundwater diversions that are cumulatively affecting the amount of water available for instream habitat. The exact number, location and extent of diversions are unknown. However, in many watersheds, parcels that do not have access to municipal water sources often extract water from the stream either; through direct diversion from the stream or from near stream wells that intercept subterranean stream flow; or from groundwater wells. Groundwater extraction has the potential to impact GDE resources and reduce streamflow, especially during the late spring and summer months which is a critical time period for the state federally endangered coho salmon and federally threatened steelhead.

Recommendations: CDFW recommends the County assess the aquatic carrying capacity of watersheds to support cannabis cultivation and propose a limit on density or number of cultivation sites. The focus of the assessment should be to determine the maximum water use availability from watersheds that maintains adequate water supply for fish and wildlife species, considering the cumulative impact of existing and future legal and illegal diversions. Prior to issuing permits for new cultivation sites, the County should prepare the assessment at a watershed scale describing a) existing water use and availability, b) potential for sediment and other pollutant discharge, and c) percentage of habitat fragmentation within a given watershed. Hemp should be incorporated into this analysis since it requires essentially the same cultivation techniques and water use. From CDFW's perspective, activities causing the same or similar environmental impacts should be reviewed and analyzed with the same rigor. Identified impacts due to hemp cultivation should be avoided, minimized, and/or mitigated. In addition, the analysis should provide detail on the amount of cannabis and hemp cultivation the County proposes to permit within each watershed (e.g., HUC 12 or smaller watershed area), and what impacts the allowed cultivation would have on each of these elements.

In order to avoid a concentration of cannabis and hemp cultivation sites in a particular watershed, which could result in potential significant effects, CDFW recommends that prior to issuing permits for new cultivation, the County defines a watershed cap based on an analysis of the impacts to each watershed as described above. Without a defined cap on the number of cultivation sites, analysis of environmental impacts should assume that all parcels meeting zoning criteria could be used for cannabis cultivation. For all cultivation sites, disclosure of the amount of water to be used from each water source, and a current, site-specific analysis of water availability should be required, and the County should reserve the discretion to modify permit conditions. Please note that possession of an active appropriative water right does not guarantee that an adequate water supply is available to support fish and wildlife resources.

Additionally, surface water diversions (including subterranean streamflow) are subject to notification under Fish and Game Code 1602. The Ordinance should require projects with surface diversions to comply with 1602 and notify CDFW for all surface diversion activities.

Wells used for cannabis cultivation should be evaluated under the CEQA review process to determine their potential for stream water depletion that may adversely affect fish and aquatic life. Wells should be metered and monitored to determine if there are any adverse impacts. Water conservation and other mitigation should be required in areas where these wells have the potential to impact public trust resources.

For consistency with the SWRCB *Cannabis Cultivation Policy – Principals and Guidelines for Cannabis Cultivation,* the Project should require a forbearance period from surface diversions and wells in subterranean streams. The intent of forbearance and storage is to require for water to be diverted during the wintertime when water is more abundant so that this stored water can be used in the summertime to meet irrigation demands.

Recommendation: CDFW recommends outlining the following Project requirements for cultivators to demonstrate adequate water supply at each site:

- For surface water and sub-streamflow diversions, sufficient off-stream water storage should be demonstrated prior to receiving a County cultivation permit in order to allow full compliance with the SWRCB forbearance periods. To determine the necessary storage, cultivators should be required to calculate how much water is required for each year of cultivation with consideration to expansion over time. In addition, CDFW encourages use of metal or wood water tanks.

- For well diversions, demonstrating adequate water should include technical analysis prepared by a qualified professional showing diversion from the well is limited to ground water only and that groundwater pumping will not deplete surface water flows.

CDFW recommends the County's cannabis program include management actions that include preventative and avoidance measures.

Preventative measures should include the planning and implementation of projects that reduce water demand in the summer months and therefore, reduce the risk of water diversions competing with Coho salmon and steelhead for surface water. These actions may include outreach, education, and funding of storage and forbearance, rainwater catchment or other water security projects. Preventative measures can be taken at any time of year and should be ongoing activities regardless of drought conditions.

Comment 6: California tiger salamander (*Ambystoma californiense*) Habitat Exclusion from Ministerial Process

Issue: The Cannabis Program Update could allow cannabis cultivation under a ministerial process that can result in significant impacts to California tiger salamander (*Ambystoma californiense,* CTS) and/or their habitat. The present range of the Sonoma Distinct Population Segment (DPS) of CTS is predominantly located on the Santa Rosa Plain but according to CNDDB, the present range also include areas outside of the cities of Petaluma, Penngrove and Cotati.

Evidence of Impacts: CTS is endemic to central California, with isolated populations in Sonoma and Santa Barbara counties (Bolster 2010, USFWS 2014). CTS relies on seasonal wetlands or freshwater ponds for successful reproduction and adjacent or accessible terrestrial habitat for migration and aestivation, making the quality of both aquatic and terrestrial habitat essential for CTS survival (Bolster 2010). Upland habitats must contain underground refugia, such as mammal burrows, that CTS depend upon for food, shelter, and protection (Laredo et al. 1996). Threats to CTS include habitat loss/conversion and fragmentation, including dispersal habitat between breeding pools and upland refugia. CTS spend the majority of their lifecycle underground (Trenham et al. 2000) and are susceptible to being crushed during ground disturbance. CTS is also threatened by competition with and predation from invasive species (USFWS 2017). Introduced species such as bullfrogs and sunfishes have had a negative effect on CTS (Bolster 2010). Larval populations undergo large fluctuations, with most populations containing less than 100 breeding pairs (Pechmann et al. 1991, Bolster 2010). Fluctuating *Ambystoma* populations were found to be susceptible to recruitment failure during stochastic events (Pechmann et al. 1991).

Over the past 25 years, land development has increased dramatically within the Santa Rosa Plain, including low- and high-density land use and agricultural conversion (USFWS 2016). The current core range of Sonoma County CTS encompasses approximately 18,000-20,000 acres of fragmented habitat. The species can migrate up to 1.3 miles between a breeding pond and upland burrows (Orloff 2011). CTS spend approximately 95 percent of their lifetime in underground burrows, emphasizing the importance of protecting potential upland habitat in addition to wetland breeding ponds (Trenham 2001).

Pesticides and fertilizers used in cannabis cultivation could decrease fitness or survival of, or cause abnormalities in, *Ambystoma* species. Construction or modification of perennial ponds has been shown to provide breeding habitat for invasive bullfrogs that prey on and compete with sensitive amphibians (Kiesecker et al. 2001, Bolster et al. 2011, Fuller et al. 2011 Kupferberg and Fury 2015). Grading and filling of habitat can result in crushing CTS, collapsing underground burrows, and trapping CTS within, and reducing or fragmenting breeding or non-breeding habitat. Roads can result in amphibian mortality and fragment habitat, as well as, create barriers to movement.

Recommendations: The Santa Rosa Plain has an enhanced potential for CTS presence and is critical to the long-term survival of the species; therefore, should not be considered eligible for cannabis cultivation under a ministerial process. Please be advised that actions related to cannabis cultivation activities, including, but not limited to, site grading, relocation of individuals out of harm’s way, and installation of fencing could result in “take” of CTS (or other listed species). A CESA ITP (pursuant to Fish and Game Code Section 2080 et seq.) is required in advance of such activities in order to lawfully take this species. A CESA ITP requires CEQA documentation, and the proposed Cannabis Program Update should adequately address impacts to CTS or provide for mitigation to reduce the impact to less-than-significant. CDFW recommends excluding any project within the Santa Rosa Plain and within 1.3 miles of an extant positive occurrence of CTS from the ministerial process. New or expanded cannabis cultivation within the Santa Rosa Plain should be thoroughly assessed through a separate Use Permit and individual CEQA analysis. Additionally, sites outside of the Santa Rosa Plain with the potential for CTS occurrence (e.g., rural Southwest Petaluma, and areas east of Penngrove and Cotati) should be delineated and excluded from the ministerial process.

Comment 7: Light Pollution

Issue: The Project has potential to generate sources of light in rural areas, near wildlands, and near sensitive natural vegetation communities, including permanent lighting from additional buildings or greenhouses, security lighting, and temporary lighting for proposed nighttime construction. In addition to lighting impacts on neighboring areas, artificial lighting and light pollution may cause significant impacts to rare, threatened, endangered, and nocturnal wildlife and migratory birds. Light pollution impacts can disrupt routine behavior of the species life cycle, degrade the quality of the environment utilized by said species and can substantially reduce the number of individuals.

Evidence of Impacts: Sensitive species, wildlife, and their habitats may be adversely affected by increased and artificial night lighting, even temporarily due to night construction activities. Light plays a vital role in ecosystems by functioning as both an energy and an information source (Gaston et al. 2012, 2013). The addition of artificial light into a landscape disrupts this role, altering the natural circadian, lunar, and seasonal cycles under which species have evolved.

Recommendations: CDFW recommends the following set of criteria of types of lighting that may be used on-site:

- The EIR should include a robust analysis of potential impacts to special-status and listed species (e.g., northern spotted owl) from lighting. Exclusion zones should incorporate lighting restrictions to avoid significant impacts to special-status and listed species.

- In addition to facing lights downward, lights should be motion-activated, or turned off or dimmed during critical times of the year (e.g., migration) and during times of night that have the most significant impact on wildlife (i.e., dawn and dusk) (Gaston et al., 2012, 2013).

- Lights with wildlife-friendly spectral composition (i.e., minimize light avoidance/attraction) should be used (Gaston et al. 2012, 2013). LED lights are well suited for operating at variable brightness and being switched off or dimmed during certain times of the year or during times of low demand, as they operate at full efficiency and have no “warm-up” time (Gaston et al., 2012, 2013).

    - Vegetation may also be used to shield sensitive areas against light, and light-absorbent surfaces can be used in in place of reflective surfaces (Gaston et al., 2012, 2013).

- All lights should be disposed of properly, as many contain mercury and other toxins.

- Hoop-houses and other grow facilities that use lighting (e.g., light deprivation) should be required to be completely covered at night from sunset to sunrise.

- Lighting should be limited in rural areas.

Comment 8: Fencing Hazards

Issue: The Project may result in the use of open pipes used as fence posts, property line stakes, signs, etc.

Evidence of Impacts: Raptor's talons can become entrapped within the bolt holes of metal fence stakes resulting in mortality. Further information on this subject may be found at: https://ca.audubon.org/conservation/protect-birds-danger-open-pipes.

Recommendations: CDFW recommends that all hollow posts and pipes be capped to prevent wildlife entrapment and mortality because these structures mimic the natural cavities preferred by various bird species and other wildlife for shelter, nesting, and roosting. Metal fence stakes used on the Project site should be plugged with bolts or other plugging materials to avoid this hazard.

Comment 9: Monofilament Plastic Netting Prohibition

Issue: Monofilament plastic netting is commonly used as trellising on cannabis plants. This plastic netting can be harmful to wildlife such as from entanglement and/or becoming trapped.

Evidence of Impacts: Plastic netting used in these products has been found to entangle many different species of wildlife, including reptiles, amphibians, birds, and small mammals. CDFW has documented wildlife mortality related to monofilament including to raptor and mammal species. Additionally, plastic materials persist in the environment for years before breaking down into smaller fragments. When plastic fragments break down, these smaller fragments or microplastics often blow away or wash materials into waterways and habitat areas.

Recommendations: The Cannabis Program Update should prohibit use of monofilament plastic netting and identify comparable materials that may be allowed that are less harmful to fish and wildlife. Allowable alternatives may include bio-degradable material, such as jute and coir (coconut husk).

FILING FEES

CDFW anticipates that the Project will have an impact on fish and/or wildlife, and assessment of filing fees is necessary (Fish and Game Code, § 711.4; Pub. Resources Code, § 21089). Fees are payable upon filing of the Notice of Determination by the Lead Agency and serve to help defray the cost of environmental review by CDFW.

If you have any questions, please contact Emily Galli, Environmental Scientist at Emily.Galli@wildlife.ca.gov; or Wesley Stokes, Senior Environmental Scientist (Supervisory), at Wesley.Stokes@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Erin Chappell
B77E9A6211EF486...

Erin Chappell
Regional Manager
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cc: **California Department of Fish and Wildlife**

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From:	dine_06_blower@icloud.com
To:	Cannabis
Subject:	Comment on NOTICE OF PREPARATION of EIR
Date:	Tuesday, March 21, 2023 5:11:58 PM
Attachments:	Scoping doc w HdL content final.pdf

March 18, 2023

Crystal Acker, Supervising Planner
crystal.acker@sonoma-county.org
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Via email

Re: Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR. In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update.

To whom it concerns:

I support the Cannabis Environmental Impact Report (EIR) researching, evaluating, identifying and measuring not only the potential for expansion of cannabis cultivation but equally important is to analyze the "project alternatives" that include limiting and/or banning outdoor cannabis cultivation in Sonoma County.

Cannabis grown in Sonoma County must be analyzed to understand IF a viable business opportunity exists for the grower and if the tax revenue will not only cover the County's costs to manage the cannabis program but will also deliver on the promises stated in the cannabis ordinance legalizing cannabis cultivation in Sonoma County.

Reasons for analyzing the "project alternatives" to be studied of cannabis cultivation include:

- Market saturation has been reached. According to HdL, a consultant working for Sonoma County, the largest 20 growers in Santa Barbara County can supply California's demand for cannabis. That means ANY cannabis grown in Sonoma County is likely to accelerate the decline in pricing which will further fuel the illegally grown cannabis market and erase any tax benefit Sonoma County would have received from supporting cannabis in the county.
- Avoid a boom-to-bust gold-rush that will leave Sonoma County's landscape littered with decaying white plastic from hoop houses, engineered soils, chemicals, fertilizers, other plastic infrastructure, further destruction of natural resources, needless grading and unsustainable development of our rural character. The HdL analysis states that; "…it should be expected that the same number of cultivators producing the same volume of product will generate lower gross receipts and related tax revenues in the future."

Analyze the Following:

- Analyze the viability and size of a market for Sonoma County craft/terroir/organic/sun grown cannabis. HdL's findings state that there is no viable market for Humboldt County sun-grown organic cannabis. [(pg 14) "Outdoor cultivation has struggled to find a place in the cannabis market. Legacy growers in Humboldt and Mendocino counties had hoped the market would reward organic, sun-grown cannabis with a premium price, but the difficulty in producing consistent product in large volumes has driven the price precipitously downward."]
- Analyze the cannabis program budget: Sonoma County's published cannabis tax revenue and expense forecast shows program costs exceeding tax revenue for all seven of the years in their forecast. The County's forecast provides no evidence that would trim these losses in future years. The analysis could include, but would not be limited to: evaluation of cannabis tax collection revenue and method(s); staffing costs to implement the program, including permitting, compliance inspection, and code enforcement; permit and inspection fees and other applicant-incurred costs to obtain permits and run permitted operations; and civil penalties.
- Analyze the long-term Sonoma County budget needed to support/manage the illegal and legal cannabis business.
- Analyze whether economic benefits of outdoor cultivation outweigh the negative impacts on neighborhoods and the environment.
- Analyze the impact of canna-tourism on the current revenue from the Transit Occupancy Tax. Napa County concluded that canna-tourism would undermine existing tourism and harm its tax base. Study and compare Napa report. https://www.winebusiness.com/content/file/9111_Report_082019.pdf
- Analyze the existing legal cannabis market size and the forecasted market size for the coming 10 years.
- Analyze how much cultivation of all agriculture can be sustainably grown in Sonoma County including the cumulative impact on resource demands on surface/ground water, soil, biotic resources, silt runoff, streams/creeks/rivers, wildlife habitat….
- Analyze the maximum sustainable carrying capacity of the existing agriculture zones and study if these zones need to be reclassified, reduced and or eliminated.

From: Kathy Stevenson
To: Cannabis
Subject: Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date: Tuesday, March 21, 2023 11:52:29 AM

EXTERNAL

Sonoma County,
Please add our names to the residents or Franz Valley asking that our area be classified as an Exclusion Zone for Commercial Cannabis.
Thank you

Kathy and Richard Horwath
8950 Franz Valley School Road
Calistoga Ca

From: Maria Mariotto
To: Cannabis; Crystal Acker
Subject: Los Alamos Road Cannabis Cultivation
Date: Tuesday, March 21, 2023 8:18:13 AM

EXTERNAL

Good morning,

I own property on Los Alamos Road and am very concerned about Cannabis Cultivation and Processing in the area.

My home and property burned in the 2020 Glass Fire and the narrow, dead-end two lane country road made it difficult for people to evacuate. This road is dangerous and cannot support more traffic. We already have home/ranch owners, an entrance to Mt. Hood Park and bicyclists on this narrow road.

There is water scarcity in the area in addition to fire danger.

This public road also narrows toward the top of the 6 mile winding road to one lane and does not meet the requirements of Title 14 State Fire Safe Regulations.

There is no second access/egress.

Please review this and conclude that no new development can occur that is accessed by Los Alamos Road.

Thank you,

Maria B. Mariotto

From: Mary Kettlewelll
To: Cannabis
Subject: Cannabis EIR/Scoping comments for exclusion Zone in Franz Valley
Date: Tuesday, March 21, 2023 3:28:18 PM

EXTERNAL

Add my name, Mary Kettlewell 8435 Franz Valley School Road, in support that Franz Valley be designated an Exclusion Zone for commercial cannabis.

Sent from my iPad

From:	Richard Crowley
To:	Cannabis
Subject:	Cannabis EIR/Scoping Comments for Exclusion Zone for Franz Valley
Date:	Tuesday, March 21, 2023 11:52:59 PM

EXTERNAL

I would like to add my name to the list of folks petitioning for Franz Valley to be designated an exclusion zone where commercial cannabis cultivation is prohibited.

Thank you,

Richard Crowley
8535 Franz Valley School Road

From:	Richard R. Rudnansky
To:	Cannabis; Crystal Acker; Scott Orr
Cc:	Susan Gorin; David Rabbitt; Lynda Hopkins; Chris Coursey; district4
Subject:	Comment on Notice of Preparation of EIR re Cannabis / Scoping
Date:	Tuesday, March 21, 2023 3:43:52 PM
Attachments:	BRCA Pettition.pdf

EXTERNAL

Crystal and Scott

I am resubmitting the email below dated March 5, 2023, and the attached petition from the Board of Directors of the Bennett Ridge Community Association with respect to the Notice of Preparation of the EIR re Cannabis.

I would also add the following reasons why cannabis cultivation should be prohibited in the Rural Residential Zoning Districts but if allowed why the Bennett Ridge neighborhood should be studied as an exclusion overlay zone. Please include these comments in the public record.

COMMERCIAL CANNABIS CULTIVATION IN RURAL RESIDENTIAL NEIGHBORHOODS INCONSISTENT WITH THE COUNTY GENERAL PLAN, THE COUNTY ZONING CODE, THE BENNETT VALLEY AREA PLAN AND THE BENNETT RIDGE CC&RS

Bennett Ridge (which includes Old Bennett Ridge Road, Rollo Road, Bardy Road, and Bennett Ridge Road) is above Bennett Valley and is zoned Rural Residential. In 2018 the Board of Supervisors decided to not allow commercial cannabis cultivation in the Rural Residential Zoning District. This decision should not change.

Under the terms of the County's current General Plan and Zoning Code, the purpose of Rural Residential Zone District is to "preserve the rural character and amenities in areas best used for low-density residential development. Rural residential uses are intended to take precedence over the agricultural uses." Cannabis cultivation is not consistent with this purpose and is simply not compatible with our rural neighborhoods.

However, if the Board decides to allow commercial cannabis cultivation and operations in Rural Residential, zones, an Exclusion Combining District would be in order for Bennett Ridge. In 2018 the Planning Commission that Exclusion Combining Districts are appropriate where road access is inadequate, where concentration of cannabis cultivation would be detrimental to the character of the area or where the there is a significant fire hazard. Bennett Ridge clearly fits within these Exclusion Zone criteria.

Bennett Ridge is within the boundaries of the Bennett Valley Area Plan ("BVAP"). That plan emphasizes the protection of scenic resources such as Bennett Ridge and Bennett Valley. A proliferation of hoop houses or greenhouses and other structures with their attendant lighting, even if limited in scale, would violate the scenic resource protection policies in the BVAP.

The Bennett Ridge CC&Rs state "No lot shall be used except for residential purposes. Without limiting the foregoing, it is specifically provided that no portion of the property shall be used for any commercial or industrial activity of any nature whatsoever." While we understand that the County does not enforce private CC&Rs, we believe that the exclusion of even commercial agricultural activity within our neighborhood strongly supports our request for an exclusion zone.

CANNABIS CULTIVATION IS INCOMPATIBLE WITH BENNETT RIDGE NEIGHBORHOOD FOR MULIPLE REASONS

Water Supply: The sole source of water for our homes is the Bennett Ridge Mutual Water Company (BRMWC) which has two wells. The BRMWC Bylaws state that water use, "shall be limited to water for domestic purposed, for use in a swimming pool and for irrigation of not more than ten percent (10%) of the area of a parcel". There is no allowance for use of BRMWC water for any commercial purposes, including commercial cannabis cultivation. Introduction of commercial cannabis cultivation into our neighborhood would seriously impact the long-term sustainability of our domestic water supply.

Odors: The Bennett Ridge CC&Rs state: "No noxious or offensive activity shall be carried on upon any lot, nor shall anything be done thereon which may be or may become an annoyance or nuisance to the neighborhood."

Given the proximity of the properties on the Ridge, the odor from commercial cannabis cultivation would have significant nuisance impacts on neighbors. There has been ample evidence and firsthand experiences previously presented to the Board by those who already live near cannabis cultivation as to the significant odor which in many instances do not even allow residents to comfortably sit outside their homes. To allow commercial cannabis cultivation in the Bennett Ridge neighborhood would clearly create a nuisance and affect the quality of our life on the Ridge.

Safety, Security, and Fire Risks: Bennett Ridge has only one way in and out. Allowing increased traffic from commercial cultivation would not be compatible with the neighborhood and would create safety and evacuation risks not unlike those experienced in 2017 when folks on the Ridge had to evacuate due to the Nuns Fire that swiftly engulfed the Ridge. Bennett Ridge is in a high fire hazard zone. The cannabis industry is subject to home invasions and other crimes. Given that the emergency response time is over 30 minutes to the Ridge allowing any cannabis operations on the Ridge would increase the risk to the residents.

Aesthetics/Visual Impacts: The Bennett Valley Area Plan, which includes Bennett Ridge, provides that the scenic quality of the area is to be protected. Allowing commercial cannabis cultivation with its hoop houses, lighting, fences and commercial structures will clearly have an adverse impact on the bucolic setting of the Ridge and Bennett Valley. Residents on the Ridge have already been impacted by cannabis operations allowed in Bennett Valley that are clearly visible from our neighborhood. Many of us have firsthand knowledge of how commercial cannabis cultivation has destroyed the scenic beauty in other jurisdictions. Please do not let this happen in Bennett Ridge/Bennett Valley.

Code Enforcement: The County's efforts to enforce the current ordinance and abate violations have been ineffective. Although the current ordinance nominally provides enforcement and abatement mechanisms the language is vague, provides little concrete guidance, and is subject to much interpretation, to the point that it is almost unenforceable. It does not provide sufficient incentive for cannabis operations to comply with requirements, nor sufficient consequences for violations. Further, it appears that the County simply does not have the resources to monitor and enforce requirements once a permit is issued. If the County is going to allow expansion of cannabis operations that rely on permit conditions, monitoring and resident complaints to mitigate the impacts of these operations, the County must demonstrate both the will and resources for effective enforcement and abatement of violations and nuisances. If not, then for this reason alone, the County must not allow such operations anywhere near neighborhoods like Bennett Ridge.

EXCLUSION ZONE AREAS SHOULD BE SPECIFICALLY SET OUT IN THE NEW ORDINANCE.

Residential neighborhoods should be studied during the EIR process, and those areas designated as Exclusion Zones should be specifically noted in the new ordinance. Residents should not be required to have to submit applications and incur costs to have their neighborhoods so designated. Any County expenses should come from the cannabis tax revenue, not out of the pockets of residents.

Thank you in advance for your anticipated consideration.

Richard Rudnansky

Bennett Ridge Resident

-------- Original Message --------

Subject: Comment on Notice of Preparation of EIR re Cannabis / Scoping Meeting of March 8, 2023
Date: 2023-03-05 13:43
From: "Richard R. Rudnansky" <rrudnansky@sonic.net>
To: cannabis@sonoma-county.org, crystal.aker@sonoma-county.org
Cc: Susan Gorin <Susan.Gorin@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, Chris Coursey <Chris.Coursey@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, District4 <District4@sonoma-county.org>, Crystal Acker <crystal.acker@sonoma-county.org>

Crystal

Although it is inconceivable to me that the Board, with or without an EIR, would allow ***any type*** of commercial cannabis cultivation in the Bennett Ridge neighborhood (which is in a Rural Residential Zoning District and included in the Bennett Valley Area Plan), in an abundance of caution I am providing these comments.

As you are undoubtedly aware, the current Cannabis Ordinance restricts any type of commercial cultivation in the Rural Residential Zoning District (RR District) I urge that this prohibition continue and that it be made clear from the beginning of this process that the RR districts are off limits to ***any*** type of commercial cannabis cultivation.

Short of that, I ask that the following residential neighborhood be designated as an Exclusion Zone: **Bennett Ridge Neighborhood consisting of properties located on Old Bennett Ridge Road, Bardy Road, Rollo Road, and Bennett Ridge Road.**

Also, analyze neighborhood areas and designate all neighborhood areas as exclusion zones where any residential neighborhood meets any one of the following criteria:

(1) residential neighborhoods that relies on a mutual water system

(2) residential neighborhoods and areas in the Rural Residential Zoning District where any parcel is less than 10 acres

(3) neighborhoods and areas whose CC&Rs are inconsistent with or do not allow cannabis cultivation

(4) areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.

(5) areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought.

(6) areas that are in a high fire or very high severity zone designated by any competent authority such as the Board of Forestry, Sonoma County Community Wildfire Protection Plan, or the Public Utilities Commission.

(7) areas where commercial cannabis activity is detrimental to the residential character of a neighborhood.

(8) areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together.

(9) areas in traditional agriculture-zoned area’s that are now primarily residential in nature. • Areas where

the scenic vistas or character are to be preserved.

(10) areas where law enforcement is inadequate because average response times are more than 20 minutes.

(11) areas where there is strong local resistance to commercial cannabis activity.

(12) areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

For your information I have attached a petition from the Board of Directors of the Bennett Ridge Community Association that has previously been provided.

Thank you for your attention.

Richard R. Rudnansky

Bennett Ridge Resident

Subject	**No to Commercial Cannibis Cultivation on Bennett Ridge**
From	Kent Dellinger <kdell58@hotmail.com>
To	Susan.Gorin@sonoma-county.org <Susan.Gorin@sonoma-county.org>, David.rabbitt@sonoma-county.org <David.rabbitt@sonoma-county.org>, Chris.coursey@sonoma-county.org <Chris.coursey@sonoma-county.org>, district4@sonoma-county.org <district4@sonoma-county.org>, Lynda.hopkins@sonoma-county-org <Lynda.hopkins@sonoma-county-org>, marcie.woychik@sonoma-county.org <marcie.woychik@sonoma-county.org>, cannabis@sonoma-county.org <cannabis@sonoma-county.org>
Date	2021-10-07 14:44

The Bennett Ridge Community Association (BRCA) strongly opposes any action and legislation by the Board of Supervisors to allow any commercial cannabis cultivation in the Bennett Ridge neighborhood and adjacent properties in Bennett Valley.

The BRCA is a not-for profit organization that works to maintain the quality of life on Bennett Ridge. Bennett Ridge is a residential neighborhood consisting of 136 homes and properties on Old Bennett Ridge Road, Bardy Road, Rollo Road, and Bennett Ridge Road. Bennett Ridge is a true neighborhood in every sense of the word. We have residents of all ages including young children. Commercial Cannabis Cultivation simply is not appropriate in or compatible with our neighborhood and would have significant adverse impacts on resources and our quality of life for a number of reasons including, but not limited to:
(1) Visual and Aesthetics: the configuration, size and topography of lots results in homes being in close proximity to neighboring lots and other residences and therefore cannabis structures and any attendant lighting would be in violation of the Bennett Ridge Architectural Review Committee guidelines and would have significant visual and aesthetic impacts on residents.
(2) Water: our water is from a mutual water company with two wells for the entire neighborhood. Any non-residential use and pesticides would have a significant impact on the quantity and quality of our residential water supply
(3) Odor: given the configuration and the proximity of lots and homes if commercial cannabis cultivation with its odor was allowed in the Bennet Ridge neighborhood it would adversely impact the quality of our life and the enjoyment of our properties.
(4) Zoning, Area Plan, CC&Rs: would be contrary to the purpose of the Rural Residential zoning district, the Bennett Ridge CC&Rs and the Bennett Valley Area Plan of which the Ridge is a part. Further, the Bennett Ridge CC&Rs prohibit conducting any type of business in the neighborhood.
(5) Safety: Bennett Ridge (a) has only one narrow and winding road in and out (b) is in a high fire risk area (c) abuts Annadel State Park with hiking trails open to the public in close proximity to homes (d) has a Sheriff response time of over 30 minutes

We invite any member of the Board of Supervisors to visit the Bennett Ridge neighborhood to see for yourself how clearly incompatible commercial cannabis cultivation is with our neighborhood.

Therefore the BRCA, on behalf of the Bennett Ridge residents, strongly urge the Board of Supervisors prohibit commercial cannabis cultivation on Bennett Ridge either by prohibiting such activity in the Rural Residential Zoning Districts, placing an Exclusion Combining District on the Ridge, or by any other legislative mechanism.

We ask that you include these comments in the official record for this issue.

Respectfully Submitted:
Bennett Ridge Community Association
Board members:
Les De La Briandais
Kent Dellinger
Marilee Jensen
George Mangan

Kathie Schmid
David Southwick, M.D.
George von Haunalter

From:	Arthur Dawson
To:	crystal.aker@sonoma-county.org; Cannabis
Cc:	"Meg"; "Teri Shore"; Tracy Salcedo; Helen Bates; craigspencerharrison@gmail.com
Subject:	Cannabis EIR Scoping Letter
Date:	Wednesday, March 22, 2023 3:53:21 PM
Attachments:	Sonoma Mountain Preservation Cannabis EIR Scoping.pdf

Dear Crystal,

Attached is our Scoping letter in response to the county's 'Notice of Preparation for the Comprehensive Cannabis Program Update Environmental Impact Report (EIR)'
Our basic request is that the EIR include a thorough study of designating Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited.

Thank you,

Arthur Dawson

Chair
Sonoma Mountain Preservation
(707) 996-9967
Sonomamountain.org

Sonoma Mountain Preservation
P.O. Box 1772
Glen Ellen, CA 95442

March 22, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org)
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance—<u>Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited</u>**

Dear Crystal Aker,

On the behalf of the Sonoma Mountain Preservation (SMP) Board and our many supporters around the mountain, I would like to express our support for the Bennett Valley Community Association's (BVCA) request that Bennett Valley be considered for designation as an exclusion zone for commercial cannabis operations, as expressed in their March 13, 2023 letter. That letter was written in response to the Notice of Preparation for the Comprehensive Cannabis Program Update Environmental Impact Report (EIR).

As advocates for open space and preservation of the mountain since 1993, SMP is deeply concerned with the many development pressures currently on and around the mountain. Commercial cannabis operations are not compatible with Bennett Valley's rural character, a value highlighted in the Bennett Valley Area Plan approved by the Sonoma County Board of Supervisors in 1979 and affirmed and updated several times, most recently in 2011.

We are especially concerned with potential impacts to sensitive biotic and other natural resources in the Matanzas Creek Riparian Zone, including its role as a wildlife corridor connecting critical protected habitats and public land in Jack London and Annadel State Parks, North Sonoma Mountain and Taylor Mountain Regional Parks, as well as conservation properties and easements stewarded by the Sonoma Land Trust.

We join with the BVCA in urging the County to study the many unique environmental conditions and qualities in Bennett Valley as part of the EIR with a specific assessment of its requested exclusion zone status.

Sincerely,

Arthur Dawson

Arthur Dawson
Chair, Sonoma Mountain Preservation
501(C)(3) EIN 68-0428234

From:	Arthur Dawson
To:	Crystal Acker
Subject:	Cannabis EIR Scoping Letter
Date:	Wednesday, March 22, 2023 6:13:45 PM
Attachments:	Sonoma Mountain Preservation Cannabis EIR Scoping.pdf

EXTERNAL

Dear Crystal,

Attached is our Scoping letter in response to the county's 'Notice of Preparation for the Comprehensive Cannabis Program Update Environmental Impact Report (EIR)'
Our basic request is that the EIR include a thorough study of designating Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited.

Thank you,

Arthur Dawson

Chair
Sonoma Mountain Preservation
(707) 996-9967
Sonomamountain.org

Sonoma Mountain Preservation
P.O. Box 1772
Glen Ellen, CA 95442

March 22, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org)
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance—Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited**

Dear Crystal Aker,

On the behalf of the Sonoma Mountain Preservation (SMP) Board and our many supporters around the mountain, I would like to express our support for the Bennett Valley Community Association's (BVCA) request that Bennett Valley be considered for designation as an exclusion zone for commercial cannabis operations, as expressed in their March 13, 2023 letter. That letter was written in response to the Notice of Preparation for the Comprehensive Cannabis Program Update Environmental Impact Report (EIR).

As advocates for open space and preservation of the mountain since 1993, SMP is deeply concerned with the many development pressures currently on and around the mountain. Commercial cannabis operations are not compatible with Bennett Valley's rural character, a value highlighted in the Bennett Valley Area Plan approved by the Sonoma County Board of Supervisors in 1979 and affirmed and updated several times, most recently in 2011.

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We join with the BVCA in urging the County to study the many unique environmental conditions and qualities in Bennett Valley as part of the EIR with a specific assessment of its requested exclusion zone status.

Sincerely,

Arthur Dawson

Arthur Dawson
Chair, Sonoma Mountain Preservation
501(C)(3) EIN 68-0428234

From:	Bill Krawetz
To:	Cannabis; Crystal Acker
Subject:	NOP of EIR Cannabis / Scoping Comments Calif Water Board concerns
Date:	Wednesday, March 22, 2023 11:19:25 AM
Attachments:	CalifWaterQualityBoard Mar18 2021.pdf

EXTERNAL

Dear Crystal Acker, Cannabis Sonoma County

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update. The comments focus on **issues raised by the North Coast Regional Water Quality Control Board,** letter dated March 18, 2021, copy attached.

Specifically the Water Board raised issues that must be studied and addressed in the EIR process and in the final ordinance:

1) Expanded Ministerial Permitting – Concerns raised of permitting without extensive site-specific reviews. These experts point out that Best Management Practices(BMPs) are at a minimum required for ministerial permitting. This includes incorporation of the most protective BMPs from both the County Ordinance, the Water Board Cannabis Policy, and Other General Order. It would make sense to apply common sense rules, that if permits are to be issued with little or no review, the standards and restrictions must be tighter than those allowed under the normal "use permit" process which actually analyzes all areas and risks.

2) Local and State Permitting Sequencing – See specific concerns raised in their letter. These haven't been resolved. Further this should be expanded to encompass the required permitting process at the state DDC level. As Sonoma County has experienced, many growers operate without both local and state approvals. This should not occurring going forward: All approvals and permits should be received before an operation can begin.

3) Required Site Plans and Reports – See specific concerns raised in their letter. These haven't been resolved or gone away.

4) Discharges to Septic Systems - See specific concerns raised in their letter. The General Term law does not allow for such discharges of industrial wastewater. And as the letter states the Regional Water Board is unlikely to issue such permits. This would indicate many areas might be off-limits

Thanks Bill Krawetz

North Coast Regional Water Quality Control Board

March 18, 2021

Sonoma County Planning Commission
c/o McCall Miller
County Administrator's Office
575 Administration Drive, Suite 104A
Santa Rosa, CA 95403
cannabis@sonoma-county.org

(transmitted via email only)

Re: NORTH COAST REGIONAL WATER QUALITY CONTROL BOARD COMMENTS ON SONOMA COUNTY'S PROPOSED CANNABIS LAND USE ORDINANCE UPDATE, GENERAL PLAN AMENDMENT, AND ASSOCIATED SUBSEQUENT MITIGATED NEGATIVE DECLARATION, SCH NO. 2021020259

Dear McCall Miller:

The North Coast Regional Water Quality Control Board (Regional Water Board) Cannabis Waste Discharge Regulatory Program (Cannabis Program) received the subject documents and is grateful for the opportunity to provide comment. The Regional Water Board understands Sonoma County's (County's) efforts to allow expanded ministerial permitting for commercial cannabis cultivation in agricultural and resource zoned areas. However, the Regional Water Board has concerns regarding how the County's proposed permitting process and requirements may overlap and/or conflict with the State Water Resources Control Board's (State Water Board's) *Cannabis Cultivation Policy Principles and Guidelines for Cannabis Cultivation* (Cannabis Policy) and *General Waste Discharge Requirements and Waiver of Waste Discharge Requirements for Discharges of Waste Associated with Cannabis Cultivation Activities* (Cannabis General Order).[1] To this end, the following comments are provided with the aim of furthering the County's efforts, providing additional information concerning the Cannabis Policy and General Order, and for the purpose of obtaining additional clarity with respect to certain water resource protection issues.

[1] The Cannabis Policy and General Order are available at: https://www.waterboards.ca.gov/water_issues/programs/cannabis/

I. Expanded Ministerial Permitting

The proposed amendments have the potential to authorize cannabis cultivation without extensive site-specific review of proposed cannabis cultivation operations. Currently, the County issues permits on project-by-project basis, that while not a streamlined process, does allow for an exhaustive environmental review process. The proposed switch from a project-specific discretionary review and approval process to a ministerial process places increased importance on the successful implementation of Best Management Practices (BMPs) by cannabis cultivators.

The Regional Water Board's review of the County's proposed revisions to its Cannabis Ordinance reveals that in some cases the BMPs required by the County are less stringent than those required by the Regional and State Water Boards (Water Boards), and vice versa. For instance, the Water Boards' riparian setback provisions for cannabis cultivation activities are much more stringent than the County's. On the other hand, the County's steep slope provisions and restrictions on the use of trucked water for irrigation are generally more stringent than the Water Boards'. In these and other such instances, it is important that the permitting outcomes from the County's ministerial process incorporate the most protective BMPs from both the County's Cannabis Ordinance and the Water Boards' Cannabis Policy and General Order. This will prevent potential threats to water quality and the beneficial uses from going unaddressed.

II. Local and State Permitting Sequencing

Similar to the County, the Water Boards require that cannabis cultivators obtain coverage under the Cannabis General Order prior to commencing any cultivation activities. The term "cannabis cultivation" is defined by the Water Boards as "[a]ny activity involving or necessary for the planting, growing, pruning, harvesting, drying, curing, or trimming of cannabis. This term includes, but is not limited to: (1) water diversions for cannabis cultivation, and (2) activities that prepare or develop a cannabis cultivation site or otherwise support cannabis cultivation and which discharge or threaten to discharge waste to waters of the state." (Cannabis Policy, Attachment A, Definition 9). The County's trigger for requiring a cultivation permit under its proposed Cannabis Ordinance is similar, but not identical. Based on past experience, the Regional Water Board understands that site-specific circumstances may at times call for alternating sequencing of the Water Boards' enrollment process and the County's permitting process.

With that in mind, the Regional Water Board seeks clarification concerning the County's requirement that cultivators must provide copies of all other agency/department permits, licenses, or certificates to the Agricultural Commissioner to serve as verification of compliance with local, state, and federal law. (Sec. 38.02.040, subd. (C).) As written, it is unclear whether the County's process requires cultivators to enroll in other agency/department permits as a condition precedent to obtaining a County permit or upon the issuance of a County permit to cultivate. For example, must a cultivator provide proof of enrollment in the Cannabis General Order via a Notice of Applicability from the Regional Water Board as a condition precedent to applying for a County permit or merely demonstrate enrollment at the time the County issues a permit? This clarification will help highlight for applicants the importance of timely applying for and obtaining all necessary permits from the County, the Water Boards, and any other agencies with relevant authorities. Therefore, the Regional Water Board recommends that as part of the Permit Application Preparation and Filing process (Sec. 38.06.030, subds. (A-D)), the County encourage concurrent enrollment with any requisite Water Boards permit(s), and those of any other State agency as appropriate.

The Regional Water Board recommends this process for two reasons. First, if the County requires enrollment in the Cannabis General Order prior to issuance of a County permit there is potential to create administrative complications.[2] Second, there is the potential that the technical plans and reports required under the Cannabis General Order may overlap with the plans, specifications, maps, reports, assessments, and other information required under the County's permitting process, and thus opportunities for developing plans that satisfy multiple agencies' requirements should be highlighted for permit applicants. This is discussed in greater detail in the next section.

III. Required Site Plans and Reports

Enrollees in the Cannabis General Order are required to submit various technical and planning reports[3] to the Regional Water Board. Many of the necessary components of the required technical plans and reports are similar to those listed in the County's Standards for Commercial Cannabis Cultivation (Art. 12). For instance, Site Management Plans (SMPs) required under the Cannabis General Order address compliance with riparian setback restrictions, site grading and drainage requirements, erosion and sediment control, construction and maintenance of roads and stream crossings, waste and wastewater management, and water storage and use. Due to the similar nature of the technical plans and reports required under the Water Boards' and County's enrollment and permitting processes for cannabis cultivation, the Regional Water Board asks that the County acknowledge the overlap between multiple agencies' planning and reporting requirements (including those imposed by state agencies other than the Water Boards), and encourage permit applicants to proceed with plan and report preparation with the broad scope of applicable agency requirements and approval authorities in mind.

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[2] For example: If a cannabis cultivator enrolls in the Cannabis General Order prior to issuance of a County permit and the County ultimately rejects the application, the Regional Water Board's self-certification enrollment process does not allow for a refund to the cultivator for the enrollment fee, which can range between $600 and $8,000.

[3] Site Management Plan (for all sites), Site Erosion and Sediment Control Plan (Medium Risk sites), Distributed Area Stabilization Plan (High Risk sites), Nitrogen Management Plan (Tier 2 sites), and Site Closure Plan (all sites).

IV. Discharges to Septic Systems

The Cannabis General Order implements general and specific requirements for cannabis cultivation activities, as listed in Attachment A of the Cannabis Policy. General Term 27 of Attachment A prohibits the discharge of industrial wastewater (e.g. excess irrigation water, effluent, process water, or graywater) to an onsite wastewater treatment system (e.g. septic tank), to surface water, or to land (e.g. via irrigation or bio-retention treatment systems) without a separate individual or general permit from the Water Boards. Separate waste discharge requirements (i.e. an individual or general permit) or waiver thereof can be sought for the discharge of cannabis wastewater into a septic system or to land. However, it is unlikely the Regional Water Board would issue such a permit. Since the adoption of the original Cannabis Policy and General Order in 2017, the Regional Water Board has yet to approve a request for such a permit. Additionally, the Water Boards consider excess irrigation water, effluent, and process water from commercial cannabis cultivation to be industrial process waters, which are prohibited to be discharged to onsite wastewater treatment systems (OWTS) by the Water Boards OWTS Policy. As such, the Regional Water Board requests the County revise the requirements of the wastewater management plan (Sec. 38.12.130) to acknowledge that the discharge of cannabis cultivation wastewater to septic (or similar) systems is generally prohibited unless an appropriate waste discharge permit is sought from the Regional Water Board.

Lastly, the Regional Water Board supports the analysis and all concerns expressed by the California Department of Fish and Wildlife, Bay Delta Region's public comment on the subject documents, dated March 17, 2021. In particular, the Regional Water Board wishes to highlight the issues raised and recommendations made in Comment 5. All cannabis cultivation sites should be evaluated for potential wetland features and the most protective standards applied for wetland setback requirements. Notably, the Regional Water Board has regulatory authority over work conducted in or near streams and wetlands, and any such work requires separate coverage under a Water Quality Certification and/or waste discharge requirements from the Regional Board.

The Regional Water Board appreciates this opportunity to comment on the County's efforts to streamline its cannabis cultivation permitting process and hopes these comments will help align and create consistency across the Water Boards and County's permitting procedures. If you have any questions or concerns, please contact me at David.Kuszmar@waterboards.ca.gov.

Sincerely,

Digitally signed by David Kuszmar
Date: 2021.03.18 11:46:31 -07'00'

Water Boards

David Kuszmar, PE #C65460
Senior Water Resource Control Engineer
Southern Cannabis Regulatory Unit

210318_NCRWQCB_Comments_on_SoCo_Cannabis_Ordinance_FINAL

Cc: **California Department of Fish and Wildlife**
Gregg Erickson, Gregg.Erickson@wildlife.ca.gov
Mia Bianchi, Mia.Bianchi@wildlife.ca.gov
Wes Stokes, Wesley.Stokes@wildlife.ca.gov

State Water Resources Control Board
Kevin Porzio, Kevin.Porzio@waterboards.ca.gov
Dan Schultz, Daniel.Schultz@waterboards.ca.gov
Dylan Seidner, Dylan.Seidner@waterboards.ca.gov

North Coast Regional Water Quality Control Board
Kason Grady, Kason.grady@waterboards.ca.gov

California Department of Food and Agriculture
Michael Vella, michael.vella@cdfa.ca.gov
Lindsay Rains, lindsay.rains@cdfa.ca.gov

From: Bill Krawetz
To: Cannabis; Crystal Acker
Subject: NOP of EIR Cannabis / Scoping Comments for canna-tourism/onsite visits
Date: Wednesday, March 22, 2023 1:35:49 PM

EXTERNAL

Dear Crystal Acker, Cannabis Sonoma County

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update. The comments focus on **Cannabis industry desire for onsite visits, canna-tourism, etc**.

Having listened to the recording of the March 8th scoping meeting where comments heard, a common request from the industry was for activities onto the growers cultivation site, include their argument that cannabis should be treated like Ag crops. In this regard please study the risks of allowing such. A few of which are:

1. The risk profile, specifically crime. The value of pot is nothing like any ag product. The County crop report highlighted cannabis bring in $2-3m acre verse $30K for grapes. There has been a rash of robbery's at pot dispensaries. During the recent tax discussion one grower said he was robbed and couldn't pay his taxes. When's the last time a winery or an apple vendor at a farmer market has been robbed at gun point? Most dispensaries have a guard on site, wouldn't a grower site that allowed the public onsite need the same?

    a. Insurance risk- Analyze if insurance company's would cover such risk and if so at what price. Would a grower have to put up an bond. The protection is not just for the cannabis owner, but their employee's, the public that visits, and neighbors nearby

2. State law does not allow many types of onsite visits including Canna-tourism. How would the County circumvent such rules?

3. Risk of intoxicated drivers. With the newer higher THC strains, the impartment from pot is likely much higher than wine. Study this risk to the health and welfare of the community.

4. Health risks - Beta-Myrcene is an abundant terpene in cannabis. B-Myrcene is a carcinogen and is listed as such under Prop 65. Study the health risks associated with the public visiting a cultivation site.

Thanks Bill Krawetz

From: john dean
To: Cannabis
Subject: Comments on Notice of Preparation of Cannabis EIR
Date: Wednesday, March 22, 2023 10:08:41 AM
Attachments: canabus 2.pdf

Please find attached EIR comments letter.

A copy of this was also sent directly to Crystal.Acker@sonoma-county.org

John P Dean
1722 Barlow Lane
Sebastopol CA 95472
360 481 2686
johnpdean@gmail.com

March 20, 2023

Crystal Acker, Supervising Planner
crystal.acker@sonoma-county.org
VIA EMAIL

Re: Sanoma County Comprehensive Cannabis Program Update
Comments on Notice of Preparation

Greetings to persons in charge of Sonoma County Cannabis EIR:

Please include these comments detailing significant effects on the environment by the commercial cultivation of cannabis in the Cannabis Environmental Impact Report being prepared.

An article in The BULWARK, an American Conservative News and Opinion Website, entitled California's Billion-Dollar Weed Boondoggle by A.L Bardach, February 23, 2023, on the World Wide Web at California's Billion-Dollar Weed Boondoggle well documents the environmental problems currently experienced by the County of Santa Barbara in their legal cannabis cultivation program. That article points out real life significant environmental effects of cannabis cultivation in Santa Barbara County which county is similar to Sonoma County so that the same effects are equally applicable to Sonoma County.

The negative impacts of cannabis cultivation set forth in the article include:

Noxious odor affects workers and nearby residents. Noxious odor is a major environmental impact of cannabis cultivation. The odious odor from the blooming plants makes surrounding areas uninhabitable by making people sick or feeling miserable from the odor. It must be kept in mind that the odor is not always immediately unpleasant but when you must live next to a cannabis operation the odor is constant and the annoyance grows with each hour and each day during the blooming season. There is no relief except temporarily to go inside, shut all doors and windows and turn on the air conditioning or other filtering device wasting electricity. This only provides temporary relief and you and your family must eventually go outside and then you cannot enjoy your yard, BBQ area, porch or other nice area to relax and enjoy life. Your life is taken over by the cannabis operation. These are very real and significant negative environmental effects.

You are denied the quiet use and enjoyment of your property which is a time honored right of property ownership. This reduces property values by causing people to sell out and move away further causing others to move into the affected property and suffering the noxious odor. These changes of ownership cause a downward spiral of a good neighborhood into blight. This reduces property taxes which reduces governmental income which affects local government ability to deal with other environmental problems all causing a significant environmental effect. This displacement of people further causes emotional distress of people affected. The new people in turn feel they either need to move out or suffer from the noxious odor both wrenching options. A further environmental effect of noxious odor is such makes people irritated. Irritated people make poor decisions concerning self-help which can cause improper action to stop the odor resulting in police involvement. It also causes complaint calls to the sheriff or Air Pollution Control District which consumes these agencies valuable resources and diverts them from other activities. All of these are significant adverse environmental effect of cannabis cultivation which must be mitigated when cannabis cultivation is close to places where people reside.

The only meaningful mitigation to noxious odor is to scientifically establish the distance the odor travels and establish safe set-back requirements between grow operations and nearby residents and public and private facilities. A preliminary determination can be made by anyone with a normal sense of smell who can detect the odor and notes the distance that odor continues to be noticeable. This then needs to be scientifically verified. The distance over which the odor can be detected is the distance neighboring houses should be from cannabis cultivation sites to achieve mitigation of the environmental effect of odor. It must be kept in mind that the detection of any cannabis odor is an environmental effect because the odor is constant and does not decrease over time. This is unlike most other agricultural odors such as the smell of sulfur or spread manure which dissipate over time. The similar agricultural noxious odors that remain constant are cattle and swine feed lots which are known to be very annoying. Even a slight odor which is constant over time grows increasing obnoxious to people forced to live nearby.

It should be noted that the current Sonoma County practice of allowing cannabis cultivation on any 10-acre or larger parcel without regard to surrounding property lot size, number of neighboring residents and distance from the grow site imposes the maximum negative environmental effect on surrounding residents. This is especially true when permits are issued ministerially without further review of the adverse environmental effects. If the 10 acre minimum is maintained, in order to mitigate the adverse environmental effect of odor, each 10 acre or larger parcel must be analyzed for how many people live nearby, how close they live to the grow site, the surrounding size and use of parcels. Especially when an entire neighborhood is affected, cannabis cultivation should not be allowed. Once this analysis is done and mapped for each 10 acre or larger parcel, permits for cannabis grow sites can be issued ministerially without adverse environmental effect.

Further environmental effects of cannabis cultivation set out in the County of Santa Barbara article include:

Grow shelters cover farm land and cause visual pollution making marijuana cultivation more industrial than agricultural in nature causing the same adverse environmental impact on farming as any industrial use of property;

Regulations of marijuana cultivation are very difficult to enforce so that attempted mitigation of adverse environmental effects are unlikely to be successful;

Local legal marijuana cultivation is not currently and may never be financially viable so that abandoned cultivation sites may litter the landscape and bankrupt growers will petition the government for relief such as conversion to dense residential use of property negatively impacting existing agricultural uses of property;

Sonoma County is unlikely to receive meaningful tax receipts so that enforcement expenses will exceed revenue cost negatively impacting the county budget;

Marijuana cultivation negatively affects local agriculture, the tourist industry and the wine industry by emission of noxious odor, farmland coverage by unsightly grow structures, diversion of agricultural workers and use of scarce resources which will reduce local governmental services;

Marijuana cultivation is a health hazard to workers causing increased health care costs and impact on local health services;

Large-scale commercial marijuana cultivation puts small growers out of business causing increased local poverty and displacement of local farmers;

The marijuana industry may be exerting undue political influence on elected public officials causing corruption and its negative effects;

Marijuana cultivation negatively impacts scarce water resources and increases fire danger interfering with existing farming operations and causing displacement resulting from fires.

An additional significant environment effect of cannabis cultivation in Sonoma County not covered in the Santa Barbara article (probably because of the benign Santa Barbara climate) is that the climate of Sonoma County is not suitable for Cannabis cultivation. GOOGLE 'climate for growing cannabis' reveals that the ideal temperature for growing cannabis is 65-80 degrees. Sonoma County is noted for its cool to cold nights and hot days during much of the year and just cold in the winter. This climate is perfect for grapes and apples but poor for Cannabis. These temperature extremes necessitate heated and cooled grow houses for productive cannabis cultivation in Sonoma County with resulting huge amounts of energy expended and greenhouse gas emitted on cannabis cultivation both which are significant adverse environmental effects. The only meaningful mitigation is to require grow houses to construct and utilize solar heat methods but this raises costs to make the whole venture unprofitable compared to locations having a more suitable climate.

Finally, the local consumption of cannabis has adverse environmental effects on our community. These includes, impaired driving, gateway to addiction, difficulty in dealing with and understanding people under the influence of cannabis and the health hazards to the lungs and possibly brain and social and mental harm to the youth. This is not to imply that marijuana should again be criminalized with it many problems. However, the degree to which cultivation of cannabis in Sonoma County increases local use of cannabis is an adverse environmental effect which must be studied with mitigation imposed.

In conclusion cultivation of cannabis in Sonoma County raises many environmental problems which at best can be only partially mitigated. The no project option as mitigation should not be forgotten as perhaps the best environmental solution.

Thank you for your consideration

John P Dean

John P Dean

From: Moira Jacobs
To: Crystal Acker; Cannabis
Cc: Susan Gorin; Lynda Hopkins; David Rabbitt; district3; district4
Subject: 03202023 Grange Excl Zone letter
Date: Wednesday, March 22, 2023 9:02:21 AM
Attachments: 03202023 Grange Excl Zone letter.pdf

EXTERNAL

Good morning Crystal,

Please see attached letter regarding Re: Scoping for Cannabis Ordinance—Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited.

The letter refers to multiple attachments which I'll provide in a separate email. Most of the referenced attachments you already have as they were sent to your department recently.

Thank you,
Moira Jacobs
President
Bennett Valley Grange #16

BENNETT VALLEY GRANGE #16
Santa Rosa, CA
Est. 1873

Proudly home to the oldest Grange Hall in the United States

4145 Grange Road, Santa Rosa, CA. 95404

March 17, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org) cannabis@sonoma-county.org

Re: Scoping for Cannabis Ordinance—
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited

Dear Crystal Acker,

The Bennett Valley Grange, founded in 1873 and serving our community as a California 501 (c) nonprofit corporation, is also a member of the larger National Grange network of over 2000 Granges nationwide. The National Grange organization is a non-partisan, fraternal organization that advocates for rural America and agriculture. The Grange has a strong history of grassroots activism, family values and community service.

The membership of the Bennett Valley Grange was made aware of the upcoming Scoping for Cannabis Ordinance and the letter which the Bennett Valley Community Association (BVCA) provided in support of an Exclusion Zone Designation for Bennett Valley, an exclusion zone where commercial cannabis operations would be prohibited.

<u>Our membership recently voted unanimously to support making Bennett Valley an exclusion zone from commercial cannabis operations and we are completely supportive of the attached BVCA letter and all of its requests, recommendations and supporting materials.</u> The Bennett Valley Grange and the BVCA have been very closely aligned partners since 1971, the founding of the BVCA. We both serve our same community with complimentary missions and are tightly aligned on this issue. The Bennett Valley Grange membership cares deeply about our environment, the safety and well being of the families and children of Bennett Valley, and promotes sustainable agriculture which provides nutrition to our citizenry. Moreover, as an agricultural community we care deeply about our water resources, safety from wildfires, safe roads, and protection of our agricultural lands from misuse or environmentally unsound exploitation.

Therefore, we urge the County to pay close attention to the Bennett Valley Area Plan and all of the recommendations in the BVCA letter attached as you proceed with your scoping project. Moreover, we provide additional requests for significant environmental and worker safety issues that require in-depth research and analysis throughout the County EIR process, provided below.

To be clear, this letter only represents the Bennett Valley Grange's membership, this does not represent any other Grange's views in this County, nor in the rest of California. It is worth noting that in the previous national meeting of Granges from across the United States, resolutions presented to promote cannabis production as a core Grange initiative were rejected. Most members of Granges across America do not support the concept of treating cannabis production the same as traditional Ag which delivers food, providing wholesome nutrition. The policy imperatives and consequences are very different between drug production and food based agriculture and must be carefully addressed.

Here is a list of issues we urge be researched and analyzed as part of this EIR process:

1) **Worker safety and cannabis production:** It is critical to study the impacts of commercial cannabis production on worker safety and health. THC is included on State of CA Prop 65 list of known carcinogens and there has not been

enough research yet on the cannabis cultivation/production process impacts on human health, especially when daily contact with the high potency THC cannabis of today occurs. Furthermore, the entire production process should be carefully studied for how it impacts human health and environmental health. This includes how cannabis plants and the production process may impact any area wildlife, the soil, the water resources, including groundwater aquifers, the surrounding air quality, bee colonies, and native flora.

As to worker safety, please research and analyze all below, taken from the highly respected Health and Safety Magazine, links included.

2) **Impacts, Incompatibilities and Conflicts between Traditional Ag and Cannabis production:** Research and analyze the impacts and conflicts between cannabis production operations and their highly sensitive requirements versus all other potential traditional Ag on neighboring parcels. Please reference the attached letter from the Yolo County Farm Bureau (YCFB) to the Supervisors there and these same issues should be researched and analyzed for Sonoma County, especially in regards to grape growers and cannabis operations. As the YCFB members point out, the process for their ordinance was also perceived to be overwhelmingly led and strongly influenced by cannabis producers early on, not taking into account a myriad of environmental issues between vineyards, livestock ranches, poultry, dairy, and outdoor cannabis productions. This same complication exists in Sonoma County and must be carefully addressed.

3) **Setbacks:** The initial recommended setbacks of at least 1,000 feet from any rural residence, and concentrations of RR neighborhoods, must be thoroughly researched and analyzed. As the attached YCFB letters demonstrate with on the ground witnesses, setbacks are needed to protect both residences and traditional agriculture from cannabis operations.

4) **Commercial Activity:** Further research and analyze the fact that cannabis production is excluded from the definition of agriculture, not considered traditional agriculture and is defined as "commercial activity" by the State of California. Cannabis production activity is fundamentally a drug production operation as the end product being marketed to the general public is predominantly a drug, with THC the main active ingredient, widely recognized as a narcotic by definition and still on the Federal Schedule 1 for controlled substances. Due to the current ambiguities of conflicting State of CA and Federal drug and health policies, Cannabis, THC, and all its Cannabinoids are still widely unregulated and vastly unverified scientifically regarding human health and worker safety. THC, which has no nutritional value, remains widely unstudied and unscientifically promoted to the general public. The entire outdoor cannabis production process, all of its inputs and outputs, and every related activity must be researched and analyzed to better understand where this commercial activity is best sited (commercial zones? indoor in more concentrated industrial Ag areas, away from residential neighborhoods). The fact that the BVAP calls out "commercial activity" is not conducive to the preservation of the rural residential character, including view shed protected status, of Bennett Valley.

5) Safety: Research and analyze exact response time for Sheriff to reach all points in rural Bennett Valley and current and planned resources assigned to Bennett Valley. These resources were never researched or analyzed before multiple cannabis operations were placed next to various rural residential neighborhoods in Bennett Valley, with no prior notice, no opportunity for feedback nor questions given to the community. There have been many incidents reported and unreported to the Sheriff regarding thefts, trespassing, loose deadly attack dogs, gunfire and threatening use of firearms from neighboring cannabis operations.

The County and State of CA appear to be negligent in enabling the vast cannabis production and marketing apparatus to operate with little regulation while neglecting any comprehensive research which by any scientific standards is much needed. The Bennett Valley Grange hopes the County views this EIR exercise as an opportunity for a policy course correction.

Sincerely,

Moira Jacobs
President
Bennett Valley Grange #16
Santa Rosa, CA 95404

Email: bennettvalleygrange@gmail.com

Data on Worker Health and Safety - requires further research and analysis within this scoping exercise:

Reference: https://www.safetyandhealthmagazine.com/articles/21427-workplace-exposures-in-the-cannabis-industry June 29, 2021

In the cultivation phase, the main hazards are pesticides, carbon dioxide and cleaning compounds. In addition, mold, yeast and fungi are serious health threats during cultivation and extraction/trimming. These chemical hazards can cause allergic reactions, coughing, wheezing and nasal congestion, as well as throat, eye and skin irritation. A certified industrial hygienist can monitor air quality to determine spore levels. Individuals with preexisting respiratory conditions may be more susceptible to reactions to mold.

Marijuana industry workers are also exposed to chemical hazards not only in the production process, but as part of housekeeping procedures. Some of the hazards include:

Carbon dioxide. At high concentrations, carbon dioxide acts as a simple asphyxiant. Workers exposed to high levels can also suffer burns.
Carbon monoxide. Exposure can result in carbon monoxide poisoning.
Pesticides. Marijuana cultivation facilities often use insecticides and fungicides. The EPA Federal Insecticide, **Fungicide, and Rodenticide** Act provides standards and guidance for the safe handling, storage and application of pesticides to avoid pesticide poisoning, which has multiple health effects, including cancer.
Volatile organic compounds. These can cause eye, nose and throat irritation; headaches; vomiting; dizziness; and worsening asthma symptoms. Long-term exposure can cause additional health effects, including kidney and liver impacts, respiratory impacts, and cancers.
Nutrients and corrosive materials. In the cannabis industry, the practice of mixing nutrients during the cultivation stage to improve the quality of the plant is increasing. However, the raw materials used to formulate nutrients may cause acute and chronic health effects. The most common corrosives include hydrochloric acid, phosphoric acid, sulfuric acid, ammonium hydroxide, potassium hydroxide and sodium hydroxide.
Cleaning products. Chemical products used for cleaning indoor environments and surfaces can cause respiratory or skin irritation, burns, irritation of eyes, and asthma. Improper mixing of chemicals can cause severe lung damage.
Butane. Extracting using butane is cost effective, but it also presents higher hazardous risks. Open releases of butane to the atmosphere during extractions is prohibited by OSHA, EPA and fire departments.

From: pod.boxlike.06@icloud.com
To: Cannabis
Subject: Fwd: NOP of Cannabis Program Update of EIR
Date: Wednesday, March 22, 2023 1:57:15 PM
Attachments: Cannabis EIR NOA response re firearms.pdf

EXTERNAL

Please submit the attached for inclusion in the Sonoma County Comprehensive Cannabis Program Update Comment on Notice of Preparation of EIR.

Thank you!

March 15, 2023

Crystal Acker, Supervising Planner
crystal.acker@sonoma-county.org
cannabis@sonoma-county.org

Via email

Re: Sonoma County Comprehensive Cannabis Program Update
Comment on Notice of Preparation of EIR

To whom it concerns:

I am in receipt of the Notice of Preparation (NOP) for the Sonoma County Comprehensive Cannabis Program Update.

Projects resulting in fencing, 24-hour security, security lighting, weapons and firearms being discharged are by definition changing their surrounding environment and thus triggering project-specific CEQA requirements.

Cannabis cultivation involves a valuable crop that criminals may try to steal. It is an easily fencible product with a sizable and ready-made market for both the illegal and legal markets. The all-cash transactions are large. All this makes for a perfect storm for criminal activity including house robberies, hostage taking, violence, shoot-outs and murder – all within Sonoma County. It is because of this that Sonoma County's current cannabis ordinance states; "Weapons and firearms at the cultivation site are prohibited."

This results in cannabis growers arming themselves for self-protection which in term causes fear by neighbors both by the criminals mistaking the neighbors for the grower and by the grower being careless with the weapons. This fear is an environmental effect as it causes stress in surrounding neighborhoods and wildlife in excess of a mile away that result in calls of concern to the sheriff and posts on NextDoor. This environmental effect is aggravated when casual shooting occurs on a grow site such as target shooting because neighbors don't know if such shooting is related to a theft. Accordingly, the EIR should develop adequate mitigation to reduce guns and shooting on cannabis grow sites. These should include ban on weapons on grow sites as the existing Sonoma County Cannabis regulation does but also extending such no-weapon area to the whole parcel containing the permitted grow site.

Analyze and Mitigate the Following:

Study how the weapons and firearms prohibition is being administered and enforced. Currently, Sonoma County Agricultural Commissioner is defining "site" as only the permitted grow square feet. As example, a 10+ acre site may have up to one acre of permitted cannabis grow. Sonoma County's Agriculture Commissioner states weapons and firearms are only prohibited from that one acre grow leaving the remaining 9+ acres of the site available for weapons, firearms and/or a rifle range.

Analyze security issues for areas near cultivation sites, including the factors that Yolo County used in its cannabis ordinance. Analyze potential impacts due to similarity with hemp.

Impacts on Lead Contamination:

Analyze the impact to the soil, ground water and surface water of uncollected led bullets that are decaying in or on the soil. The analysis should include California Department of Fish and Wildlife studies.

Wildfire and Hazardous Land Use risk:

Study the impacts of weapons and firearms at the cannabis cultivation site and their potential for becoming hazardous. According to California code, "A land use that presents a significantly elevated potential for the ignition, prolonged duration, or increased intensity of a Wildfire due to the presence of flammable materials, liquids, or gasses, or other features that initiate or sustain combustion. Such uses are determined by the Local Jurisdiction and may include, but are not limited to, power-generation and distribution facilities; wood processing or storage sites; flammable gas or liquids processing or storage sites; or **shooting ranges**."

Analyze increased wildfire risk from cannabis operations where weapons, firearms and/or rifle ranges are stored, used and or discharged.

Health and Safety:

Commercial cannabis activity shall not create a public nuisance or adversely affect the health or safety of the nearby residents.

Make project determinations based on the Mandatory Findings of Significance, which protects adjacent property owner's rights to health, safety and the peaceful enjoyment of their properties.

Analyze the noise from weapons, firearms and rifle ranges and the impact on neighborhoods and the surrounding wildlife.

Analyze prohibiting all weapons, firearms and or rifle ranges on all parcels where cannabis cultivation is permitted.

From: Sara L. Breckenridge
To: Crystal Acker; Cannabis; BOS; Scott Orr; Tennis Wick
Cc: Carmen J. Borg; Joseph D. Petta
Subject: Notice of Preparation of a Draft Environmental Impact Report - Sonoma County Comprehensive Cannabis Program Update
Date: Wednesday, March 22, 2023 11:55:36 AM
Attachments: SOSN-NLV NOP Comments 3-22-23.pdf

EXTERNAL

Ms. Acker,

Please find attached a letter from Joseph Petta, on behalf of Save Our Sonoma Neighborhoods and Neighbors of Liberty Valley, LLC, regarding comments on the Notice of Preparation of a Draft Environmental Impact Report for the Sonoma County Comprehensive Cannabis Program Update. Please confirm your receipt of the letter and contact our office with any questions. Thank you.

SM&W
40 YEARS

Sara L. Breckenridge
Secretary to Carmen J. Borg
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Joseph Petta
Attorney
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March 22, 2023

Via Electronic Mail Only

Crystal Acker, Supervising Planner
County of Sonoma
2550 Ventura Avenue
Santa Rosa, California 95403
Email: crystal.acker@sonoma-county.org

Re: Notice of Preparation of a Draft Environmental Impact Report - Sonoma County Comprehensive Cannabis Program Update

Dear Ms. Acker:

This firm represents Save Our Sonoma Neighborhoods ("SOSN") and Neighbors of Liberty Valley, LLC ("NLV") in connection with the Sonoma County Comprehensive Cannabis Program Update ("Project"). Like all concerned members of the public, SOSN and NLV expect to rely heavily on the environmental document required by the California Environmental Quality Act ("CEQA") for an honest and thorough assessment of the environmental impacts of the proposed Project. To this end, we submit the following comments on the Notice of Preparation ("NOP") prepared for the proposed Project.

I. The NOP Lacks Necessary Information Regarding the Project and Its Probable Environmental Impacts.

The purpose of an NOP is to solicit guidance from public agencies and the public as to the scope and content of the environmental information to be included in the EIR. In order to effectively solicit such guidance, the NOP must provide adequate and reliable information regarding the nature of the project and its probable environmental impacts. As detailed below, the NOP does not provide sufficient information regarding the Project and its probable environmental impacts.

A. Project Description

One of CEQA's fundamental requirements is that an EIR contain an accurate and complete project description. Without a clear and comprehensive project description, the public cannot be assured that the environmental impacts of the entire Project have been considered in the EIR. Unfortunately, the County's NOP fails to meet the minimum standard for adequacy in this regard. The NOP fails to include a draft of the proposed ordinance or information regarding activities to be allowed or prohibited, criteria for location of cannabis cultivation facilities, and approaches to permit streamlining. Instead, the NOP only states that the EIR will analyze these issues.

We respectfully request that the County revise and recirculate its NOP in order to provide substantive information about the Project, including a draft of the proposed ordinance, any proposed limitations on cannabis cultivation (indoor vs. outdoor, required minimum distances from sensitive receptors, limits on number of public events such as tastings and promotional events at cultivation sites, any caps on total acreage planted, etc…) and the Project's likely environmental impacts. Because the NOP provides no substantive description of the Project, and no information about the Project's potential environmental impacts, this letter addresses some of the issues that are of particular concern to SOSN and NLV.

Residents have for a long time requested that the County establish combining district overlay zones or 'exclusion zones' where cannabis cultivation would be prohibited and 'inclusion zones' where cannabis cultivation would be allowed with streamlined review. In December 2016, the County Board of Supervisors gave staff direction to develop inclusion and exclusion zones for cannabis cultivation for the Board to consider. County of Sonoma 2017 Cannabis Ad Hoc Committee Charter/Scope of Work (April 11, 2017).The County's 2017 Ad Hoc Committee was directed to work on development of these zones to identify specific areas to be included or excluded from cannabis cultivation separately from what is allowed by the base zoning. In addition, the issue of establishing exclusion (and inclusion) zones was also raised during the community engagement meetings to inform the County's Cannabis Program Update Framework. In those meetings, SOSN, NLV and others advocated for inclusion zones that would allow cannabis cultivation with expedited permitting and exclusion zones that would prohibit cannabis growing in certain areas to ensure protection of residents, sensitive areas, and resources, thereby avoiding the Project's worst impacts. Specifically, SOSN and NLV request that the Project be defined to incorporate the exclusion and inclusion areas. Criteria for designating exclusion zones should include:

- Residential Zones, particularly rural residential neighborhoods, to protect residents from the harmful effects of air emissions and odors, and to preserve neighborhood character.

- Known Sensitive Natural Resources, including Biotic Habitat Combining Zones, to protect sensitive watersheds, habitat areas, wetlands, waterways, parks, and preserves and the sensitive biotic resources within them.

- Water Resources. Excluding areas designated as Groundwater Zones 3 and 4 due to historically low ground water and areas within sensitive watersheds will protect groundwater supply and water quality.

- Scenic Resources, including voter-approved community separators, to protect the County's rural character.

- High Fire Hazard Areas With Constrained Evacuation Access. Given the recent history of wildfires in the County, and the high incidence of substandard rural roads that don't meet State Fire Safe Regulations, the County should exclude these areas to ensure safe evacuation access. Most of this information should be readily available to the County in background documents prepared for the General Plan. Therefore, we see no reason why the County cannot map these sensitive areas and exclude them from the Project area.

- Open Space areas to protect and natural resource and open space.

Conversely, the DEIR should also analyze areas appropriate as inclusion zones (i.e., combining district overlay zones), that is, areas away from sensitive receptors and resources where permits for cannabis cultivation would be expedited. Some examples to consider, assuming water and power are available there, are:

- areas zoned as Industrial Zones

- areas near landfill sites, water treatment plants, and other areas typically located away from sensitive receptors.

B. Analysis of the Project's Probable Environmental Effects

The CEQA Guidelines specify that an NOP shall include a description of the probable environmental effects of the project. CEQA Guidelines § 15082. Here too, the NOP fails to meet CEQA's mandate. Despite the fact that the County has previously prepared and circulated an Initial Study on the Project, and gathered data regarding residents' concerns from community meetings, the NOP fails to provide a description of the Project's probable environmental effects. *Id*. Instead, it only provides a list of the issue areas that would be analyzed in the EIR. NOP at pps. 6-8.

1. Air Quality and Odor

The Draft EIR should thoroughly analyze the Project's air quality and odor impacts. Particular attention must be paid to comprehensively identifying each source of emissions that would be generated by different types and methods of cultivation. The analysis must also include emissions from motor vehicle traffic, stationary sources, and area sources. The Draft EIR must also evaluate the Project's potential to threaten public health from the increase in criteria air pollutants and toxic air contaminants during construction and operation of Project-related development. The EIR should include a thorough analysis of the potential public exposure to tetrahydrocannibinol "THC" and beta-myrcene emissions, both listed as carcinogens by the California Office of Environmental Health Hazard Assessment ("OEHHA"). Beta-myrcene is a known substantive component of cannabis.[1] If the Project's air quality impacts are determined to be significant, the EIR must identify feasible mitigation measures or alternatives to avoid or reduce those impacts.

2. Hydrology and Water Quality Impacts

Significant impacts to the hydrologic regime, water quality, and groundwater supply could occur as a result of implementation of the proposed Project. The Draft EIR must thoroughly investigate these potential impacts and determine whether implementation of the proposed Project would result in the violation of any water quality standards, result in substantial new amounts of polluted runoff (including erosion and silt), result in impacts on groundwater quality including impacts to the public trust areas, interfere with groundwater supply and recharge measured on both an individual and cumulative scale, or alter existing drainage patterns. If such impacts are determined to be significant, the EIR must identify feasible and enforceable mitigation measures or alternatives to avoid or reduce those impacts.

3. Biological Resources

As acknowledged in the NOP, a variety of biological communities and habitat types occur countywide. The NOP provides no indication as to the extent of impacts to these communities and habitats. A full analysis of the cumulative effects on biological resources impacts will be essential to development of effective mitigation measures to ensure that impacts on biological resources impacts will be fully offset. This detailed analysis should begin with an accurate description of the existing biological setting,

[1] *See*, https://oehha.ca.gov/proposition-65/crnr/notice-intent-list-beta-myrcene ["*Beta-Myrcene* meets the criteria for listing as known to the State to cause cancer under Proposition 65, based on findings of the NTP" (NTP, 2010)].

which forms the baseline for the analysis. The analysis must also consider how the Project would impact the County's recent habitat conservation planning efforts.

4. Wildfire Risk and Public Safety Related to Emergency Response and Evacuation

As we have commented previously, as the climate changes and fire risk grows, Californians and Sonoma County residents and their neighbors are rightfully concerned about the risk of wildfire. See, comment letter from SOSN and NLV to Sonoma County Board of Supervisors, May 17, 2021. With the state still recovering from the disastrous fires of the last few years, decisionmakers must consider the role that increased cannabis cultivation plays in the proliferation of wildfires, especially when that development encroaches into heavily forested areas with steep hills that are designated by state agencies as high or very high fire risk. The NOP provides no meaningful information about Project-related increased risk of wildfires, and barriers to emergency response and evacuation once a fire starts. The DEIR must thoroughly analyze Project-related risk of wildfire and indirect impacts related to emergency access and evacuation.

5. Aesthetic Impacts

The NOP's discussion of aesthetic impacts also fails to include a meaningful discussion of the Project's likely impacts on aesthetics and visual resources. The DEIR must provide a thorough analysis of the Project's foreseeable impacts, including increased light and glare, on scenic corridors and vistas, parks, greenbelts, established community separators, and similar areas, and changes to the rural character of the County.

6. Land Use and Planning

The NOP fails to identify the Project's potential land use and planning impacts as a probable environmental effect. As discussed above, without the details of the proposed ordinance, it is not possible for the public to submit meaningful comments on this Project component. The EIR must specifically identify the proposed ordinance, analyze its environmental implications, and propose mitigation measures or Project alternatives to remedy these inconsistencies. The EIR must also identify and analyze any other of the Project's inconsistencies with the County's General Plan and other planning policies.

7. Cumulative Impacts

An EIR must discuss the cumulative impacts of a project when the incremental effects of the project are considerable when viewed in connection with the effects of other past, current, and probable future projects. CEQA Guidelines §§ 15130(a), 15065(c). Projects currently under environmental review clearly qualify as reasonably probable future projects to be considered in a cumulative impact analysis. *See San Franciscans for Reasonable Growth v. City & County of San Francisco*, 151 Cal.App.3d 61, 74 n.13 (1984). In addition, projects anticipated beyond the near future should be analyzed for their cumulative effect if they are reasonably foreseeable. *See Bozung v. Local Agency Formation Comm'n*, 13 Cal.3d 263, 284 (1975). Here, the EIR must thoroughly analyze the Project's cumulative environmental impacts.

II. Conclusion

Thank you for the opportunity to provide these comments. SOSN and NLV remain concerned about the potential far-reaching impacts of this Project. Given that the NOP does not provide adequate information regarding the Project's probable environmental impacts, we respectfully request that the County revise and recirculate its NOP. Alternatively, if the County intends to proceed with the preparation of the Draft EIR without republishing the NOP, please keep SOSN, NLV, and this office informed of all notices, hearings, staff reports, briefings, meetings, and other events related to the proposed project.

Very truly yours,

SHUTE, MIHALY & WEINBERGER LLP

Joseph Petta

Cc: Cannabis@sonoma-county.org
Board of Supervisors at bos@sonoma-county.org
Scott Orr, scott.orr@sonoma-county.org
Tennis Wick, Tennis.Wick@sonoma-county.org

From: Christopher Spaulding
To: Cannabis
Subject: comment re EIR process for the Comprehensive Cannabis Program Update
Date: Thursday, March 23, 2023 4:50:42 PM
Attachments: OH comment re EIR process and cannabis program.docx

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EXTERNAL

Greetings.

Please accept the attached for entry into the public comments regarding the EIR process for the Comprehensive Cannabis Program Update. Thank you for the opportunity for the community to provide input.

Best regards,
Christopher Spaulding

Christopher Spaulding
Executive Director

Sonoma Recovery Services, LLC | Olympia House
11207 Valley Ford Road, Petaluma, CA 94952
main: (707) 795-7609 | direct: (707) 992-1303 | fax: (833) 211-9608

Click here to send me a secure e-mail.

From:	Ambrose, Travis@Cannabis
To:	Cannabis
Cc:	Ponce, Kevin@Cannabis; Susan Pearce
Subject:	DCC Comment Letter_NOP_SCH No. 2023020144
Date:	Thursday, March 23, 2023 4:02:51 PM
Attachments:	image003.png NOP Comment Ltr_Sonoma County Cannabis Ordinance_031523_final.pdf

EXTERNAL

Hello,

Attached are the DCC comments on the Notice of Preparation (NOP) of an Environmental Impact Report for:

- SCH No. 2023020144- Sonoma County Comprehensive Cannabis Program Update

Please let me know if you have any questions or need more information.

Thank you,

Travis Ambrose
Environmental Scientist

1-279-217-3605

844-61-CA-DCC (844-612-2322)
info@cannabis.ca.gov
www.cannabis.ca.gov

Department of
Cannabis Control
CALIFORNIA

March 17, 2023

Crystal Acker, Supervising Planner
County of Sonoma
2550 Ventura Avenue
Santa Rosa, California 95403
Cannabis@sonoma-county.org

Re: Notice of Preparation of an Environmental Impact Report for the Sonoma County Comprehensive Cannabis Program Update (SCH No. 2023020144)

Dear Ms. Acker:

Thank you for providing the California Department of Cannabis Control (DCC) the opportunity to comment on the Notice of Preparation (NOP) of an Environmental Impact Report (EIR) circulated by Sonoma County for the Sonoma County Comprehensive Cannabis Program Update (Proposed Project).

DCC is a Responsible Agency with respect to the Proposed Project, with jurisdiction over the issuance of licenses to operate commercial cannabis businesses in California. DCC issues licenses to cannabis cultivators; cannabis nurseries and cannabis processor facilities; cannabis manufacturing, testing, distribution, and retail facilities; and cannabis microbusinesses, where the local jurisdiction authorizes these activities. (Bus. & Prof. Code, § 26012(a).) All commercial cannabis businesses within California require a license from DCC. For more information pertaining to commercial cannabis business license requirements, including DCC regulations, please visit: https://cannabis.ca.gov/cannabis-laws/dcc-regulations/.

Background

Sonoma County is the Lead Agency on the Proposed Project. The Sonoma County Permit and Resource Management Department is preparing a comprehensive cannabis program update, including a new commercial cannabis land use ordinance and potential General Plan Amendments. The Cannabis Program Update would result in a series of zoning changes that may retain, replace, expand on, or eliminate existing provisions of the current cannabis ordinance. The primary goals of the Cannabis Program Update are to consider the need for expanded or new cannabis land uses within the unincorporated County, further enhance neighborhood compatibility and environmental protections (which could result in restriction or elimination of cannabis land uses), and streamline the cannabis permitting process. Sonoma County filed an NOP for the Proposed Project in February 2023.

DCC Comments and Recommendations

In response to the NOP, DCC has several comments and recommendations about the anticipated scope of the EIR and recommendations regarding issues the County should address and consider during preparation of the EIR.

Comment 1: Consideration of DCC Regulations

DCC has published regulations containing environmental protection measures designed to reduce the severity of environmental impacts for several resource topics. The EIR's analysis would benefit from a review of the protections for environmental resources provided by DCC's regulations and a discussion of how these regulations may affect or reduce the severity of the Proposed Project's environmental impacts. Current DCC regulations can be found at: https://cannabis.ca.gov/cannabis-laws/dcc-regulations/.

Comment 2: Analysis of Site-specific Resource Impacts

Some environmental topics may generally fall outside of DCC's regulatory authority because these topics are regulated by local land use regulations. These could include issues such as aesthetics, land use and planning, geology and soils, mineral resources, noise, odors, regional recreational facilities and services, compliance with building standards, provisions for police and fire protection, and connections to public utilities (e.g., public water, wastewater, and storm drainage systems). Many of these topics involve the evaluation of site-specific conditions, the details of which may not be known by state regulatory agencies. In addition, local conditions affecting resources, such as site-specific groundwater availability, traffic conditions, and wildfire risk, may be best assessed and evaluated by local lead agencies.

DCC requests that Sonoma County's Program EIR evaluate potential impacts of licensed commercial cannabis business activities on these resource topics at an appropriate site-specific level. Evaluations should include mitigation measures that would ensure that the Proposed Program would avoid, reduce, or minimize significant adverse impacts on the environment to a less-than-significant level, where possible.

In considering changes to its cannabis program ordinance, Sonoma County should review the State regulations and requirements and consider adopting policies that are equally restrictive as those defined by the state. Applicants for state licensure will be required to meet these requirements, so requiring measures that are at least as restrictive will provide clarity to cultivators and increase the likelihood that DCC will be able to issue licenses for individual projects.

Comment 3: Cumulative Impacts

It is important for the Program EIR to disclose and evaluate potential cumulative impacts of cannabis business activities. Of particular importance are topics for which the impacts of a single cannabis project may be less than significant but, collectively with other existing and proposed cannabis operations, and/or other industrial complexes where it is allowable and reasonable to predict future cannabis operations may be permitted, would contribute to a significant cumulative impact. These topics may include:

- Impacts of surface water diversions on aquatic species and habitats, including riparian habitats reliant on stream flows;
- Impacts of groundwater diversions on the health of the underlying aquifer, including impacts on other users, impacts on stream-related resources connected to the aquifer;
- Impacts on terrestrial biological species and habitats, particularly special-status species as defined under CEQA;
- Impacts related to noise; and
- Impacts related to air quality and objectionable odors.

Adequately evaluating these cumulative impacts and incorporating mitigation measures to address them will allow applicants and the County to take advantage of CEQA streamlining opportunities at the site-specific level.

Comment 4: CEQA Streamlining for Annual State Cannabis Business License Applicants

It is important to note that, pursuant to state regulations, DCC requires an annual-license applicant to provide evidence of exemption from, or compliance with, CEQA (Cal. Code of Regs., tit. 4, § 15010(b)). When a local jurisdiction prepares a site-specific CEQA compliance document that contains the information required by DCC to issue an annual license, it improves the efficiency with which the Department can issue annual licenses for projects located within that jurisdiction. For site-specific cannabis projects where DCC must act as the CEQA lead agency, DCC must either direct the applicant to prepare site-specific analysis or charge the applicant for the costs of preparing any necessary supplemental environmental documentation as well as the Department's costs for procedures to comply with CEQA (Cal. Code of Regs., tit. 4, § 15010(c)). It is possible that some projects may require extensive CEQA documentation. This may result in significant delays to projects receiving state cannabis business licenses.

DCC therefore requests that the County plan to provide site-specific environmental documentation for each project, including mitigation measures or permit terms that minimize the direct impacts of each project and reduce its contribution to less than considerable for any significant cumulative impacts identified in the County's Program EIR.

When completing CEQA documentation for individual cannabis business projects, DCC recommends that Sonoma County plan to provide evidence of the basis on which the Planning Director makes the determination of whether new impacts might occur or whether mitigation measures are required. This may include a "written checklist or similar device to document the evaluation of the site and the activity to determine whether the environmental effects of the operation were within the scope of the program EIR." (CEQA Guidelines, § 15168(c)(4).) While CEQA does not require the lead agency to document its conclusions under these circumstances, supporting documentation helps DCC and other agencies, acting as responsible agencies, to document the reasoning of the lead agency in concluding that the proposed activity fits within the analysis covered by the Program EIR and that subsequent environmental review is not required. This documentation need not be elaborate but may take the form of a short memorandum or checklist with an accompanying project description documenting the lead agency's evaluation.

Comment 5: Multi-tenant Operations
DCC recommends that the County consider the potential impacts, including the potential for cumulative impacts, that would result from multi-tenant operations where multiple cannabis businesses may be located on a single parcel. The EIR should consider whether the implementation of mitigation measures would reduce site-specific impacts and cumulative impacts from multi-tenant sites to less-than-significant levels.

Conclusion
DCC appreciates the opportunity to provide comments on the NOP for the Proposed Project. If you have any questions about our comments or wish to discuss them, please contact Kevin Ponce, Senior Environmental Scientist Supervisor, at (916) 247-1659 or via e-mail at Kevin.Ponce@cannabis.ca.gov.

Sincerely,

Lindsay Rains
Licensing Program Manager

From: Jay M. Behmke
To: Cannabis
Subject: Cannabis Program Update & Environmental Impact Report
Date: Thursday, March 23, 2023 3:43:38 PM

EXTERNAL

Attachment available until Apr 22, 2023

To Whom It May Concern:

Attached are my initial comments on the Cannabis EIR.

Thank you for your consideration.

—

Jay M. Behmke
Bayside Law PC
jay.behmke@bayside.legal
Ph: 707-561-0001

Click to Download
Letter EIR Cannabis Nuisance 03.23.23.pdf
22.2 MB

From: Kathy Pons
To: Crystal Acker; Cannabis
Subject: EIR Cannabis / Scoping Comments
Date: Thursday, March 23, 2023 12:51:40 PM

EXTERNAL

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and strongly recommended for study in the Sonoma County Comprehensive Cannabis Update EIR:

Agricultural and Forest Resources:

Analyze the cumulative impacts of categorizing cannabis as "agriculture" with respect to the General Plan Ag Resource Element. Is this consistent with California law?

Analyze the impacts to traffic, water, and rural character associated with policies that would encourage "visitor-serving uses that promote agriculture" for cannabis grows on agriculturally zoned properties.

Analyze the impacts of cannabis "visitor-serving uses" as compared to what the wine industry is allowed per the General Plan policies and Winery Events Ordinance.

Analyze the cumulative impacts of cannabis tourism.

Analyze how cannabis tourism and wine tourism might overlap and dangers to public safety due to known augmented intoxication from combining cannabis with alcohol.

Thank you.
Kathy Pons

From: Katy Mangan
To: Cannabis
Subject: Cannabis letter
Date: Thursday, March 23, 2023 5:01:44 PM
Attachments: Cannabis letter 3-23-23.pages

EXTERNAL

Katy Mangan
Storyteller
707-483-4873

From: kbparr@sonic.net
To: Cannabis
Subject: EIR Study Topics
Date: Thursday, March 23, 2023 2:24:43 PM
Attachments: Cannabis EIR topics to Permit Sonoma 20230322.pdf

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EXTERNAL

Hello,

Please find attached our topics requested to be studied as part of the EIR for Sonoma County Cannabis Update.

Thank you.

March 23, 2023

Via Email
Crystal Acker
Permit Sonoma
2550 Ventura Avenue
Santa Rosa, California 95403
Email: cannabis@sonoma-county.org

Dear Ms. Acker:

We are grape growers in Sonoma County. We ask that the topics below be researched and evaluated as part of the EIR study for the Sonoma County Cannabis Ordinance Update.

Standard vineyard practices are threatened if cannabis is planted next to grapevines. A brief search on the internet finds articles about vineyards and cannabis operations embattled in fights over divergent crop cultivation practices and how the requirements of these two operations are at odds. Study should be undertaken to research the impacts of cannabis and winegrapes grown near one another and mitigate potential conflicts.

Vineyard and Cannabis Cultivation

How will cannabis impact farming activities and operations in existence prior to cannabis cultivation? Is it fair and equitable for preexisting farming operations to be harmed, sued or put out of business due to the conflicts that may arise from opposing new cannabis cultivation on adjacent or neighboring property? How will Sonoma County mediate problems that arise between growers of the two crops?

Pesticide Use

It's been suggested that cannabis crops sold in California are restricted from having pesticide application or residue on the crop. Pesticides used on winegrapes are legal, regulated and a necessary component for vineyard operations. How can winegrape cultivation exist adjacent to cannabis crops which eschew pesticides?

Cannabis terpene taint

Study must be undertaken to research any risk of winegrape taint by way of residue or odor from cannabis terpenes. Conduct airflow and circulation studies in a boxed in valley like Franz Valley.

Remedies

Consider allowing cannabis cultivation in areas where winegrapes are not in production or at a minimum:

Establish large set backs – 1000 ft plus minimums between cannabis cultivation and grape growing operations

Establish regulation to promote or require separation, where winegrape and cannabis cultivation will not be adjacent.

We appreciate the work Permit Sonoma and affiliated agencies are doing to rework the cannabis ordinance. Thank you for the careful consideration of the points we have addressed, as well as those submitted by all interested parties.

Sincerely,

Ken Parr
Michele Parr
8410 Franz Valley School Road
Calistoga, CA 94515

From:	Moira Jacobs
To:	Crystal Acker; Cannabis
Cc:	Susan Gorin; Lynda Hopkins; David Rabbitt; district3; district4
Subject:	Bennett Valley Grange Excl Zone letter
Date:	Thursday, March 23, 2023 9:37:52 AM
Attachments:	Scoping BVCA Exclusion Zone.pdf BVAP highlighted.pdf CLUO-BOS-3-8-2111102021.pdf CLUO-BOS-6-28-21 Letter-6-28-2111102021.pdf 03202023 Grange Excl Zone letter.pdf

EXTERNAL

Good morning Crystal,

As referenced below, please see attached here all four documents we reference in our letter delivered yesterday. We understand your office already received these letters from the other organizations, yet we wish to be sure our letter includes these referenced documents as attachments:

1) Letter from BVCA Board
2) BVAP with highlights
3) Yolo County Farm Bureau letter 3/8/21
4) Yolo County Farm Bureau letter 6/28/21

Thank you,
Moira Jacobs
President
Bennett Valley Grange #16

Begin forwarded message:

From: Moira Jacobs <moiraajacobs@comcast.net>
Date: March 22, 2023 at 8:58:34 AM PDT
To: crystal.acker@sonoma-county.org, cannabis@sonoma-county.org

Cc: Susan Gorin <Susan.Gorin@sonoma-county.org>, Lynda Hopkins <Lynda.Hopkins@sonoma-county.org>, David Rabbitt <David.Rabbitt@sonoma-county.org>, district3 <district3@sonoma-county.org>, district4 <district4@sonoma-county.org>
Subject: 03202023 Grange Excl Zone letter

Good morning Crystal,

Please see attached letter regarding Re: Scoping for Cannabis Ordinance
—
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited.

The letter refers to multiple attachments which I'll provide in a separate email. Most of the referenced attachments you already have as they were sent to your department recently.

Thank you,
Moira Jacobs
President
Bennett Valley Grange #16

Bennett Valley Community Association

P.O. Box 2666, Santa Rosa, CA 95405
http://bennettvalley.org

March 20, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org)
cannabis@sonoma-county.org

Re: **Scoping for Cannabis Ordinance—**
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited

Dear Crystal Acker,

The Bennett Valley Community Association (BVCA) was founded in 1971 and is a § 501(c) (3) organization. The BVCA represents the residents of unincorporated Bennett Valley within the boundaries of the Bennett Valley Area Plan (BVAP). With respect to the Notice of Preparation for the Comprehensive Cannabis Program Update, we request that the Cannabis Environmental Impact Report (EIR) research, evaluate and identify both "inclusion zones" and "exclusion zones," the former where commercial cannabis is permitted to be grown and the later where cannabis activities are forbidden. Since the board of supervisors adopted the BVAP in 1979, this area has been a planning unit that readily lends itself to designation as an exclusion zone.

As outlined in the BVAP, which the BVCA Board of Directors is charged with protecting on behalf of our residents, multiple policies are violated by allowing any commercial cannabis operations within the BVAP boundaries.

On behalf of the residents of Bennett Valley within the boundaries of the BVAP, the Board of Directors of the BVCA urge that the EIR to study the environmental effects of designating this area to be an exclusion zone where commercial cannabis operations are prohibited so that the Supervisors can include such a designation for Bennett Valley in the revised ordinance.

We propose this Exclusion Zone designation based on the following considerations and request this be further assessed in the upcoming EIR:

1) Analyze the adequacy of Bennett Valley's unique water resource conditions and constraints (a class 3 area, and possibility of class 4 at valley floor with updated data), including impacts on the Matanzas Creek Riparian Zone as a significant aquifer recharger for the entire valley. Include sensitive biotic and other natural resources that require special protections, including numerous state and federally-designated endangered or threatened species; and

2) Analyze the nine development policy guidelines as approved by the County in 1979 in the BVAP and enforced continuously since, and <u>ALL environmental impacts</u> associated with this development policy framework, including but not limited to: 1) Land Use; 2) Housing; 3) Conservation of Resources; 4) Open Space; 5) Public Safety; 6) Circulation; 7) Scenic Corridor; 8) Public Services; 9) Transportation. Please see the attached highlighted BVAP for reference of these nine development policy guidelines and associated environmental protections; and

3) Assess the impact of commercial cannabis operations on the health of the Matanzas Creek Riparian Zone, its multiple sensitive biotic resources and its critical role as wildlife corridor, especially in regards to the corridors integration with critical protected habitats and parks surrounding Bennett Valley, including: Taylor Mountain, Sonoma Mountain Open Space, Annadel State Park and Jack London State Park; and

4) Assess the impact of commercial cannabis operations on the health of the Matanzas Creek Riparian Zone specific to its 100-year floodwater assessment and the 2023 Matanzas Creek Dam Restoration Project; and

5) Analyze the impacts of commercial cannabis operations in regards to the scenic character and protected view shed status for Bennett Valley as described in the BVAP, with special attention to aesthetic incompatibilities and violations of the visual natural resources protected as part of the view shed protections in the BVAP and adjacent parks; and

6) Analyze the impacts of commercial cannabis operations on roads in Bennett Valley, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time; and

7) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to fire safety, including the designation of much of Bennett Valley as a high fire severity zone by various public agencies; and

8) Analyze the impacts of commercial cannabis operations in Bennett Valley with respect to the slow lead times for law enforcement to respond to emergencies; and

9) Take into consideration the overwhelming support for an exclusion zone status and the strong resistance to commercial cannabis activity throughout the community as evidenced by hundreds of petition signatures by the residents, urging the County designate the BVAP area as an exclusion zone, multiple community organization letters of support, and many hundreds of resident emails, phone calls and meetings with officials urging exclusion zone status for Bennett Valley.

Therefore, the BVCA Board of Directors urges the County to study the many unique environmental conditions in Bennett Valley as part of the EIR with a specific assessment of its requested exclusion zone status.

Approved by BVCA Board of Directors

Attachment: Bennett Valley Area Plan (highlighted), including BVAP Map

YOLO COUNTY FARM BUREAU

Yolo County Farm Bureau

69 W Kentucky Avenue, Woodland CA 95695
P O Box 1556, Woodland CA 95776
530.662.6316 O * 530.662.8611 F
www.yolofarmbureau.org

PRESIDENT
Joe F. Martinez
1st VICE PRESIDENT
Garrett Driver
2nd VICE PRESIDENT
Mike Hall
SECRETARY & TREASURER
Denise Sagara

June 28, 2021

Yolo County Board of Supervisors
625 Court Street
Woodland, CA 95695

RE: 6/28/2021 Agenda Item #49: Time Set 9:00 am

First – Yolo County Farm Bureau is writing in regard to redirecting your attention to the comments we verbally made at the BOS meeting on June 8. They bear repeating. Outdoor cannabis is incompatible with traditional county agriculture and if you allow it, you will be endangering the ability of those who farm your major Yolo County food crops, who unfortunately find themselves near outdoor cannabis grows, to continue to compete in our world price structure.

YCFB is concerned that some County staff and elected officials seem to believe that outdoor cannabis cultivation is compatible with traditional Yolo County agriculture. Yet, although we have sent written documentation explaining the detrimental impacts of cannabis on food crops since 2017, today's staff report disregards the evidence and documentation explaining how cannabis negatively impacts food crops and therefore is detrimental to Yolo county as a whole.. We note the language in the FEIR at page 3-9: the authors of the FEIR appear to believe that State Pesticide regulations and their enforcement by the County Ag Commissioner, and enforcement of "nuisance dust" by the YSAQD "solve" both issues because "regulations and enforcement" are in place. Thus –ipso facto – no incompatibility.

The existence of and good intentions behind a regulatory scheme do not make it the solution to obvious environmental impacts. The personal experience of one of our board members illustrates this reality: No one doubts the training and the expertise of county employees, or their commitment to do their jobs carefully and well: That is especially true of those who handle herbicides. Some years ago the growers noticed that about 10 walnut trees at the east end of a roadside row had sustained spray drift damage. After looking at the possibilities they realized that the County of Yolo had put on a roadside weed herbicide – and the walnut trees were unintended recipients. The regulations were there --- the good intent was there – but the damage was done. This illustrates that a law on the books is just verbiage: it is not the same as physical barriers and impediments to prevent spray damage. Then, we have the conundrum: The owner of a $1M/acre dollar crop sustaining accidental damage through no intent or bad motive as an adjunct from farming the neighboring $6T/acre almond orchard. This risk- loss of conventional farming - has to be counted in your assessment because it IS an environmental cost of outdoor cannabis cultivation.

Second: Along with more evidence of incompatibility I revisit an issue that I thought would have been handled last meeting: I was assured that the letter filed by Mr. Kyle Lang would be read into the record. However, it was not read. The relevant information that needed to be read was that The Lang family has raised walnuts in Yolo County, both organic and conventional, since 1937. I summarize it now: Kent Lang lived on their River Ranch in West Sacramento just under a mile from an outdoor cannabis grow. Kyle Lang advises that regular and normal farming practices are absolutely not compatible based on the following examples: "each time we disced our field we immediately got texts demanding and begging us to stop because we were ruining the buds. We piled dead trees to burn and were told not to –we were damaging the cannabis. – And should wait until November. When we sprayed nutrition or for pests, we received the same texts telling us – again -to stop and wait until November. Obviously – waiting until November was not an option if one expects to continue farming. Kyle sums up this part of his narrative by stating "The County really needs to look at the negative impacts to regular agriculture activities because every activity regular farming does will negatively impact the marijuana plant. The marijuana plants need to have a sterile medical filtration system to keep dust, fertilizer sprays and any chemical sprays from devaluing their highly sensitive plants."

Secondly, Kyle gave first hand information about the skunk stench that is part of the cannabis operation for at least 3 months of the year. Kyle outlined that the stench of cannabis would spread for 2-3 miles around and with wind it would become concentrated –and travel farther. He states that there were several tenants living on the River Ranch, and they, along with Kent, experienced the terrible stench of "standing next to a dead rotting skunk" in 109 degrees. It was so strong it would keep him up at night, and caused both him and their tenants to have bad headaches. Kyle also pointed out that crime came with the marijuana: he knows of two times trespassers tried to use their land to access the back of the marijuana grow. He concludes by stating, "If our county cannot see the issues growing pot brings to our agricultural practices and way of life, then our county cannot claim to be 'pro agriculture'".

We note that the Staff Report seems to be discussing outdoor cultivation and – maybe -600 ft buffers. What happened to the 1000 feet? What happened to 10,000 feet? ? Why not consideration of at least the suggested 2,500 foot buffer? We stress that there has been NO discussion of indoor cultivation: it is a ridiculous argument for Staff to use the excuse that a "filtration system might fail". Seriously? Any system "might fail" but it is ridiculous for Staff to try to use this long-shot of a reason to disregard the very valid indoor cultivation alternative.

Staff clearly seems to be fixated on outdoor cultivation coupled with minimal buffers, which remain a major unresolved issue because the proposed 600 foot buffer is seriously inadequate. Cannabis is not only incompatible but has serious negative impacts that must not be imposed on a rural farm constituency and their accompanying farming and ranching. The reality of nearby outside cannabis cultivation incompatibilities include nauseating odors that will destroy their quality of life, damage their health, and bring crime onto their ranches and farms.

Very truly yours,

Joe F. Martinez
President

BENNETT VALLEY GRANGE #16
Santa Rosa, CA
Est. 1873

Proudly home to the oldest Grange Hall in the United States

4145 Grange Road, Santa Rosa, CA. 95404

March 17, 2023

Via email:
Crystal Acker, Sonoma County Supervising Planner (crystal.acker@sonoma-county.org) cannabis@sonoma-county.org

Re: Scoping for Cannabis Ordinance—
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited

Dear Crystal Acker,

The Bennett Valley Grange, founded in 1873 and serving our community as a California 501 (c) nonprofit corporation, is also a member of the larger National Grange network of over 2000 Granges nationwide. The National Grange organization is a non-partisan, fraternal organization that advocates for rural America and agriculture. The Grange has a strong history of grassroots activism, family values and community service.

The membership of the Bennett Valley Grange was made aware of the upcoming Scoping for Cannabis Ordinance and the letter which the Bennett Valley Community Association (BVCA) provided in support of an Exclusion Zone Designation for Bennett Valley, an exclusion zone where commercial cannabis operations would be prohibited.

<u>Our membership recently voted unanimously to support making Bennett Valley an exclusion zone from commercial cannabis operations and we are completely supportive of the attached BVCA letter and all of its requests, recommendations and supporting materials.</u> The Bennett Valley Grange and the BVCA have been very closely aligned partners since 1971, the founding of the BVCA. We both serve our same community with complimentary missions and are tightly aligned on this issue. The Bennett Valley Grange membership cares deeply about our environment, the safety and well being of the families and children of Bennett Valley, and promotes sustainable agriculture which provides nutrition to our citizenry. Moreover, as an agricultural community we care deeply about our water resources, safety from wildfires, safe roads, and protection of our agricultural lands from misuse or environmentally unsound exploitation.

Therefore, we urge the County to pay close attention to the Bennett Valley Area Plan and all of the recommendations in the BVCA letter attached as you proceed with your scoping project. Moreover, we provide additional requests for significant environmental and worker safety issues that require in-depth research and analysis throughout the County EIR process, provided below.

To be clear, this letter only represents the Bennett Valley Grange's membership, this does not represent any other Grange's views in this County, nor in the rest of California. It is worth noting that in the previous national meeting of Granges from across the United States, resolutions presented to promote cannabis production as a core Grange initiative were rejected. Most members of Granges across America do not support the concept of treating cannabis production the same as traditional Ag which delivers food, providing wholesome nutrition. The policy imperatives and consequences are very different between drug production and food based agriculture and must be carefully addressed.

Here is a list of issues we urge be researched and analyzed as part of this EIR process:

1) **Worker safety and cannabis production:** It is critical to study the impacts of commercial cannabis production on worker safety and health. THC is included on State of CA Prop 65 list of known carcinogens and there has not been

enough research yet on the cannabis cultivation/production process impacts on human health, especially when daily contact with the high potency THC cannabis of today occurs. Furthermore, the entire production process should be carefully studied for how it impacts human health and environmental health. This includes how cannabis plants and the production process may impact any area wildlife, the soil, the water resources, including groundwater aquifers, the surrounding air quality, bee colonies, and native flora.

As to worker safety, please research and analyze all below, taken from the highly respected Health and Safety Magazine, links included.

2) **Impacts, Incompatibilities and Conflicts between Traditional Ag and Cannabis production:** Research and analyze the impacts and conflicts between cannabis production operations and their highly sensitive requirements versus all other potential traditional Ag on neighboring parcels. Please reference the attached letter from the Yolo County Farm Bureau (YCFB) to the Supervisors there and these same issues should be researched and analyzed for Sonoma County, especially in regards to grape growers and cannabis operations. As the YCFB members point out, the process for their ordinance was also perceived to be overwhelmingly led and strongly influenced by cannabis producers early on, not taking into account a myriad of environmental issues between vineyards, livestock ranches, poultry, dairy, and outdoor cannabis productions. This same complication exists in Sonoma County and must be carefully addressed.

3) **Setbacks:** The initial recommended setbacks of at least 1,000 feet from any rural residence, and concentrations of RR neighborhoods, must be thoroughly researched and analyzed. As the attached YCFB letters demonstrate with on the ground witnesses, setbacks are needed to protect both residences and traditional agriculture from cannabis operations.

4) **Commercial Activity:** Further research and analyze the fact that cannabis production is excluded from the definition of agriculture, not considered traditional agriculture and is defined as "commercial activity" by the State of California. Cannabis production activity is fundamentally a drug production operation as the end product being marketed to the general public is predominantly a drug, with THC the main active ingredient, widely recognized as a narcotic by definition and still on the Federal Schedule 1 for controlled substances. Due to the current ambiguities of conflicting State of CA and Federal drug and health policies, Cannabis, THC, and all its Cannabinoids are still widely unregulated and vastly unverified scientifically regarding human health and worker safety. THC, which has no nutritional value, remains widely unstudied and unscientifically promoted to the general public. The entire outdoor cannabis production process, all of its inputs and outputs, and every related activity must be researched and analyzed to better understand where this commercial activity is best sited (commercial zones? indoor in more concentrated industrial Ag areas, away from residential neighborhoods). The fact that the BVAP calls out "commercial activity" is not conducive to the preservation of the rural residential character, including view shed protected status, of Bennett Valley.

5) Safety: Research and analyze exact response time for Sheriff to reach all points in rural Bennett Valley and current and planned resources assigned to Bennett Valley. These resources were never researched or analyzed before multiple cannabis operations were placed next to various rural residential neighborhoods in Bennett Valley, with no prior notice, no opportunity for feedback nor questions given to the community. There have been many incidents reported and unreported to the Sheriff regarding thefts, trespassing, loose deadly attack dogs, gunfire and threatening use of firearms from neighboring cannabis operations.

The County and State of CA appear to be negligent in enabling the vast cannabis production and marketing apparatus to operate with little regulation while neglecting any comprehensive research which by any scientific standards is much needed. The Bennett Valley Grange hopes the County views this EIR exercise as an opportunity for a policy course correction.

Sincerely,

Moira Jacobs
President
Bennett Valley Grange #16
Santa Rosa, CA 95404

Email: bennettvalleygrange@gmail.com

Data on Worker Health and Safety - requires further research and analysis within this scoping exercise:

Reference: https://www.safetyandhealthmagazine.com/articles/21427-workplace-exposures-in-the-cannabis-industry
June 29, 2021

In the cultivation phase, the main hazards are pesticides, carbon dioxide and cleaning compounds. In addition, mold, yeast and fungi are serious health threats during cultivation and extraction/trimming. These chemical hazards can cause allergic reactions, coughing, wheezing and nasal congestion, as well as throat, eye and skin irritation. A certified industrial hygienist can monitor air quality to determine spore levels. Individuals with preexisting respiratory conditions may be more susceptible to reactions to mold.

Marijuana industry workers are also exposed to chemical hazards not only in the production process, but as part of housekeeping procedures. Some of the hazards include:

Carbon dioxide. At high concentrations, carbon dioxide acts as a simple asphyxiant. Workers exposed to high levels can also suffer burns.
Carbon monoxide. Exposure can result in carbon monoxide poisoning.
Pesticides. Marijuana cultivation facilities often use insecticides and fungicides. The EPA Federal Insecticide, **Fungicide, and Rodenticide** Act provides standards and guidance for the safe handling, storage and application of pesticides to avoid pesticide poisoning, which has multiple health effects, including cancer.
Volatile organic compounds. These can cause eye, nose and throat irritation; headaches; vomiting; dizziness; and worsening asthma symptoms. Long-term exposure can cause additional health effects, including kidney and liver impacts, respiratory impacts, and cancers.
Nutrients and corrosive materials. In the cannabis industry, the practice of mixing nutrients during the cultivation stage to improve the quality of the plant is increasing. However, the raw materials used to formulate nutrients may cause acute and chronic health effects. The most common corrosives include hydrochloric acid, phosphoric acid, sulfuric acid, ammonium hydroxide, potassium hydroxide and sodium hydroxide.
Cleaning products. Chemical products used for cleaning indoor environments and surfaces can cause respiratory or skin irritation, burns, irritation of eyes, and asthma. Improper mixing of chemicals can cause severe lung damage.
Butane. Extracting using butane is cost effective, but it also presents higher hazardous risks. Open releases of butane to the atmosphere during extractions is prohibited by OSHA, EPA and fire departments.

BENNETT VALLEY
AREA PLAN

Adopted by Resolution No. 63206A
February 27, 1979

Modified by Resolution No. 93-0337
March 9, 1993

Modified by Resolution No. 08-0808
September 23, 2008

Modified by Resolution No. 11-0461
September 30, 2011

ACKNOWLEDGMENTS

BENNETT VALLEY SPECIFIC PLAN

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CHARTS

INTRODUCTION

In 1979, the County adopted the Bennett Valley Specific Plan, a planning document prepared under specific requirements of State law and intended to provide an intermediate level of detail between the 1978 General Plan and site development plans submitted to the County for approval. The 1978 General Plan focused on policies of county-wide significance and utilized generalized graphics to illustrate land use, open space and other elements.

In 1989, the County adopted an update of the 1978 General Plan. The General Plan update provided parcel-specific information concerning land use and open space. The General Plan update also included "area policies" in an attempt to focus particular attention on a specific area or parcel. Because of this level of specificity in the general plan update, the Board of Supervisors determined that several of the specific plans, including the Bennett Valley Specific Plan, were either duplicative or conflicted with the updated General Plan. The Board of Supervisors further determined that to the extent the specific plans provided policy guidance beyond that provided by the General Plan update, that such plans should be reviewed and revised to focus on such policies, and readopted as "area plans." The General Plan includes a discussion of these specific plans in Land Use Element Section 2.1.1., under Policy LU-1a.

The document was prepared pursuant to General Plan Policy LU-1a.

In keeping with the above intent, the 1993 revisions of the Bennett Valley Area Plan did not include exhaustive evaluation or reconsideration of the policies or designations contained in this plan. The scope of the revisions was limited to that necessary to achieve General Plan consistency.

In addition, during this process much of the original background language was deleted. This deletion should not be interpreted as diminishing or reducing the significance of the content of the language to the original plan. Should there be any future questions regarding the intent or basis of the policies in the revised plan, the Planning Department shall keep copies of the original plan on file for reference.

SUMMARY

Located on the southeastern border of the City of Santa Rosa, the 15,500 acre Bennett Valley Study district was established by the Board of Supervisors in 1977 in response to local resident concern about the impacts of residential development.

The eleven-person Citizens Committee, appointed by the Board of Supervisors to provide a policy framework for the 1978 plan, set as its goals provision of residential opportunities and the protection of agriculture while retaining the rural character in Bennett Valley.

The Bennett Valley Area Plan is guided by goals, objectives and policy framework of the adopted Sonoma County General Plan. Four major land use categories are used in the Bennett Valley Plan to achieve the desired balance of residential and agricultural use:

(1) Rural Residential acknowledges residential development as the primary land use, but supports the retention of open space through density regulation, primarily to minimize public hazards.

(2) Diverse Agriculture encourages the use of the land for agriculture by retaining larger parcels and clustering residential units on smaller parcels.

(3) Land Intensive Agriculture recognizes agriculture as the primary land use. Dwellings are permitted to support the agricultural operation.

(4) The Resources and Rural Development category supports agricultural and conservation uses and recognizes public safety hazards.

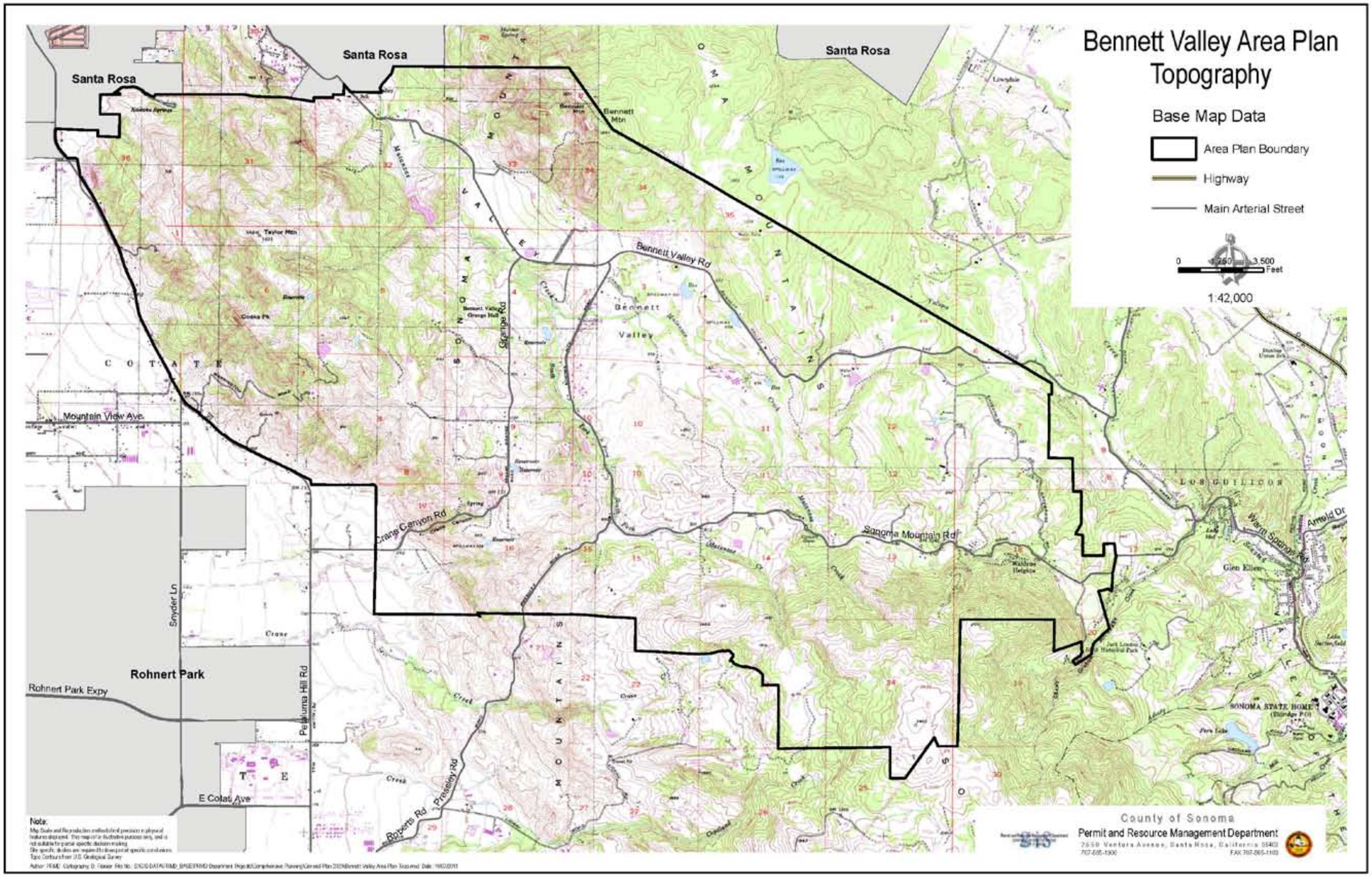
With the Land Use Map, the Bennett Valley Area Plan integrates a Critical Open Space Plan, a set of Development Guidelines, and implementation tools. The Critical Open Space Plan establishes visual and riparian corridors within which the development is prohibited except in special cases. The Critical Open Space Plan also designates scenic landscape units, unique biotic features and critical habitats. The Development Guidelines establish a policy of design review for all new structures in the Plan Area and recommend building and planting materials compatible with the landscape units of Bennett Valley. Other recommended implementation techniques include trust funds, assessment districts, open space easements and trusts, and special studies.

DESCRIPTION OF BENNETT VALLEY

Bennett Valley is located just southeast of the city of Santa Rosa in the County of Sonoma, known as the North Bay Region (see Location Map). Between the mountain backdrops and the valley floors lie rolling upland hills: Taylor Mountain, Bennett Mountain and the Sonoma Mountains ring the triangular shaped valley, which is drained by Matanzas Creek, a tributary of Santa Rosa Creek (see Topography Map).

Map - Location Map

Map 3 Bennett Valley Area Plan Topography



GOALS AND POLICIES

Two major goals define the Bennett Valley Area Plan: (1) to retain and enhance the rural character, and (2) to reflect the environmental and economic constraints, suitabilities and sensitivities of the area in the determination of the location and intensity of development. The following policies were endorsed by the committee to achieve these goals:

I. LAND USE

Low density is important to maintain the rural character of Bennett Valley.

(1) Residential densities shall reflect the extent of constraints, suitabilities and sensitivities of the area.

(2) Commercial development is not considered appropriate to the rural character of Bennett Valley.

(3) Development shall be coordinated with the public's ability to provide schools, fire, police and other needed services.

(4) To minimize environmental disruption, the County Subdivision Ordinance shall be the minimum standards applied for grading, road construction, drainage, driveway construction, siting, landscaping and energy. Where development standards included in Bennett Valley Plan exceed County Subdivision Standards, the Bennett Valley Standards shall apply.

(5) New development throughout Bennett Valley shall be reviewed for site design and consistency with Bennett Valley development guidelines.

(6) Cluster development should be encouraged.

II. HOUSING

(1) When methods of on-site sewage disposal permit the accommodation of multiple-family dwellings, such dwellings should be considered to satisfy the need for lower cost housing. Multiple-family dwellings should be designed to appear to be single-family dwellings and surrounded by open space.

(2) Agricultural employee housing should be encouraged.

III. CONSERVATION (Resources)

(1) Agriculture is a vital component of the rural character and shall be encouraged and protected.

   a. Parcel sizes and future land division shall be consistent with economic productivity of potential and existing agriculture.

   b. Board of Supervisors should reassess County policies implementing the Land Conservation Act to assure that they meet current needs of farmers.

(2) Unique scenic, visually and environmentally sensitive, and historic resources are important to the character of Bennett Valley and shall be protected.

(3) Water is a valuable and necessary resource which should be protected.

   a. Residential densities shall reflect net safe yield of groundwater.

   b. County Subdivision standards for areas designated as Marginal Water Availability (Groundwater Availability Map) shall be followed in Bennett Valley.

   c. Mutual water systems should be authorized for major subdivisions only where supplies are adequate to serve existing and projected growth for the life of the system.

   d. On existing but undeveloped lots, proof of water shall be required prior to issuance of a building permit.

IV. OPEN SPACE

A feeling of Open Space is a vital component of rural character in Bennett Valley. Where the standards below are less restrictive than the General Plan standards, compliance with the General Plan standards is required.

(1) Open vistas shall be protected.

(2) Development patterns and specific development shall be in harmony with natural surroundings, including, but not limited to topography and vegetation.

   a. Skyline development shall be prohibited.

   b. Planting of native vegetation should be encouraged to screen existing development from the road.

(3) A scenic corridor shall be established to protect views from the road and the community should be encouraged to undertake tree-planting programs where appropriate along scenic corridors.

V. PUBLIC SAFETY

(1) Residential development shall occur in the least constrained, most suitable areas.

a. Parcels within the Alquist-Priolo Zone or in geologically unstable areas shall be developed only at very low densities. Siting and foundation design of all structures in these areas shall comply with the General Plan Public Safety Element.

b. Structures shall be located outside of the flood inundation area.

(2) Understanding that fire could destroy the rural character of Bennett Valley and present hazard of life and property.

a. New dwellings should utilize fire-resistant materials.

b. Roof overhangs shall be designed for fire resistance.

c. Densities should be reflective of degree or fire hazard as determined by fire department response time.

d. Site landscaping shall be managed to limit fire hazard around structures.

VI. CIRCULATION

The character of the road system is a vital component of rural character of Bennett Valley.

(1) The character of the existing public road system shall be retained. Improvements should be made in the interest of safety.

(2) Development shall be sited with minimum impact on the view from the road.

(3) Intensity of land use shall reflect the conditions character and capacity of roads.

VII. SCENIC CORRIDORS

The scenic quality of all transportation routes within Bennett Valley is a vital component of the rural character, and shall be protected.

VIII. PUBLIC SERVICES

(1) Trust funds shall be considered to finance road construction and maintenance for public roads which are determined to be inadequate for proposed development.

(2) School impact fees shall be considered to finance school construction and/or classroom construction when public schools are determined to be inadequate for proposed development.

IX. TRANSPORTATION

Petaluma Hill Road, Bennett Valley Road and Grange/Crane Canyon Roads are two lane rural scenic roadways. Sonoma Mountain Road, Pressley and Enterprise Road, which complete the internal circulation system within Bennett Valley, are one lane rural scenic byways. Petaluma Hill Road is classified as a Rural Minor Arterial; Bennett Valley Road and Grange/Crane Canyon Roads as Rural Major Collectors; and Sonoma Mountain, Pressley and Enterprise Roads as Local Roads. The guiding priority is to retain their basic rural character. The following recommendations from the General Plan Circulation and Transit Element are standards for the roads in Bennett Valley:

(1) All roads should receive maintenance and hazard correction as the need arises.

(2) All roads may in some case need to be upgraded because of safety or structural deficiencies. Proposals for major safety upgrades should be thoroughly reviewed before specific projects are undertaken, including citizen review.

(3) All roads should be retained in their basic rural character.

(4) Petaluma Hill Road is designated for 3 lanes where necessary to provide access from side streets, driveways, etc.

LAND USE AND CRITICAL OPEN SPACE PLAN

The Bennett Valley Area Plan is consistent with the County General Plan. It was the intention of the General Plan to assign densities to properties in this plan area which allowed the same number of residences as provided by the "PA Table" zoning in the 1979 plan.

Rural Residential (5 acre) category is characterized by residential development which precludes commercial agriculture, resource production or commercial development.

Diverse Agriculture describes the category where preservation of agriculture and agriculture potential is the highest priority but is complicated by the number of smaller residential parcels.

Land Intensive Agriculture is a category which reflects the existing and potential intensive agricultural land use. Residential development is related to the agricultural economy and can include farm labor housing as well as single-family residences. Residential density is low in this area.

Resources and Rural Development category is characterized by low level of human activity. It includes mountainous areas and other open space and agriculture.

The Bennett Valley Area Plan contains a Land Use Plan Map and Critical Open Space Plan Map.

MITIGATION MEASURES

The following section of this report discusses the rationale for the Land Use designations in this plan. While the Zoning Ordinance provides a tool for implementing land use decisions, additional tools are needed to mitigate adverse impacts that might occur with the proposed land use. The list below gives mitigation measures which respond to specific impacts. At the conclusion of each subarea analysis, the pertinent mitigating measures have been noted.

A. FOR GEOLOGIC HAZARDS

(1) Retain very low density.

(2) Site structure and design foundation in accord with recommendations of an engineering geologist.

B. FOR FLOOD HAZARDS

(1) Prohibit residential structures within designated inundation area as mapped on Critical Open Space Plan.

C. FOR WATER AVAILABILITY

(1) Encourage Board of Supervisors to authorize a monitoring of groundwater supplies in Bennett Valley.

(2) Encourage Mutual Water Systems only when consistent with Policy PF-1h of the General Plan.

D. FOR FIRE HAZARD

(1) Retain low densities.

(2) Encourage major subdivisions with mutual water systems and require adequate access for fire suppression equipment.

(3) Where minor subdivision occurs, encourage cluster development with adequate water supply and access for fire suppression.

(4) Clear wildland grass and brush near associated structures

E. TO MAINTAIN VISUAL AMENITY

The Critical Open Space Plan Map shows designated open space areas. Where the following standards are less restrictive than General Plan standards, compliance with General Plan standards is required.

(1) Avoid skyline development.

(2) Site and design structures in harmony with natural surroundings.

(3) Prohibit structures in visual/scenic corridors as mapped on the Critical Open Space Plan.

(4) Prohibit structures in visual corridors as mapped on the Critical Open Space Plan.

(5) Apply the Bennett Valley Design Guidelines.

(6) Development in scenic landscape units shall comply with the General Plan and Zoning Ordinance.

F. TO MAINTAIN VALUABLE OPEN SPACE

The Critical Open Space Plan Map shows designated open space areas. Where the above standards are less restrictive than General Plan standards, compliance with General Plan standards is required.

(1) Prohibit structures in riparian corridors and unique biotic features as mapped in the Critical Open Space Plan.

(2) Site and design structures in harmony with natural surroundings.

G. TO PRESERVE AND PROTECT AGRICULTURE

(1) Encourage utilization of Land Conservation Act of 1965 as amended.

(2) Retain appropriately low densities.

H. TO AVOID INCREASING HAZARD ON INADEQUATE ROADS

(1) Retain low density until road upgraded.

(2) Encourage road trust funds to maintain establishment of and improve roads consistent with the transportation policy.

I. TO ASSESS IMPACTS OF PROJECTS ON PUBLIC SERVICES

(1) To assess adequately the cumulative impact of individual projects on the public services of the area, plans for any major or minor subdivision or rezoning should reflect the ultimate potential buildout of that project.

SUBAREA MITIGATION MEASURES

To facilitate the analysis of a large and variable study district, the Bennett Valley area is divided into fifteen subareas as shown on the Subareas Map. Each subarea below is followed by a list of mitigation measures applicable therein.

A. Kawana Springs Road: C-1, 2; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; I-1

B. Taylor Mountain: A-1, 2; B-1; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

C. Petaluma Hill Road/Warrington Road Area: A-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; I-1

D. Crane Canyon/Alta Monte Area: A-1, 2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; I-1

E. Grange Road below Bennett Valley Road to Perracca and including Guenza: D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; H-1, 2; I-1

F. Sonoma Mountain Road, North-South Alignment: C-1, 2; E-1, 2, 3, 4, 5, 6, 7; I-1

G. Bennett Valley Road Adjacent to Matanzas Dam: A-2; B-1; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1; I-1

H. Valley Floor, Bennett Road: E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

I. Bennett Mountain: A-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; I-1

J. Jamison Road Extension: A-1, 2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1, 2; H-1, 2; I-1

K. Lower Grange Road, Pressley Road and Sonoma Mountain East-West Alignment: A-1, 2; C-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

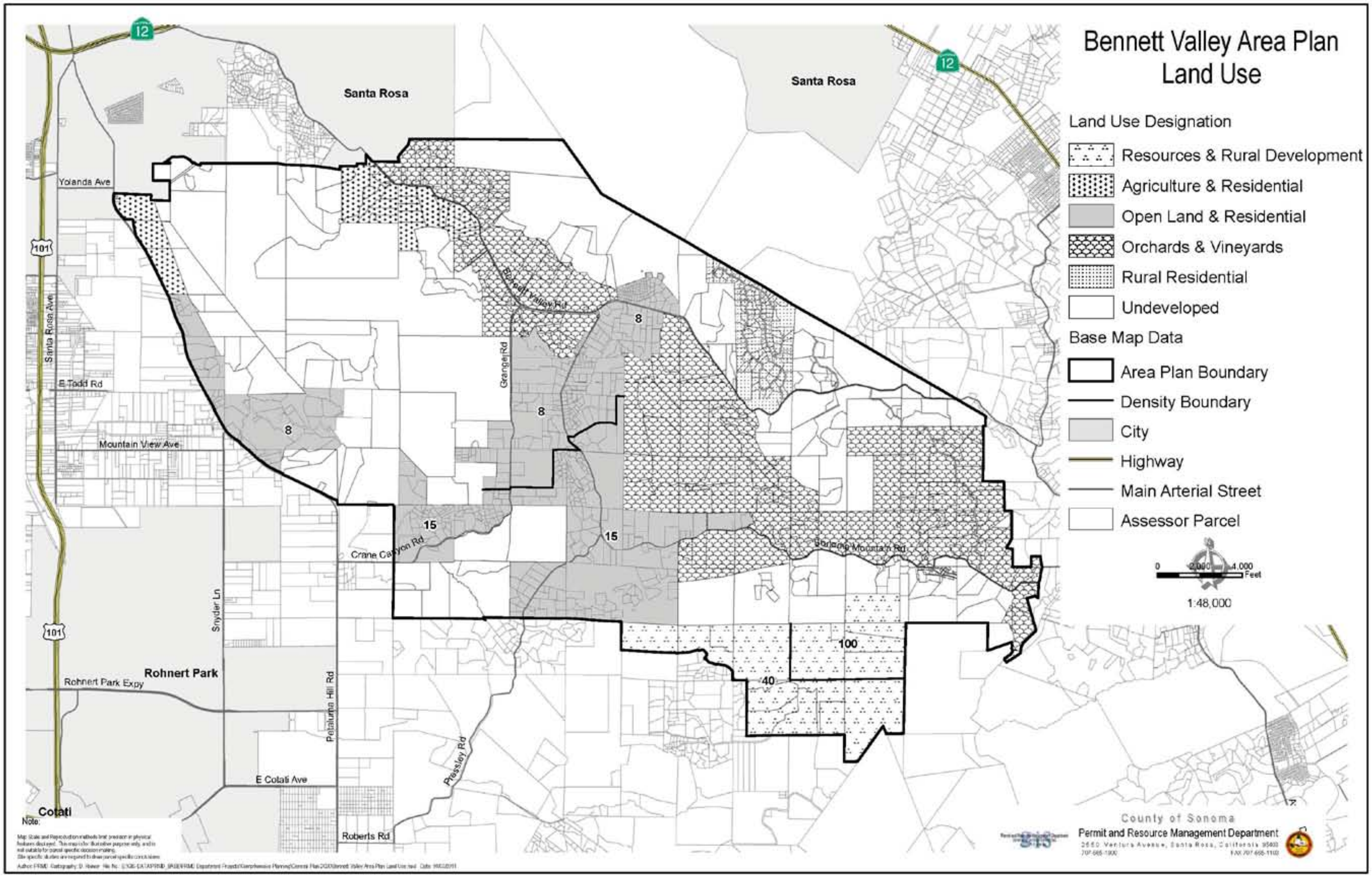
L. Sonoma Mountain Road East-West Alignment: A-1, 2; C-1, 2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

Open Land Between Bennett Valley Road and Sonoma Mountain Road (West of Enterprise): A-2; C-1, 2; D-1, 2, 3, 4, 5, 6, 7; E-1, 2, 3, 4; F-1, 2; G-1, 2; H-1, 2; I-1

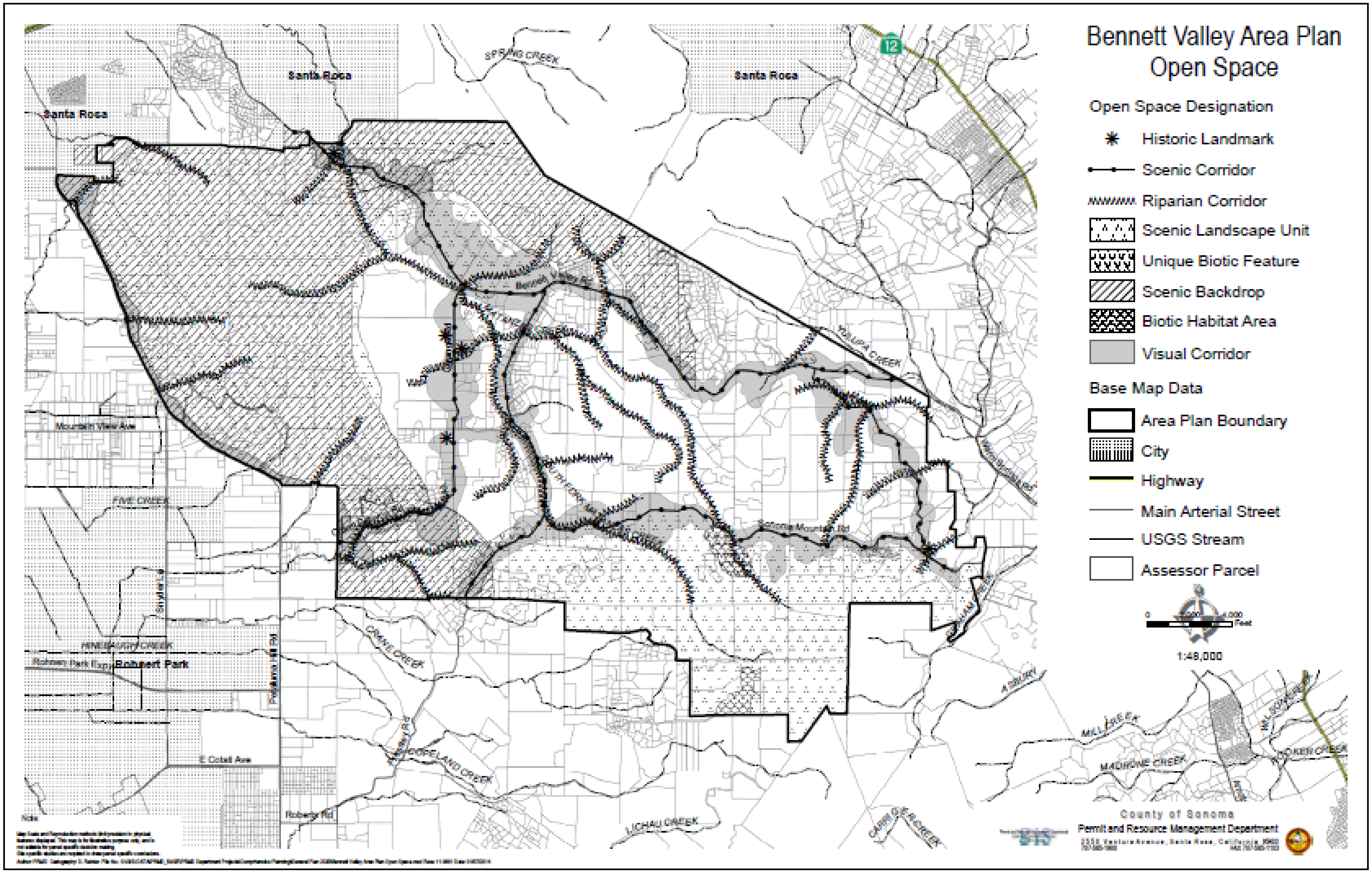
M. Enterprise Road Area: D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; F-1, 2; G-1, 2; H-1, 2; I-1

N. Bennett Ridge: A-2; C-2; D-1, 2, 3, 4; E-1, 2, 3, 4, 5, 6, 7; H-1; I-1

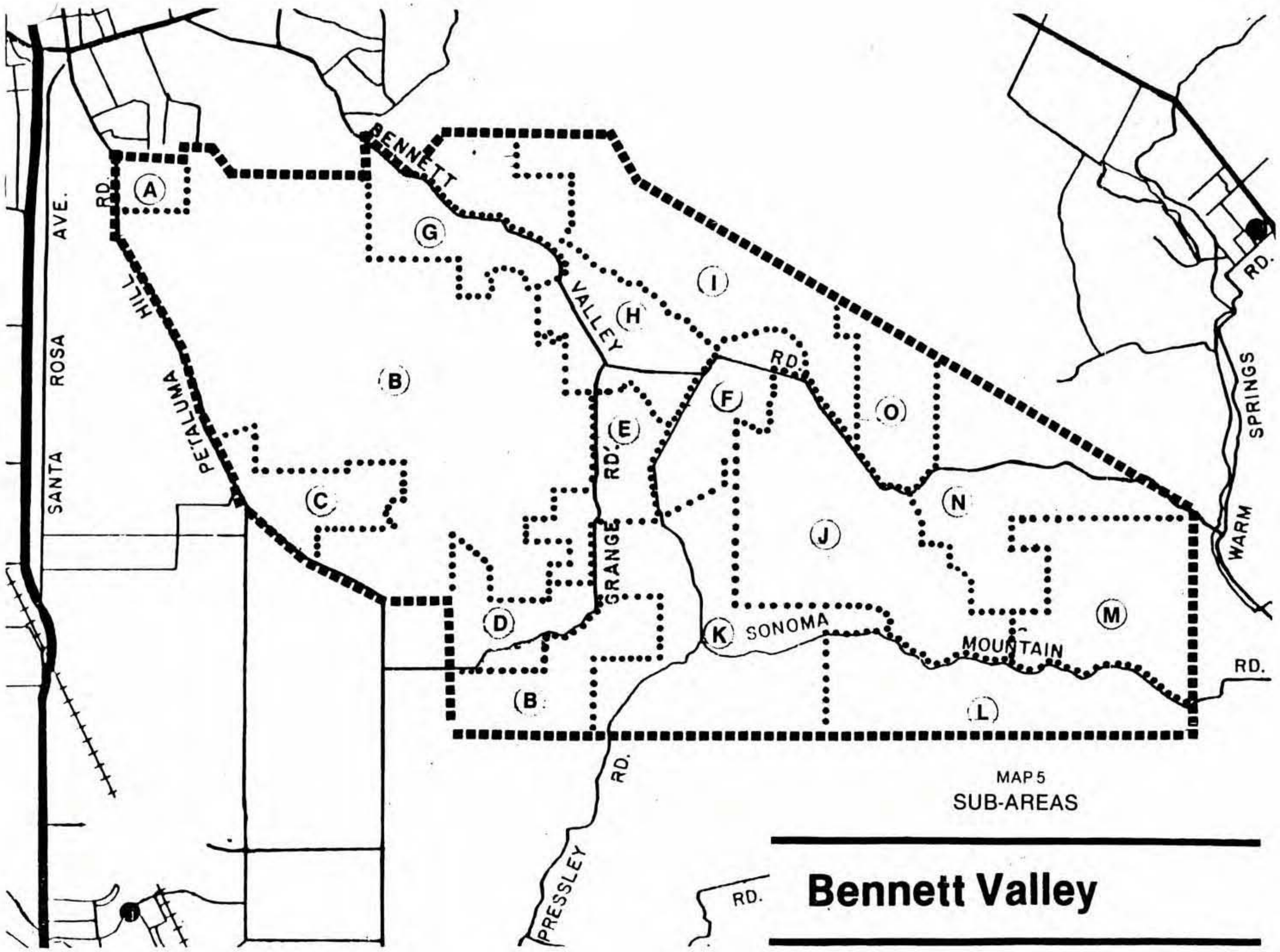
Map Bennett Valley Area Plan Land Use



Map - Bennett Valley Area Plan Open Space Map



Map - Bennett Valley Area Plan Sub Areas



PLAN IMPLEMENTATION TOOLS

Mechanisms in addition to zoning are needed to achieve the desired goals of a Land Use Plan. The mitigations specifically related to the subarea analysis are some of the implementation measures. Specific standards for development will also implement the goals and policies of this Plan. The following section addresses Development Guidelines, Public Service Standards, other techniques and Development Staging.

BENNETT VALLEY DEVELOPMENT GUIDELINES

DESIGN REVIEW COMMITTEE

To insure the adherence to the goals and policies set forth in this study, the Board of Supervisors should establish a Design Review Committee to advise the County regarding development within the Bennett Valley study area. All properties depicted on the Area Subject to Design Review Map shall be subject to these guidelines. However, properties outside of the Bennett Valley Area Plan boundary shall not be subject to other goals, policies and implementation measures set forth in this Area Plan.

(1) The Bennett Valley/North Sonoma Mountain Design Review Committee shall consist of seven (7) members who shall be residents of the Area Subject to Design Review as depicted on Figure B. Members shall be appointed by the Board of Supervisors which shall take into consideration expertise in architecture, landscape architecture, site planning, engineering or other similar fields.

(2) All meetings of the Bennett Valley/North Sonoma Mountain Design Review Committee shall be open to the public, and interested Bennett Valley/North Sonoma Mountain area residents shall be encouraged to attend sessions.

(3) The Bennett Valley/North Sonoma Mountain Design Review Committee shall review the siting and design of subdivisions and single-family dwellings within the area depicted on Figure A except that after the Committee has reviewed a subdivision, individual single-family dwellings within that subdivision need not be reviewed a second time.

(4) Advisory decisions by the Bennett Valley/North Sonoma Mountain Design Review Committee shall be made in writing to the Planning Director.

(5) The following findings shall be made for any project recommended for approval by the Committee or ultimately approved by the Planning Director.

   a. That the site is adequate in size and shape to accommodate the proposed use.

   b. That private streets and driveways, both existing and proposed, are properly designed and located to carry the type and quantity of traffic generated by the proposed use and to minimize visual impact.

   c. That approval of the proposed use at the proposed site will have no significant adverse effect on adjacent property.

   d. That the proposed use is consistent with the County General Plan, and where applicable, the Bennett Valley Area Plan.

e. That the minimum requirements are met with respect to:

i. Visual/scenic corridor, riparian corridor, scenic landscape unit and critical habitat and unique biotic feature setbacks.

ii. Height and location of fences and walls.

iii. Controlling erosion and screening structures with landscaping.

iv. Other conditions to insure conformity with the intent and purpose of this plan, where applicable.

If the Design Review Committee recommendation results in staff refusal to sign off the building permit, an applicant may appeal in the same manner provided for in Chapter 26 of the Sonoma County Code.

STANDARDS - APPLICATION

Review of any proposed development should consider each of the standards described below. Each standard should be applied to the maximum extent feasible, recognizing that in some cases these standards when applied to a particular project may be contradictory. General Plan policies shall apply where the development guidelines conflict with the General Plan. The Design Review Committee should consider the total impact of the project in determining the extent to which each standard should be applied.

(1) It is the policy of this study to preserve the natural state of the land and vegetation.

(2) Structures shall blend with the existing landscape and vegetation to the maximum feasible extent. Therefore, minimum setbacks shall be consistent with the Sonoma County Subdivision Ordinance, the General Plan, or where applicable, with the adopted Bennett Valley Area Plan, whichever is more restrictive. No new structure shall be sited within visual/scenic corridors, riparian corridors or unique biotic resource areas as designated on the Critical Open Space Plan Map of the Bennett Valley Area Plan, where applicable, except in the visual/scenic corridor where the entire parcel is included within such designation or except in the visual/scenic corridor where said structure is a fence or agricultural appurtenance. Where the entire parcel is included in a visual/scenic corridor area, or where said structure is an agricultural appurtenance greater than 200 sq. ft., the Bennett Valley/North Sonoma Mountain Design Review Committee shall condition the approval of such structure(s) to mitigate adverse effects to the open space resource. In considering mitigation measures on agricultural appurtenances, the Design Review Committee will give priority to the needs of productive agriculture. A fence or agricultural appurtenance less than 200 square feet is permitted without design review.

(3) Site plans shall be presented to the Bennett Valley/North Sonoma Mountain Design Review Committee including:

a. An existing topographic map
b. An existing vegetation plan
c. Photographs of the site from four (4) directions
d. A proposed grading plan (if any)
e. A proposed landscape plan
f. A plan showing siting, bulk, design, color and materials of structures.

(4) Approval of plans for new structures shall consider the relationships of the site.

(5) All new structures shall be sited so that they harmonize with the natural surroundings, including but not limited to topography and vegetation; specifically

a. Roof lines shall follow established lines of land and/or tree forms;

b. Existing vegetation and landforms shall be utilized to screen structures from public view.

(6) New structures should be sited to take advantage of solar energy where that siting does not conflict with the public view.

(7) Structures shall utilize color, texture and materials that blend harmoniously with surrounding landscape. The following are recommended for harmonious development:

a. Materials: natural wood siding or shingles and natural stone for exteriors;

b. Colors: earth tone;

c. Roofing: fire resistant but dark toned if visible;

d. Roofline: considered in relationship to the total composition of structure with landscape.

(8) Utilities shall be placed underground from source point, unless masked by existing vegetation.

(9) Project outdoor lighting shall comply with the outdoor lighting policies of the General Plan Open Space and Resource Conservation Element.

(10) Existing structures shall be encouraged to comply with the standards for new structures as they undergo remodeling and maintenance.

(11) Existing neighborhoods shall be encouraged to undertake tree planting and landscaping programs to screen existing development from public view and to increase the privacy, comfort and habitability of the neighborhood (Chart 1).

Chart 1 SOIL PLANTING MATRIX

PLANTING CHOICES	MAJOR SOIL GROUPINGS IN BENNETT VALLEY					
		A	C	D	E	G
A. Choice of plants NOT LIMITED BY SOILS. Soils are deep through very deep, moderately coarse through medium textured, moderately well through well drained, moderately rapidly through moderately slowly permeable. (Soils in this group can have slight salinity or alkalinity).	Akc	x				
	Bof	x				
	Cca		x			
	Ccb		x			
	DbE		x			
	GgE	x				
	GgG	x				
C. Choice of plants LIMITED BY FINE TEXTURES. Soils are deep through very deep, moderately fine through fine textured, moderately well drained, moderately slowly through slowly permeable.	GlD					x
	GlE					x
	GlF					x
	GoF					x
	HcC			x		
D. Choice of plants LIMITED BY VERY SLOWLY PERMEABLE (CLAYPAN) SUBSOILS. Soils are moderately well drained, with slow or very slow subsoil permeability.	HcD			x		
	LaC	x				
	LaD	x				
	LuA	x				
E. Choice of plants LIMITED BY WETNESS. Soils are somewhat poorly through very poorly drained. (Drained soil phases will be placed in appropriate group according to their current drainage status. Slight salinity and/or alkalinity may be present).	LvB	x				
	MbC	x				
	PeC	x				
	Phb	x				
	PlC	x		x		
	PsC			x		
G. Choice of plants LIMITED BY DEPTH. Soils are shallow through moderately deep, well drained, over hardpan, bedrock, or other unfractured reuse material.	RaC		x			
	RaD		x			
	RaE		x			
	RnA				x	
	SkC			x		
	SkE			x		
	SkF			x		
	ToE					x
	TuE					x
	YsA	x				
	ZaA	x				
	ZaB	x				

PUBLIC SERVICE STANDARDS

To maintain present standards for the schools, redistricting the elementary school boundary to take advantage of Bellevue Union's declining enrollment, relieve Bennett Valley Union's overcrowding and converting bus service to a self-supporting entity by requiring a fare should be considered.

The cumulative impact of additional development on the school system should be completely analyzed in the consideration of major and minor subdivisions and rezonings.

The Sheriff's Department foresees no need to expand facilities as a result of increased development. The Fire Department, however, will require at least an additional pumper and another firefighter. The present revenue base is not sufficient to provide the additional equipment and staff will not be funded. Other revenue sources will need to be sought.

At the densities proposed, the capacity of the roads should not be exceeded. Improvements to roads other than safety and maintenance will occur if, and only if supported by the local residents, and if designated in the General Plan Circulation and Transit Element. If road improvements are desired, funding will be generated by development fees, trust funds, state and federal government funding, or combination of these. In the case of conflict of policies of standards between the Bennett Valley Area Plan and the General Plan, the more restrictive policies or standards shall apply.

If tax revenues are insufficient to support present public service standards for future development, and if the public wishes to maintain these standards, alternative sources of funding must be generated. Both Trust Funds and Assessment Districts can be used to provide fund for schools, fire departments, roads and landscaping.

Trust Funds are a one-time assessment that can be established by the Board of Supervisors without a vote of the people. They are not expensive to administer and they place the fiscal burden on new development. Trust Funds are most appropriate for providing for one time capital expenditures.

The following procedure should be utilized to implement road trust funds:

(1) Determine condition of roads.

(2) Determine minimum facility that would be required by development allowed in Land Use Plan and compute cost of facility.

(3) Develop a factor for a County share of road costs based on factors such as through traffic and typical maintenance costs before development.

(4) Assess a per lot fee based on total construction costs minus county share of such costs, divided by the number of potential building sites.

(5) Lot fee would be due and payable at the time of lot sale (lots in excess of 100 acres would be exempt).

Assessment Districts also generate revenues. They are taxing jurisdictions established for a particular purpose by a two-thirds vote of the residents involved. They are both expensive and difficult to establish particularly with the new taxation requirements of Jarvis-Gann, and place the burden of the assessment on the entire district, rather than the new development. Assessment Districts are continual sources of funds which can provide for ongoing operational expenditures.

Provision of permanent Open Space is a major objective of this plan. The Land Conservation Act of 1967 as amended provides a property incentive for Open Space Easements, if the County makes the findings that the preservation of the land as open space is consistent with the General Plan and is in the best interests of the County.

Permanently dedicated Open Space can also be preserved and qualify for income and estate tax benefits if the landowner deeds development rights or property to the Sonoma Land Trust.

Where land is not voluntarily restricted from development, preservation of other unique resources in complex. Sensitive archaeologic sites and biotic communities could be irreversibly damaged if adequate precautions are not exercised. Specific designation of such sensitive areas might result in their destruction; thus, in concert with County policy, sensitive archaeologic and biotic sites are mapped in a generalized way. Any development proposals that fall in one of the mapped locations will be referred to the appropriate experts for further investigation and mitigation as part of the project level CEQA review.

YOLO COUNTY
FARM BUREAU

Yolo County Farm Bureau

P O Box 1556, Woodland CA 95776
530.662.6316 O * 530.662.8611 F
www.yolofarmbureau.org

PRESIDENT
Joe F. Martinez
1ST VICE PRESIDENT
Garrett Driver
2nd VICE PRESIDENT
Mike Hall
SECRETARY & TREASURER
Denise Sagara

March 8, 2021

Yolo County Board of Supervisors
ATTN: Jim Provenza, Chair
625 Court Street
Woodland, CA 95695

RE: Draft Cannabis Land Use Ordinance
Review March 9, 2021

Dear Supervisor Provenza;

Yolo County Farm Bureau (YCFB) is here to once again comment that we do not believe that this Cannabis Land Use Ordinance (CLUO) is "ready for prime time".

YCFB has raised many issues since this process started over 4 years ago. I am making only five points today – all of which you have heard before. YCFB requests that the appropriate county legislative bodies, the Board of Supervisors and the Planning Commission rethink the direction in which the County is going.

POINT 1: The EIR should have had a base line of NO CANNABIS (other than the six plant personal use authorized under CA Law). Preparing a comprehensive document by injecting a "given" of dozens of permitted grows distorted the entire process. The perception to the rest of us is that the County's development process for the CLUO was cannabis grower/processor driven.

POINT 2: We – Yolo County Farmers and Ranchers of traditional crops do not consider cannabis agriculture although we recognize it is so described in State law. There are many incompatibilities between cannabis and neighboring or nearby traditional Yolo County crops as I outline.

POINT 3: The disparity in value between cannabis and traditional crops creates seeds of incompatibility that can lead to the inability of the neighboring traditional farmer being able to continue farming. Example: value of an acre of cannabis - $1M. Value of an acre of almonds - $6,000. You need to remember that cannabis is a "No pesticide residue" crop. For instance: pesticides can be put on a neighboring crop according to law – but – testing could show residue on the cannabis grow. And, farmers create dust. However, when dust gets on a neighbor's outdoor cannabis crop the traditional farmer is told the crop has lost value, and he/she is threatened or sued. Insurance is expensive and may not be available at a cost the farmer can afford. In some areas of the State we are seeing cannabis growers use tort law to sue their neighbors. There are instances where pesticide applicators will not apply pesticides for fear a neighboring cannabis grow might be impacted – thus, the traditional farmer may not be able to protect his crop and may lose it. We add that Cannabis can be grown in pots – completely enclosed in space that does not let outside air in or inside air out. The ideal location for all cannabis operations is indoors, in restricted inside air conditions, and in industrial zones located in or near cities. We believe that the DEIR did not cover this value disparity/ incompatibility and inside option adequately.

POINT 4: The FEIR offers a 1,000 foot buffer from a cannabis grow (we note that there are excellent arguments that the buffer should run from any part of the cannabis operation because of the issues they create) to a residence on 20 acres or less, and a 200 foot buffer to a residence located on an ag zoned parcel of over 20 acres. The FEIR justifies this distinction by noting that the house on the "ag zoned" parcel is "incidental" to the ag use and therefore should not expect to be insulated from incidents of "agriculture". Again, in Yolo County cannabis is not a traditional crop. No farmer should have to accept cannabis as a very close neighbor because the State has decided to so categorize it. We also note that the 1,000 feet buffer is a minimum and it must run to the property line --- not include the neighbor's land adjacent to his/her residence. Otherwise, the cannabis grower is "taking" the neighbor's land without paying for it.

POINT 5: we believe that cannabis growers should have the burden of themselves paying for the added risk to neighbors. You all know from the crime statistics that cannabis brings in people with questionable backgrounds. Our members have told us that they have cannabis connected trespass/thievery issues that cause problems. Cannabis growers have security: guard dogs, armed guards, intensive and intrusive lighting to protect their operations. However, the main focus of cannabis security plans should be the neighbors. Thus, cannabis operations should have to provide the county sheriff with a security plan that is focused on protecting those neighbors. They should pay for policies of insurance with reasonable and inflation adjusted limits to protect those neighbors from harm and loss. They should not be able to start any operations until the sheriff has accepted and signed off on an individual plan. The added policing required by these operations should not be the responsibility of the property tax payers of Yolo County.

Sincerely,

Joe Martinez

Joe F. Martinez
President

Cc: County Supervisors
Patrick Blacklock, CEO
Taro Echiburu, Yolo County Community Services
Leslie Lindbo, Yolo County Chief Assistant Department Director
California Farm Bureau Federation

From: Moira Jacobs
To: Crystal Acker; Cannabis
Cc: Susan Gorin
Subject: Scoping for Cannabis Ordinance
Date: Thursday, March 23, 2023 3:52:07 PM

EXTERNAL

Via email:
Crystal Acker, Sonoma County Supervising Planner
(crystal.acker@sonoma-county.org) cannabis@sonoma-county.org

Re: Scoping for Cannabis Ordinance—
Designation of Bennett Valley as an exclusion zone where commercial cannabis operations are prohibited

Dear Crystal Acker,

I'm writing here as an individual resident per the above.

I urge the EIR scoping process fully research and analyze the parcel map of Bennett Valley in detail. It must be fully analyzed in regards to the rural residential (RR) parcels under 20 acres and the various neighborhoods with concentrated RR parcels in clusters (eg Bennett Ridge, Hidden Acres, Woodside, Batesole Rd., Jamison Rd, Matanzas Creek Ln, Warehill Rd, and the many other narrow rural lanes with concentrations of RR parcels under 20 acres). These are mostly all family residences, some with very small family vineyards or small scaled livestock keepers.

The issue of marijuana odor must be researched and analyzed, and how it interferes with all the Bennett Valley private property owners from their right to enjoy their property free of noxious fumes.

I believe your consultants will find about 20-30 (or more) distinct neighborhoods of residential properties where the siting of commercial marijuana operations nearby (under 1,000 feet from property lines) is not advisable due to odor transference alone. These residential neighborhoods are distributed across Bennett Valley and separated by the few remaining larger parcels.

If an outdoor commercial marijuana operation is sited anywhere near these neighborhoods (under 1,000 feet), the residents will suffer loss of use for their property and likely devaluation of their property. This is another reason why Bennett Valley should be studied as and granted an exclusion zone from commercial marijuana production operations. Our geography is simply unsuitable for such large commercial marijuana operations.

As you may know, the Bennett Valley Area Plan, in place since 1979, protects this area and the preservation of its rural residential character. Commercial operations of any kind are not appropriate to the geography, landscape, wildlife corridors, flora or fauna.

As an individual resident I also concur with the many letters sent by all the other Bennett Valley community groups and urge the County to designate Bennett Valley exclusion zone status.

Thank you,
Moira Jacobs

From:	Virginia Hair
To:	Cannabis; Crystal Acker
Cc:	David Rabbitt
Subject:	Scoping Letter Regarding NOP for the EIR for the Sonoma County Cannabis Ordinance
Date:	Thursday, March 23, 2023 12:47:27 PM

EXTERNAL

To Whom It May Concern:
Goals:
My personal goal is the elimination of all cannabis cultivation in Sonoma County. The County is required to protect my health, safety and general welfare. Allowing any cannabis cultivation near my residence violates this sacred trust as it endangers my health, safety and general welfare.

Otherwise:

- The County must update the General Plan before they even begin to draft or adopt an EIR or a new Cannabis Program or Ordinance.
- No Mitigations can reduce the Negative Impacts of cannabis cultivation near any residence.
- Limit cannabis cultivation and processing to areas that do not create noise, lighting or odor nuisances for residences; are not in public view; and are not in impaired watersheds, not near unincorporated towns where their only source of water is wells, not in high fire risk zones, and not in areas without fire safe roads.
- Limit cannabis cultivation only to indoor permanent greenhouse facilities on commercial or industrial zoned lands.
- Limit cannabis processing only to designated commercial and industrial zoned lands.
- Do not allow cannabis cultivation within five miles of any unincorporated towns in Sonoma County.
- Do not allow Ministerial Permits. All permits should only be allowed through the Conditional Use Permit Process and must require Public Notification and Hearings.
- Do not allow any events or tourism at cannabis cultivation or processing sites.
- Do not classify cannabis as an agricultural crop. It is an agricultural product that has harmful effects to both humans and animals and it is addictive.
- Seed dispersal and the harmful effects of cannabis to nearby farm animals or pets needs to be studied in the EIR.

For the County and the Public to be able to make an informed decision on all aspects of the Cannabis Program, the County must study the full range of options. Therefore, two additional Project Description Alternatives should be prepared, in addition to what is proposed in the Notice of Preparation (NOP) for the Environmental Impact Report (EIR).
Add the following Project Description Alternatives:

1. To significantly reduce the size, type and scope of cannabis cultivation in Sonoma County.
2. The elimination of all cannabis cultivation in the County.

Finally, I support the “Bloomfield Comments…” document submitted to Crystal Acker at Sonoma County by Veva Edelson and Vi Strain on behalf of the Concerned Citizens of Bloomfield (CCOB).

Thank you for your service.
Sincerely, Virginia Hair

From:	Katy Mangan
To:	Cannabis
Subject:	Re: Cannabis letter
Date:	Friday, March 24, 2023 7:43:03 AM
Attachments:	image001.png image002.png image003.png image004.png Cannabis letter 3-23-23.pdf

EXTERNAL

Dear Crystal,

Thank you for the opportunity to re-send my letter as a pdf.

Katy Mangan
Storyteller
707-483-4873

From: Cannabis <Cannabis@sonoma-county.org>
Sent: Friday, March 24, 2023 7:26 AM
To: Katy Mangan <katymangan@msn.com>
Subject: RE: Cannabis letter

Katy, This letter doesn’t open. Please re-send.

Crystal Acker, M.S.
Supervising Planner
Planning Division | Project Review
sonomacounty.ca.gov/cannabis-program
Sign up for Cannabis Program Updates

www.PermitSonoma.org
County of Sonoma
2550 Ventura Avenue, Santa Rosa, CA 95403
Direct: 707-565-8357 |
Office: 707-565-1900 | Fax: 707-565-1103

From: Katy Mangan <katymangan@msn.com>

Sent: March 23, 2023 5:00 PM
To: Cannabis <Cannabis@sonoma-county.org>
Subject: Cannabis letter

EXTERNAL

Katy Mangan
Storyteller
707-483-4873

THIS EMAIL ORIGINATED OUTSIDE OF THE SONOMA COUNTY EMAIL SYSTEM.
Warning: If you don’t know this email sender or the email is unexpected,
do not click any web links, attachments, and never give out your user ID or password.

Date: March 23, 2023

To: **cannabis@sonoma-county.org**

Subject: EIR Cannabis / Scoping Comments – recommendations for study

Dear Cannabis Sonoma County

In response to the "Notice of Preparation and Program EIR Public Scoping", the following comments are provided and are strongly recommended for study in the Sonoma County Comprehensive Cannabis Update:

1. Neighborhood Compatibility –The topic of Neighborhood Compatibility has been a difficult topic for all parties - Growers, residents, and County staff. The inability to successfully address this issue is one of the main reasons for this EIR. Neighborhood Compatibility has been the largest stumbling block of the current Ordinance and the new Ordinance will only be successful if this is properly addressed. A commercial operation of high value product is incompatible with a residential neighborhood. We ask the County to study and establish the proper neighborhood separation criteria to safeguard the neighbors and allow the grower to conduct their business. At a minimum the criteria should consider odor, safety (including crime, road access and wildfire), water (especially sustainable groundwater usage), visual and noise impacts.
2. Environmental sustainable standards- The County should study and establish standards that assure cannabis operations are environmentally sustainable and meet Sonoma County climate goals. These includes 100% renewable energy; Greenhouse Gas neutral; water sustainable used (no groundwater overdraft, no streamflow depletion, no net use of water, no cultivation in water scarce areas); hazardous fertilizers and waste do not pollute the environment and are properly disposed of; air quality is not compromised; and negative cumulative impacts are not allowed.
3. Setbacks- The County should study and establish sufficient setback standards so that neighboring properties are not impacted. Sonoma County Ordinance has 1000-foot setbacks from schools, parks, etc. Further it states "… children are sensitive populations". Given the fact that children spend a larger percentage of their time at home than they do at school, it makes sense to have the same 1000-foot setbacks at home (currently 100 ft.) implemented (from the property line).
4. Zoning: The proposed scope includes expanding cannabis cultivation onto residential zoned parcels (Zoned AR and RR) and onto smaller parcel sizes. This should not be allowed and is completely against the general public's wishes. In 2017, in response to the public outcry over growing in such residential areas in close proximity to neighboring homes, the Board of Supervisor amendment the ordinance to remove these non-Agricultural parcels (zoned AR and RR) and increase the parcel size to 10 acres. The AR & RR areas are primarily residential now and as such are very incompatible. The 10 acre minimum is insufficient to provide the necessary separation between the growers and families. A 20 acre minimum and a 1,000 foot setback from the property lines is needed to eliminate the majority of neighborhood complaints. There is plenty of Agriculture land to accommodate the growers.
5. Water- The recent rains are a welcome relief, but our officials continue to recommend caution long term. Sonoma County Crop report acknowledge the problem: The USDA designates Sonoma County as "D4: Extraordinary Drought " with 2021 considered

Sonoma County's worst drought year on record. Along with 3 of last 4 years have been the driest on record. Sonoma County has not updated its water studies for decades, does not understand the impacts of the new norm of global warms/droughts, the effects of increased population growth and uses, and does not know the cumulative impacts. Now consider that cannabis is one of the thirstiest crops (3 to 6 times more than grapes depending on the study). These two facts point to a long conflict and challenge with growing cannabis in Sonoma County. The County should analyze the current water availability and usage levels by area, to assure rural residential wells will not be impacted. Analyze prohibiting cannabis in water scare areas. Analyze prohibiting cannabis in areas where fish and wildlife would be impacted. Most rural residences are on wells with minimal water use compared to cannabis. We can't afford large users with the resources to drill deeper wells adjacent to our residential wells

6. Ministerial permitting: The scoping document calls for this fast track permitting process, which removes public input. This process should not be allowed or only allowed in rare circumstances under the strictest criteria. Since no public input is allowed, the required standards should be higher than what the general ordinance requires under the normal process (full review with public comment). For example there should be no homes nearby (1500 setback verse 1000), the parcel size is larger (20 verse 10 acres), in industrial zoned land (where all city services are available), etc.
7. The current proposed scope requires no minimum parcel size and minimum setback from neighboring homes. The EIR should study and establish the minimum thresholds to protect surrounding neighborhoods. 20 acre minimums should be studied. 1000-1500 ft. setbacks should be studied.
8. Inclusion zones- the EIR scope proposes the establishment inclusion zones, inside of which homeowners would lose their right to contest a commercial cultivation operation nearby. The County should study and establish rules and conditions under which such neighbors can participate/vote on establishing such zone, the level of protections provided, and if any compensation is necessary for loss of property value.

The Sonoma County EIR study and final Ordinance must successfully address these issues. Only then will nearby citizens' rights to health, safety and peaceful enjoyment of their properties be ensured.

Thank you

Catherine Mangan

2870 Rollo Road

Santa Rosa CA 95404

Date: March xx, 2023

To: **cannabis@sonoma-county.org**

Subject: NOP for EIR Cannabis: Scoping Comments for **Neighborhood Compatibility**

Dear Cannabis Sonoma County,

In support of the Count's efforts, Neighbors of West County(NOW) is providing the following recommendations for study in the EIR and incorporation into the final Cannabis Ordinance. The following comments are provided specifically to the Neighborhood Compatibility (NC) requirement called out in the Project Description of the NOP scope document issued Feb 6, 2023. For over five years, the community has submitted substantive evidence into the record as to the need for an ordinance that addresses Neighborhood Compatibility and it is great the Framework/NOP now recognizes this as a top priority. As we know the topic of Neighborhood Compatibility (NC) has been a difficult topic for all parties - Growers, residents, and County staff. The inability to successfully address this issue is one of the main reasons for this EIR. Neighborhood Compatibility has been one of the largest stumbling blocks of the current Ordinance and the new Ordinance will only be successful if this is properly addressed.

The analysis of Neighborhood Compatibility must address the most critical issue to our health, safety and the peaceful enjoyment of our properties. Commercial operations that have a high value product are incompatible with residential neighborhoods. The recent increase in cannabis burglaries, weapons and high speed pursuits brings home this point. The County Ordinance must include neighborhood separation criteria that ensures sufficient separation of a commercial operation from a residential type neighborhood that, at a minimum, considers odor, groundwater, visual, safety (including crime, road access and wildfire), and noise impacts. Setbacks of 1000 ft. and 20 acre minimum parcel size should be studied and required.

The EIR portion of this process focuses on the 19 environmental elements required by CEQA. Although Neighborhood Compatibly is not called out specifically, its requirement is covered in many of these elements so needs to be addressed and resolved. These CEQA Environmental elements include: Aesthetics/Visual, Air Quality, Hazardous Materials and waste, Hydrology and Water quality, Land use/planning inclusive of compatibility with existing communities, Noise, Public Services including crime and neighborhood safety, wildfires and cumulative impacts.

Finally, the CAG (Cannabis Advisory Group), which was comprised mainly of growers, pointed out in their March 2018 report to the BOS: "Many rural landowners are upset with the influx of cannabis operations and permit applications in their neighborhoods. They are upset for a variety of reasons: environmental concerns, access concerns, concerns about odor, crime, aesthetics, and the onset of commercial activity in a serene rural residential setting…..**The residential character of the area would be significantly compromised by the installation of a commercial cannabis cultivation operation**…." . Considering the industry's acknowledgement on the Adjacency issue, we loudly encourage the County to study during the CEQA process and ultimately incorporate NC standards into the final ordinance that protect the average citizens way of life. This will ensure nearby property owners rights to health, safety and peaceful enjoyment of their properties.

Thank you

EXCLUSION ZONES AND ZONING CHANGES – Example letter

Dear Sonoma County Cannabis

Although it is inconceivable to me that the Board, with or without an EIR, would allow ***any type*** of commercial cannabis cultivation in the Bennett Ridge neighborhood (which is in a Rural Residential Zoning District and included in the Bennett Valley Area Plan), in an abundance of caution I am providing these comments.

As you are undoubtedly aware, the current Cannabis Ordinance restricts any type of commercial cultivation in the Rural Residential Zoning District (RR District) I urge that this prohibition continue and that it be made clear from the beginning of this process that the RR districts are off limits to ***any*** type of commercial cannabis cultivation.

Short of that, I ask that the following residential neighborhood be designated as an Exclusion Zone: **Bennett Ridge Neighborhood consisting of properties located on Old Bennett Ridge Road, Bardy Road, Rollo Road, and Bennett Ridge Road.**

Also, analyze neighborhood areas and designate all neighborhood areas as exclusion zones where any residential neighborhood meets any one of the following criteria:

(1) residential neighborhoods that relies on a mutual water system

(2) residential neighborhoods and areas in the Rural Residential Zoning District where any parcel is less than 10 acres

(3) neighborhoods and areas whose CC&Rs are inconsistent with or do not allow cannabis cultivation

(4) areas where the roads are inadequate, including shared access private roads and roads so narrow that vehicles cannot safely pass each other at the same time and areas where there is only one way in and one way out.

(5) areas where water supply is inadequate, including mutual water systems, water zones 3 and 4, and portions of water zone 2 that have experienced water shortage in drought.

(6) areas that are in a high fire or very high severity zone designated by any competent authority such as the Board of Forestry, Sonoma County Community Wildfire Protection Plan, or the Public Utilities Commission.

(7) areas where commercial cannabis activity is detrimental to the residential character of a neighborhood.

(8) areas where the primary residential nature is to be preserved, especially where four or more contiguous parcels under 10 acres in size are grouped together.

(9) areas in traditional agriculture-zoned area's that are now primarily residential in nature. • Areas where the scenic vistas or character are to be preserved.

(10) areas where law enforcement is inadequate because average response times are more than 20 minutes.

(11) areas where there is strong local resistance to commercial cannabis activity.

(12) areas where the Board determines that it is in the public interest to prohibit commercial cannabis activity.

For your information I have attached a petition from the Board of Directors of the Bennett Ridge Community Association that has previously been provided.

Thank you for your attention.

Re: Sonoma County Comprehensive Cannabis Program Update

Comment on Notice of Preparation of EIR - Economic Analysis

The Framework for the revised cannabis ordinance (March 2022) includes an economic analysis "to help inform relevant policy decisions."

Study, confirm or refute the HdL economic report released March 2023. https://sonoma-county.legistar.com/View.ashx?M=F&ID=11658055&GUID=9AF6DE4F-C9BA-4C84-B3E6-313B573F0575

Include the following criteria in the economic analysis:

Include a robust and credible baseline financial and economic analysis of all aspects of the cannabis industry operations including: Cultivation (Outdoor, Mixed light, Indoor). Processing. Manufacturing, Testing, Retail (Dispensaries, Delivery)

Analyze cultivation operations of various sizes and types (outdoor; indoor; mixed light). Evaluate Sonoma County's commercial cannabis cultivation operations viability in relation to the statewide cannabis industry, both legal and illegal. Evaluate state viability for future federal legalization. Evaluate expected revenues derived from taxes, fines for violations, permit and inspection fees, etc. Include all expenses and costs incurred by all County departments (including Sherriff and Courts) involved in implementing and administrating the program.

Ascertain if there would be sufficient income from all cannabis operations to meet the County's legal and promised obligations to establish and maintain the required education, health, and safety programs as required by Proposition 64. Analyze potential future health expenses.

Analyze the economic impact of county and state payments to growers due to disaster losses (flood/drought/fire)

Analyze whether economic benefits of outdoor cultivation outweigh the negative impacts on neighborhoods and the environment.

Analyze if revenue will support services needed including but not limited to staffing costs to implement the program, including permitting, compliance inspection, and code enforcement; permit and inspection fees and other applicant-incurred costs to obtain permits and run permitted operations; and civil penalties. Determine if the product pays for itself with reduced revenues.

Analyze impacts to public services such as landfill costs resulting from disposal of waste from the various cannabis operations.

Analyze the impact of canna-tourism on the current revenue from the Transit Occupancy Tax. Napa County concluded that canna-tourism would undermine existing tourism and harm its tax base. Study and compare Napa report. https://www.winebusiness.com/content/file/9111_Report_082019.pdf
with Sonoma County.

Analyze how canna-tourism and wine tourism might overlap and dangers to public safety due to known augmented intoxication from combining cannabis with alcohol.

Study two additional policy options:

1) significantly reducing the size, type, and scope of cannabis cultivation

2) the elimination of ALL cultivation in the County.

Present the full range of policy options.

Subject: Re: Is cannabis a failing business in CA?

Thank you for sending the 'Bulwark' article which well outlines some of the negative environmental impacts of marijuana cultivation. The text should be made part of the record for preparation of the Sonoma County Marijuana EIR so that the environmental impacts set forth in the article can be fully addressed in the EIR.

These negative impacts include:

Noxious odor effect workers and nearby residents with need to establish safe set-back requirements between grow operations and nearby residents and, public and private facilities;

Grow shelters cover farm land and cause visual pollution making marijuana cultivation more industrial than agricultural;

Regulations of marijuana cultivation are very difficult to enforce;

Local legal marijuana cultivation is not currently and may never be financially viable;

Sonoma County is unlikely to receive meaningful tax receipts so that enforcement expenses will exceed revenue;

Marijuana cultivation negatively affects local agriculture, the tourist industry and the wine industry by emission of noxious odor, farmland coverage by unsightly grow structures, diversion of agricultural workers and use of scarce resources;

Marijuana cultivation is a health hazard to workers;

Large-scale commercial marijuana cultivation puts small growers out of business;

The marijuana industry may be exerting undue political influence on elected public officials;

Marijuana cultivation negatively impacts scarce water resources and increases fire danger.

Appendix B

Draft Cannabis Program Ordinance

The complete Agricultural Resources Element of the Sonoma County General Plan is available on the General Plan – Agricultural Resources webpage.

Excerpts which include proposed amendments to the Agricultural Resources Element are as follows:

2.1 ASSIST IN THE MARKETING AND PROMOTION OF SONOMA COUNTY'S AGRICULTURAL PRODUCTS

Objective AR-1.2:

Permit marketing of products grown and/or processed in Sonoma County in all areas designated for agricultural use **in compliance with applicable state regulations, including restrictions placed on cannabis advertising by the Department of Cannabis Control.**

2.4 AGRICULTURAL USES IN DESIGNATED AGRICULTURAL PRODUCTION AREAS

Both on the urban fringe and in the midst of agricultural areas, parcelization has occurred which has resulted in residential use being the primary use of the land. Complaints about noise, odors, flies, spraying and similar "nuisances" attendant to agricultural practices have discouraged and sometimes prevented farmers from managing their operations in an efficient and economic manner. Not only do residents complain about aspects of farming operations, but residential areas often directly affect the operations. ~~**For example, residential sites can become a sanctuary for pests which could damage adjacent crops. Clear policy is needed operations.**~~ For example, residential sites can become a sanctuary for pests which could damage adjacent crops. Clear policy is needed for County decision makers to balance the needs of the farmer with the concerns of ~~**his or her many**~~ residential neighbors.

Cannabis is unique from other agricultural crops as it is classified as a controlled substance under the Controlled Substances Act and its production and use are prohibited under federal law. Largely due to this classification, the County initially defined cannabis as an agricultural product separately from other agricultural crops, and existing policies for agriculture and agriculture-related activities did not directly apply to cannabis. However, with the permitting and regulation of cannabis, the County finds that cannabis production has many similarities to traditional agricultural production and is more appropriately recognized as an agricultural use. Still, due to its federal classification, highly regulated status, and the complicated and evolving public sentiment around the crop and its classification, it is best categorized as a controlled agricultural crop that is at times subject to unique regulations to protect public health and safety.

While cannabis cultivation is not new to Sonoma County, it was only first regulated and permitted on agricultural lands in 2017, following State legislation (Medical Cannabis Regulation and Safety Act of 2015) and a State ballot initiative legalizing commercial medical and adult use cannabis businesses (Proposition 64: The Adult Use of Marijuana Act). Compared to most traditional agricultural production in Sonoma County, cannabis cultivation is more likely to occur within fully enclosed permanent structures utilizing artificial or supplemental lighting and imported growth media, a cultivation method that does not utilize the native soil or the sun. When located on agricultural lands, such structures result in a loss of agricultural soil, and crops produced in such structures do not exhibit unique characteristics associated with Sonoma County geographical environmental conditions, like climate, soils, and topography. In addition, year-round cultivation within structures involves continual activity throughout the year, unlike most traditional agricultural crop production, resulting in many of the same physical impacts as agricultural processing and agricultural support uses. Outdoor cultivation is therefore more appropriate on agricultural lands than cultivation within structures because it conserves agricultural soil, follows a traditional seasonal farming cycle, and produces an agricultural crop utilizing the native soil, climate, and sunlight specific to the area in which it is grown.

Growth of the cannabis industry in other California counties has resulted in a trend towards large greenhouses in rural agricultural lands. Greenhouses and other agricultural structures can be compatible with surrounding agricultural areas if the size and scale of structures is subordinate to the overall production operation, so that structures support the operation rather than house it entirely. As with large wine processing facilities, large cannabis cultivation and processing facilities can begin to appear industrial in nature. Policies are needed to encourage diversified cannabis operations, which may integrate structures into the agricultural production operation, but which are not entirely contained within large structures better suited to industrial areas.

As a controlled agricultural crop, policies are needed to allow cannabis production on agricultural lands in a way that conserves agricultural soils and protects agrarian character while also protecting public health and safety.

The Agricultural Resources Element establishes policies that support the needs and practices of agriculture as the highest priority in areas designated for agricultural use. **All policies in the Agricultural Resources Element include cannabis as an agricultural use, unless specifically excluded.**

> **Policy AR-4c:** Protect agricultural operations by establishing a buffer between an agricultural land use and residential interface. Buffers shall generally be defined as a physical separation of 100 to 200~~'~~ **feet** and/or may be a topographic feature, a substantial tree stand, water course or similar feature. In some circumstances a landscaped berm may provide the buffer. The buffer shall occur on the parcel for which a permit is sought and shall favor protection of the maximum amount of farmable land. *
>
> **Policy AR-4g: Permanent structures used for cannabis production should be limited in size and be subordinate to outdoor on-site agricultural production of any type. Consider all of the following factors when making a determination:**
>
> (1) **Whether and to what extent Prime Farmland or Farmland of Statewide Importance would be permanently encumbered by structures.**
> (2) **The portion of the site devoted to agricultural production within permanent structures as opposed to outdoor agricultural production.**
> (3) **The relative number of employees needed for on-site agricultural production within permanent structures in comparison to that needed for outdoor on-site agricultural production.**
> (4) **The use of existing structures and infrastructure compared to new development.**
>
> **Policy AR-4h: Notwithstanding AR-4a and AR-4c, due to its unique classification, cannabis production on agricultural lands should be separated from existing residential areas and established in a manner that protects public health and safety, given the complicated and evolving public sentiment around the crop and its classification.**

2.5 REGULATE THE LOCATION AND INTENSITY OF AGRICULTURE RELATED SUPPORT USES IN AGRICULTURAL AREAS

Given its broad diversity, Sonoma County agriculture requires a variety of support activities that are available in close proximity to production sites. The determination of which support uses belong on agricultural lands involves their connection to agriculture, potential for conflicts, the size, scale and adaptability of the use, and the amount of land lost to farming. Policies are needed to permit on agricultural lands those agriculture-related uses which support agriculture without undermining production activities.

Policies for support activities should also balance the need for such uses with the continued preservation of the rural character and agricultural diversity of the County, and should support products grown in Sonoma County over those produced elsewhere. The substantial growth in the wine industry during the last decade has, for example, resulted in a trend towards larger processing facilities, facilities that may appear more industrial than rural in character. **As with large wine processing facilities, large cannabis processing facilities also can begin to appear industrial in nature**. In addition, the apparent increase in the reliance of County processing facilities upon raw agricultural products imported from outside Sonoma County highlights the importance of demonstrating "connection" to local production in order to avoid County agricultural lands becoming defacto "industrial lands."

Policy AR-5d: Define "agricultural support services" as processing services **that change an agricultural product from its natural state to a different form,** maintenance and repair of farm machinery and equipment, veterinary clinics, custom farming services, **cannabis centralized processing**, agricultural waste handling and disposal services, and other similar related services.*

Policy AR-5e: Only permit agricultural support services that support local agricultural production consistent with the specific requirements of each of the three agricultural land use categories. ~~**Insure**~~ **Ensure** that such uses are subordinate to on-site agricultural production and do not adversely affect agricultural production in the area. Consider the following factors in determining whether or not an agricultural support service is subordinate to on-site agricultural production:

(1) The portion of the site devoted to the service as opposed to production.
(2) The extent of structure needed for the service as opposed to production.
(3) The relative number of employees devoted to the support service use in comparison to that needed for agricultural production.
(4) The history of agricultural production on the site.
(5) The potential for the service facility to be converted to non-agricultural uses due to its location and access. *

2.6 REGULATE THE LOCATION AND INTENSITY OF VISITOR-SERVING USES WITHIN AGRICULTURAL AREAS

The benefits and potential adverse impacts of visitor-serving uses vary by diversity of the agricultural industry in Sonoma County. It is important to recognize that agricultural tourism directly promotes the sale of agricultural products. Activities such as special events attract customers, build a customer base, market products, and build customer loyalty. However, the economic benefits of agricultural tourism must be balanced against associated impacts such as increased traffic, particularly in areas such as in Sonoma Valley or along routes where multiple visitor-serving uses may be hosting events at the same time. In addition, visitor-serving uses must supplement agricultural production, not replace it.

Wine tasting is an important promotional component of the viticulture industry, yet the people who come to enjoy the wine country may create a conflict with necessary practices of land intensive farming. This "people versus practices" conflict suggests a limit to tourist activities in vineyard areas, most of which are sufficiently close to communities that have available sites for such visitor services as lodgings and restaurants.

In extensive agricultural areas, some conflicts between visitors and agricultural practices are less severe due to the greater amount of land available to separate the activities. In these areas, small scale lodgings and some outdoor recreational uses could promote the agricultural activity and provide a secondary income source for the farmer or rancher without hindering the primary use of the land.

While cannabis tasting rooms could provide an important opportunity for the cannabis industry, there is insufficient guidance on the impact of consumption amounts to allow open cannabis tasting rooms with unlimited public access in rural agricultural areas that lack public transportation infrastructure. Instead, consumption activities should be limited such that the establishment can more effectively educate and control visitors related to the amount of consumption and the mode of visitor transportation.

The Agricultural Resources Element promotes the County's agricultural industry by establishing policies which allow specific, limited visitor-serving uses in agricultural areas.

> **Policy AR-6i: Consumption of cannabis and cannabis products in rural agricultural areas is only allowed associated with cannabis events and periodic special events in compliance with permit conditions. Events may include small groups of people throughout the day. Permitted events should encourage education and consider appropriate modes of visitor transportation and methods to control consumption amounts. Policies allowing all other visitor-serving uses apply to cannabis, including sales and promotion of products grown or processed in the County, educational activities and tours, and incidental sales of items related to local area agricultural products.**

The complete Sonoma County General Plan Glossary is available on the General Plan – Glossary webpage.

Amendments to the Glossary of the Sonoma County General Plan to modify or replace certain definitions and add definitions are shown below in alphabetical order:

Agricultural Production Activities: Those activities directly associated with agriculture, but not including agricultural support services, processing, and visitor-serving uses. Activities include growing, harvesting, crop storage, milking, etc. **Ancillary processing of cannabis grown on-site is considered an agricultural production activity because it does not change an agricultural product from its natural state to a different form, as grapes to wine, apples to juice or sauce, agricultural crops to extracted oils, etc.**

Agricultural Support Services: Processing services, maintenance and repair of farm machinery and equipment, veterinary clinics, custom farming services, agricultural waste handling and disposal services, and other similar services. **Processing of cannabis grown off-site (i.e., "centralized processing") is considered an agricultural support service.**

Controlled Agriculture or Controlled Agricultural Crop: A type of agriculture or agricultural crop that is subject to unique regulations but is included as agriculture (agricultural crop) in all General Plan agricultural policies unless stated otherwise. Cannabis is the only crop defined as a controlled agricultural crop. Cannabis does not include "industrial hemp" as defined by Section 81000 of the California Food and Agricultural Code.

Chapter 4, Article X, Cannabis License is added as follows:

Chapter 4. Article X – Cannabis Licenses

Sec. 4-300. – Title
This article is known as the cannabis license ordinance.

Sec. 4-301. – Purpose
The purpose of this article is to establish a cannabis license program for cannabis uses in unincorporated Sonoma County to ensure the uses operate in compliance with all applicable laws and regulations, to protect the regulated industry from competing illicit market operations, and to maintain the public health, safety, and welfare of each community and county as a whole.

Sec. 4-302. – Administration

A. **Administrative authority. This section will be administered under the direction of the board of supervisors, by and through the local authority subject to the standards and criteria contained in this section. The local authority is authorized to develop application forms and procedures and require all information necessary to verify compliance with this article.**
B. **Enforcement. The local authority is the enforcing officer for purposes of enforcing this article under Chapter 1.**
C. **Review. Except as provided in Section 4-304, all decisions made by the local authority under this article are final, subject only to judicial review.**
D. **Other Laws and Permits. Nothing in this section eliminates the need for a licensee to comply with local, state, or federal law, or to obtain other permits, approvals, or authorizations required by this code or state or federal agencies.**

Sec. 4-303 – License requirements.

A. **License Required. A cannabis use regulated under Chapter 26 must be licensed under this article. Personal cultivation exempt from the land use permit requirement under Chapter 26 is also exempt from this cannabis license requirement.**
B. **Compliance Generally.**
    a. **State cannabis license. A licensee must hold an active state license as required by the California Department of Cannabis Control.**
    b. **County zoning authorization. A cannabis use licensed under this article must be operated and maintained in compliance with Chapter 26, including obtaining a zoning permit or use permit as required.**
    c. **Ongoing violations. To obtain, renew, or maintain a license, the site cannot have any unresolved violations related to the cannabis operation issued by Sonoma County.**
C. **Property Owner Authorization. Authorization from the property owner or landlord must be provided.**
D. **Consent to Inspections. A licensee must consent to inspections that may be conducted at any time during normal business hours, with or without prior notice.**
E. **Tax Compliance. A licensee must comply with Sonoma County Cannabis Business Tax Ordinance, Sonoma County Code Chapter 35.**
F. **Term and renewal. A license expires one year from the date of issuance and must be renewed annually.**

Sec. 4-304 – License suspension or revocation.

A. **Suspension or Revocation. The local authority may suspend or revoke a license in the event of 1 or more of the following:**
   1. **License issuance was based on inaccurate or incomplete information.**
   2. **Licensee has operated in non-conformance with this article or license.**
   3. **Licensee has failed to pay permitting or licensing fees or civil penalties associated with the cannabis use.**

B. **Notice of Suspension or Revocation. To suspend or revoke a license, the local authority must issue a written notice to the licensee. The notice must include:**
   1. **The address of the cannabis operation;**
   2. **License number;**
   3. **License holder; and**
   4. **Reason for suspension or revocation.**

C. **Service of Notice. A notice of suspension or revocation must be sent via email and certified mail to the licensee address on file with the local authority.**

D. **Appeals.**
   1. **Right of Appeal. A notice of suspension or revocation may be appealed by the licensee to ____.**
   2. **Form and Timing. An appeal must be made in writing and submitted to the department within 10 calendar days from the date of the notice.**
   3. **Failure to Appeal. Failure to file a timely appeal makes the suspension or revocation final and constitutes a waiver of the right to an appeal hearing and adjudication of the suspension or revocation.**
   4. **Appeal Hearing. An appeal hearing must be noticed, conducted, and decided in accordance with the rules and timelines established by Section 1-7.3 of the Sonoma County Code and any administrative procedures established by the local authority.**
   5. **Consolidation. The department may consolidate an appeal hearing for a notice of suspension or revocation with an appeal hearing for a related administrative enforcement action under Chapter 1, in which case the appeal provision of the relevant enforcement section apply.**

E. **Effect of Suspension or Revocation.**
   1. **License Suspension. If a license is suspended the corresponding cannabis operation cannot operate until the suspension expires. If the license expires during the suspension a license application will not be accepted for the cannabis operation until the suspension expires. An application for a new licensee will be accepted.**
   2. **License Revocation. If a license is revoked a new license cannot be issued for the same land use within the same premises for 1 year from the date of revocation. "Premises" has the same meaning as the term "cannabis premises" as defined in Chapter 26.**

Sec. 4-305 – Fees.

The board of supervisors will establish a schedule of fees for services provided under this section. Services subject to fees may include, but are not limited to, licensing, license renewal, monitoring, and enforcement. Fees may be changed from time to time by a resolution of the board of supervisors.

Amendments to Definitions in Section 26-04-020 of the Sonoma County Code is amended to delete or replace certain definitions and add definitions in alphabetical order to read as shown below:

SECTION 1: The following definitions shall be modified to read as follows:

Agricultural Crop. Any cultivated crop grown and harvested for commercial purposes **including cannabis**.~~**except for cannabis and other controlled substances, which are defined and classified separately.**~~

Cannabis. All parts of the plant Cannabis sativa Linnaeus, Cannabis indica, or Cannabis ruderalis, or any other strain or varietal of the genus Cannabis ~~**that may exist or hereafter be discovered or developed**~~ whether growing or not; ~~**the seeds thereof; the resin, whether crude or purified, extracted from any part of the plant; and every compound, manufacture, salt, derivative, mixture, or preparation of the plant, its seeds, or resin. "Cannabis" also means the separated resin, whether crude or purified, obtained from cannabis. "Cannabis" does not include the mature stalks of the plant, fiber produced from the stalks, oil or cake made from the seeds of the plant, any other compound, manufacture, salt, derivative, mixture, or preparation of the mature stalks (except the resin extracted therefrom), fiber, oil, or cake, or the sterilized seed of the plant which is incapable of germination. For the purpose of this section,.**~~ "Cannabis" does not ~~**mean**~~ **include** "industrial hemp" as defined by Section 81000 of the California Food and Agricultural Code. ~~**or Section 11018.5 of the California Health and Safety Code, or the weight of any other ingredient combined with cannabis to prepare topical or oral administrations, food, drink, or other product. Cannabis is classified as an agricultural product separately from other agricultural crops.**~~

~~**Cannabis Business Owner. A person with an aggregate ownership interest of twenty percent (20%) or more in the person applying for a permit, unless the interest is solely a security, lien, or encumbrance; the chief executive officer of a nonprofit or other entity; a member of the board of directors of a nonprofit; the trustee(s) and all persons that have control of the trust and/or the commercial cannabis business that is held in trust; and/or an individual who will be participating in the direction, control, or management of the person applying for a permit.**~~

Cannabis Cultivation. ~~**Any activity involving the**~~ Planting, growing, **developing, propagating, or** harvesting~~**, drying, curing, grading, or trimming**~~ of cannabis.

~~**Cannabis Cultivation Area. The total aggregate area(s) of cannabis cultivation on a single premises as measured around the outermost perimeter of each separate and discrete area of cannabis cultivation at the dripline of the canopy expected at maturity and includes, but is not limited to, the space between plants within the cultivation area, the exterior dimensions of garden beds, garden plots, hoop houses, green houses, and each room or area where cannabis plants are grown, as determined by the review authority**~~.

Cannabis Cultivation - Indoor. Cannabis cultivation ~~**with**~~in ~~**any type of**~~ a structure using exclusively artificial lighting.

Cannabis Cultivation - Mixed-Light. Cannabis cultivation in a greenhouse or other similar structure ~~**using natural light, light deprivation, and/or**~~ any combination of natural and supplemental artificial lighting.

Cannabis Cultivation - Outdoor. Cannabis cultivation using no artificial lighting **conducted in the ground or in containers outdoors.**

~~**Cannabis Cultivation Site.** The premises where commercial cannabis is planted, grown, harvested, dried, cured, graded, or trimmed or where all or any combination of those activities occurs.~~

~~**Cannabis Cultivation Type.** The type of cultivation is classified as outdoor, indoor or mixed-light as defined herein, consistent with the state licensing scheme.~~

~~**Cannabis Delivery.** The commercial transfer of cannabis or cannabis products to a customer, including use by a retailer of any technology platform owned and controlled by the retailer.~~

~~**Cannabis Dispensary.** A facility where cannabis, cannabis products, or devices for the use of cannabis are offered, either individually or in any combination, for retail sale, including an establishment that delivers cannabis and/or cannabis products as part of a retail sale.~~

~~**Cannabis Distribution.** The procurement, sale, and transport of cannabis or cannabis products between licensees.~~

~~**Cannabis License.** A license issued by the state of California pursuant to the Medicinal and Adult-Use Cannabis Regulation and Safety Act (MAUCRSA).~~

~~**Cannabis Licensee.** Any person issued a license by the state of California under the Medicinal and Adult-Use Cannabis Regulation and Safety Act (MAUCRSA).~~

~~**Cannabis Manufacturer.** A person that conducts the production, preparation, or compounding of cannabis or cannabis products either directly or indirectly or by extraction methods, or independently by means of chemical synthesis, or by a combination of extraction and chemical synthesis at a fixed location that packages or repackages cannabis or cannabis products or labels or relabels its container.~~

Cannabis Manufacturing. ~~**All aspects of the**~~ **Includes cannabis** extraction ~~**process,**~~ **and cannabis** infusion ~~**process, and packaging and labeling processes, including preparing, holding, or storing of cannabis products. Manufacturing also includes any preparing, holding, or storing of components and ingredients.**~~

~~**Cannabis Medical. Any cannabis or cannabis product intended to be sold for use pursuant to the Compassionate Use Act of 1996 (Proposition 215), found at Section 11362.5 of the Health and Safety Code.**~~

~~**Cannabis Operator. The individual authorized to represent the person applying for or operating pursuant to a permit authorizing any commercial cannabis activity pursuant to this chapter.**~~

Cannabis Product. Cannabis that has undergone **extraction, infusion, packaging, labeling or a combination of these.** ~~**any process whereby the plant material has been transformed into a concentrate, including, but not limited to, concentrated cannabis, or an edible or topical product containing cannabis or concentrated cannabis and other ingredients.**~~

~~**Cannabis Testing Laboratory.** A laboratory, facility, or entity in the state of California that offers or performs tests of cannabis or cannabis products.~~

~~**Cannabis Transport.** The physical movement of cannabis or cannabis products from one (1) licensed premises to another licensed premises.~~

~~**Commercial Cannabis Activity.** The cultivation, possession, manufacture, distribution, processing, storing, laboratory testing, packaging, labeling, transportation, delivery, or sale of cannabis and cannabis products.~~

~~**Hoop House - Cannabis. A temporary structure used for season extension or crop protection erected for less than one hundred eighty (180) days. Hoop houses do not include light deprivation, ventilation, artificial lighting, or any electrical components. The ends are left open and the material covering the structure is removable.**~~

Manufactured Cannabis. Raw cannabis that has undergone a process whereby the raw agricultural product has been transformed into a concentrate, an edible product, or a topical product.

~~**Marijuana.** See Cannabis.~~

~~**Medical Marijuana.** See "Cannabis - Medical."~~

Nonmanufactured Cannabis. Flower, shake, kief, leaf, and pre-rolls.

Nonvolatile Solvent: Any solvent used in the extraction process that is not a volatile solvent. ~~**For purposes of this chapter, 'nonvolatile solvents' include carbon dioxide and ethanol.**~~

~~**Nursery Cannabis. An establishment that produces only clones, immature plants, and seeds for wholesale distribution to permitted cultivators or dispensaries, used specifically for the planting, propagation, and cultivation of medical cannabis.**~~

~~**Process, Processing, or Processes – Cannabis. All activities associated with drying, curing, grading, trimming, rolling, storing, packaging, and labeling of nonmanufactured cannabis.**~~

Volatile Solvent. Volatile solvents may include but **are** ~~**is**~~ not limited to: (1) explosive gases, such as Butane, Propane, Xylene, Styrene, Gasoline, Kerosene, 02 or H2; and (2) dangerous poisons, toxins, or carcinogens, such as Methanol, Methylene Chloride, Acetone, Benzene, Toluene, and Tri-chloro-ethylene as determined by the fire marshall.

SECTION 2: The following definitions are added in their alphabetical order to read as follows:

Cannabis Cultivation – Personal Use. Cannabis cultivation exempt from permitting.

Cannabis Extraction. Process by which cannabinoids are separated from cannabis plant material through chemical or physical means.

Cannabis Infusion. Process by which cannabis extract or cannabis plant material is combined with other ingredients to make a cannabis product.

Cannabis Non-Storefront Retail. A facility that sells cannabis or cannabis products to a customer exclusively by delivery.

Cannabis Premises. The entire land area, including structures used for a cannabis operation, provided that driveways may be excluded.

Cannabis Processing. Drying, curing, grading, trimming, rolling, and storing, of non-manufactured cannabis. Processing of cannabis grown off-site (i.e., centralized processing) is considered an agricultural support service.

Cannabis Propagation. Cultivation of propagative plant material, including live plants, seeds, seedlings, clones, cuttings, transplants, or other propagules used to establish plants for planting.

Cannabis Research and Development. Cannabis cultivation for the research or development of cannabis, cannabis strains, or cultivars.

Cannabis Storefront Retail (Dispensary). A facility that sells and delivers cannabis or cannabis products to customers.

Nursery Wholesale, Cannabis. An establishment that engages in the commercial production of cannabis clones, immature plants, or seeds for wholesale distribution to cannabis operations.

Amendments to Section 26-18-020 Agricultural Crop Production and Cultivation of the Sonoma County Code is modified as follows:

Sec. 26-18-020. Agricultural crop production and cultivation.

A. **Definition.** The commercial growing and harvesting of agricultural crops.

1. Includes:

   a. Growing and harvesting shrubs, plants, flowers, trees, vines, fruits, vegetables, hay, grain and similar food and fiber crops.

   b. The preparation of soil for the raising of agricultural crops.

   c. Incidental cleaning, storage, packing, and similar preparation of crops grown on site, at the time of harvest or shortly thereafter.

   d. Growing of plants in temporary membrane-covered frame structures (i.e., hoop houses).

   e. Includes Cannabis Cultivation subject to use standards (Sec. 26-18-115)

2. Excludes:

   ~~**a. Cannabis Cultivation.**~~

   b. Agricultural support services.

   b. Visitor-serving uses.

   c. Processing of agricultural crops where the crop is changed from its natural state to a different form (see "agricultural processing").

   d. The growing and harvesting of crops in greenhouses or similar structures (see "indoor crop cultivation").

B. **Standards.**

1. Crop production must comply with applicable provisions of Article 65 (RC riparian corridor combining zone) and Chapter 36 (vineyard and orchard development ordinance); which may require a use permit.

2. Temporary membrane-covered frame structures (i.e., hoop houses) may only be erected for less than 180 days per twelve-month period and cannot include ventilation, heating, artificial light, or any other electrical components, including electrical conduit or use of portable generators.

Sec. 26-18-115. Cannabis cultivation.

A. **Definition. Planting, growing, propagating, or harvesting of cannabis plants.**

1. **Includes: Outdoor, mixed-light, and indoor cannabis cultivation; wholesale cannabis nursery.**
2. **Excludes:**
   a. **Hemp Cultivation. (Chapter 37)**
   b. **Centralized cannabis processing. (See Sec 26-20-025).**

B. **Permits.**

1. **Cannabis license (Chapter 4, Article X) required.**
2. **Zoning Permit required in LIA, LEA, DA, RRD for a crop swap or the reuse of existing non-residential structures consistent with Section 26-18-115(4)(h) or both. It is the intent of the Board of Supervisors that these permits be subject to ministerial review only within the meaning of the California Environmental Quality Act and the State CEQA Guidelines and must be issued if all the ministerial standards are met.**
3. **Use Permit required in LIA, LEA, DA, RRD for all operations which do not meet Section 26-18-115(4)(h) ministerial standards.**
4. **Use Permit required in MP, M1, M2, M3, where urban services (water and sewer) are not available.**
5. **Exemption - Personal Cultivation. Cannabis cultivation up to 6 plants is allowed accessory to a residential dwelling unit in all zoning districts, and is exempt from the permit requirements and standards in this section except for (C)(5).**

C. **Standards.**

1. **Applicable to all zone districts:**
   a. **Odor Control. A structure containing cannabis must be equipped with a filtration and ventilation system to control odors, humidity, and mold, provided that structures containing only packaged cannabis products may be excluded from this requirement.**
   b. **Lighting. All lighting is to be fully shielded and downward casting so that it does not spill over onto neighboring properties. For operations cultivating within structures, all light is to be fully contained so that little to no light escapes at a level that is visible from neighboring parcels.**
   c. **Accessory Uses. Cannabis cultivation may include accessory uses that directly support the on-site cannabis cultivation, such as: propagation, research and development, processing, manufacturing, packaging and labeling, distribution, and other similar support uses as determined by the Director.**
   d. **Generators. Generator use is prohibited, except in the case of an emergency.**
   e. **Propagation, Research and Development. Propagative and research and development plant material that is not located within the cannabis canopy cannot be distributed, manufactured or sold.**
2. **MP, M1, M2, M3 zones:**
   a. **Outdoor cultivation is prohibited.**
   b. **Accessory Uses. Accessory retail is prohibited.**
3. **LIA, LEA, DA zones: Indoor and Mixed Light cultivation must be consistent with General Plan Policies, AR-4a and AR-4g.**
4. **LIA, LEA, DA, RRD zones:**

a. **Minimum Lot Size of 5 acres.**

b. **Canopy.**

   1. **Maximum Canopy. Canopy is limited to 10% of the parcel. All structures including those used for canopy remain subject to the applicable development standards in Sec. 26-06-040 and Sec. 26-16-010.**

   2. **Canopy Measurement. Canopy is the total area within the cannabis premises that will contain mature plants and is measured based on clearly identifiable boundaries, such as trellis netting, walls or other partitions, shelves, hedgerows, garden beds, or fencing. If mature plants are cultivated using a shelving system, the surface area of each level is included in the total canopy calculation. Canopy may be noncontiguous if each canopy area has an identifiable boundary.**

c. **Setbacks.**

   1. **Property Line Setback. The cannabis premises must be setback at least 100 feet from each property line.**

   2. **Residential Land Use Setback. The cannabis premises must be setback at least 600 feet from all properties within Residential Zoning Districts including Low, Medium, and High Density Residential (R1, R2 & R3), Rural Residential (RR), Agriculture and Residential (AR), and Planned Community (PC).**

   3. **Incorporated City Boundaries. The cannabis premises must be setback at least 600 feet from incorporated city boundaries.**

   4. **Sensitive Use Setback.**

      a. **Distance. The cannabis premises must be setback at least 1,000 feet from each property line of a parcel with a sensitive use that exists at the time the application to initiate the cannabis use is deemed complete.**

      b. **Definition of Sensitive Use. Sensitive uses are K-12 schools, public parks, day care centers, and alcohol or drug treatment facilities. In this section, a public park means existing Federal Recreation Areas, State Parks, Regional Parks, Community Parks, Neighborhood Parks, and Class I Bikeways as designated in the Sonoma County General Plan, but not proposed public parks that have not yet been constructed.**

   5. **Existing Permits and Applications. The following setbacks apply to an application that was approved or deemed complete prior to the effective date of this Ordinance and any amendment to such permit or application;**

      a. **Property Line Setback. New structures, the reuse of existing structures not currently used for the cannabis operation, outdoor event areas, and outdoor canopy must be setback at least 100 feet from each property line.**

      b. **Offsite Residential Setback. Outdoor canopy, mixed-light cultivation structures, and outdoor event areas must be setback at least 300 feet from offsite residences on residentially zoned parcels.**

      c. **Sensitive Use Setback. Approved permits and any amendments thereto are only subject to the sensitive use setbacks that were applied to the original approval.**

d. **Best Management Practices. Outdoor cultivation must comply with best management practices for cannabis cultivation issued by the agricultural commissioner for erosion and sediment control and management of wastes, water, fertilizers, and pesticides.**

e. **Parking must be located on-site and not located on driveways shared with another parcel or property.**

f. **Hoop Houses. Outdoor cultivation may use temporary membrane-covered frame structures (i.e., hoop houses) in accordance with Section 26-18-020. Plastic used for hoop houses must be removed and securely stored immediately after harvest and when not in use.**

g. **Accessory Uses.**

   1. **Accessory manufacturing is limited to chemical extraction using carbon dioxide, extraction by physical or mechanical means, and infusion of non-ingestible products from cannabis grown on-site.**

   2. **Accessory retail is allowed in compliance with the standards of Farm Retail Sales (Sec. 26-18-140 & Sec. 26-88-215), except that food sampling, on-site cannabis consumption and the sales of cannabis and cannabis products grown offsite are prohibited.**

h. **A crop swap is the replacement of active cultivation of perennial or row crops with outdoor cannabis cultivation or the reuse of an existing nonresidential structure for an accessory cannabis use or indoor or mixed light cannabis cultivation, involving no or negligible expansion of use. The application must conform to all standards in Secs. 26-18-115(C)(1), (3) and (4) and the following:**

   1. **Active cultivation. A minimum of five years of active cultivation of perennial or row crops must have occurred immediately preceding permit application filing.**

   2. **Reuse of structures. To allow for the reuse of an existing permanent structure, a bona fide on-site outdoor agricultural use must exist on the parcel.**

   3. **Operation size.**

      a. **Cultivation footprint. The cultivation footprint cannot be expanded beyond the actively cultivated land area being replaced. Actively cultivated land cannot be removed to accommodate cannabis cultivation inside permanent structures.**

      b. **Structural footprint. A permanent structure used in the operation cannot be expanded or modified beyond its existing footprint.**

   4. **Soil Protection.**

      a. **Grading which requires a permit under Chapter 11 or Chapter 36 of the Sonoma County Code is prohibited.**

      b. **Deep ripping during crop removal is prohibited. Deep ripping is the mechanical manipulation of the soil at depths greater than sixteen inches to break up or pierce of highly compacted, impermeable, or slowly permeable subsurface soil layer or other similar kinds of restrictive soil layers.**

   5. **Tribal Monitor. A tribal monitor is required for the removal of the existing crop.**

   6. **Trip Generation.**

      a. **Additional employees are limited to two.**

      b. **Total additional trip generation is limited to 10 average daily trips.**

7. **Focused Species Assessment in Critical Habitat. Unless state and federal permits, approvals, or authorizations to incidentally take listed species have been obtained, if the cannabis premises is within a federally designated critical habitat area, a focused species assessment is required that finds it is not reasonably foreseeable that the use will result in the take of listed species. Applicants must incorporate and implement the recommendations and avoidance measures in the focused species assessment, including any subsequent surveys recommended. A use permit is required if the focused species assessment finds that take is reasonably foreseeable or that compensatory mitigation is required to address a potential impact.**

8. **Water Source. The on-site water supply must be adequate to support the new use as demonstrated by consistency with the following for each water source proposed. Trucked water is only allowed in the event of an emergency as determined by the director.**

    a. **Municipal Water or Recycled Water. Municipal water and municipal recycled water require proof of availability.**

    b. **Groundwater Well. A study prepared by a qualified professional must be submitted to demonstrate no net increase in groundwater use for all agricultural operations on the parcel.**

    c. **Surface Water. A surface water diversion to a tank or an existing reservoir requires an appropriative water right and a Lake and Streambed Alteration (LSA) Agreement. A maximum of 100,000 gallons of new tank storage is allowed. Riparian water rights are prohibited.**

    d. **Rainwater and sheet flow. A rainwater catchment system or an existing reservoir that collects sheet flow, requires a water supply assessment prepared by a qualified professional. A maximum of 100,000 gallons of new tank storage is allowed.**

5. **Personal Cultivation Standards**

    a. **Personal cultivation must comply with best management practices for cannabis cultivation issued by the agricultural commissioner for erosion and sediment control and management of wastes, water, fertilizers, and pesticides.**

    b. **Outdoor Personal Cultivation**

        1. **Cultivation of cannabis cannot be located within the front and side yard setback areas designated by the base zoning district and cannot be visible from a public right of way.**

        2. **Outdoor cannabis cultivation is prohibited on parcels with multi-family units or in medium and high-density residential zones (R2 and R3).**

        3. **All lighting must be fully shielded, downward casting, and cannot spill over onto neighboring properties.**

    c. **Personal Cultivation – Structures.**

        1. **All lighting must be fully contained so that little to no light escapes at a level that is visible from neighboring parcels.**

        2. **The use of a generator is only allowed in the case of an emergency.**

Section 26-18-270 Cannabis Events is added as follows:

Sec. 26-18-270. Cannabis events.

- **A. Definition. "Cannabis event" means an event that includes cannabis promotional activities and consumption.**
  - **1. Includes.**
    - **a. Any cannabis event associated with a cannabis land use permit.**
    - **b. Cannabis events not associated with a cannabis land use permit that occur more frequently than Periodic Special Events, Section 26-22-120.**
  - **2. Excludes.**
    - **a. Periodic Special Events, Section 26-22-120.**
- **B. Applicable Zones. This section applies to parcels zoned LIA - Land Intensive Agriculture, LEA-Land Extensive Agriculture, DA -Diverse Agriculture, and RRD -Resources and Rural Development.**
- **C. Permits. Use Permit required for Cannabis Events.**
- **D. Operating Standards.**
  - **1. Number and size of events.**
    - **a. Small-scale events.**
      - **1. Attendees: 25 or fewer. But the number of attendees may be increased to a maximum of 50 attendees, if attendees are shuttled from an offsite location as specified in the use permit.**
      - **2. Annual small-scale events allowed: up to 104 event days.**
    - **b. Large-scale events.**
      - **1. Attendees: Any number greater than 25.**
      - **2. Annual large-scale events allowed: up to 2 events with up to 2 event days each.**
  - **2. Hours of Operation. The maximum hours of operation for a cannabis event are 10:00 am to 10:00 pm, unless further limited by the use permit.**
  - **3. On-Site Parking.**
    - **a. On-site parking must include 1 space per 2.5 attendees and 1 space per event employee.**
    - **b. This parking standard may be reduced in accordance with Article 86, Parking Regulations, Section 26-86-010(i) and when attendees are shuttled from an offsite location as specified in the use permit.**
    - **c. Required parking may be satisfied by on-site unimproved overflow parking areas.**
    - **d. All parking must be on-site or at approved shuttle pick up locations**
  - **4. Food Service. Food service is allowed only for on-site consumption during the event as specified below.**
    - **a. Food must feature local foods and food products.**
    - **b. Attendees may bring outside food on-site during events.**
    - **c. Retail sales of pre-packaged food is allowed.**
    - **d. On-site food preparation requiring a food facility permit is prohibited except for mobile food facilities (i.e., food trucks).**
  - **5. Setbacks. The location of the event area on the parcel is subject to the setback requirements of Section 26-18-115(C)(4)(c).**
  - **6. Traffic Management. A traffic management and parking plan is required to address the maximum number of attendees visiting during a cannabis event. For an event exceeding 100 attendees and for an event that uses overflow parking, the traffic management plan must include the following:**

   a. **Provisions for event coordination to avoid local traffic delays.**
   b. **Parking attendants for each day of the event.**
   c. **A shuttle plan, if shuttling is proposed, to support each day of the event. A convenient and secure "park and ride" area must be provided.**
   d. **A plan for on-site parking requirements and queuing of traffic.**
   e. **Enforcement of the on-street parking restrictions.**
   f. **Subsequent changes to the approved Traffic Management Plan must be submitted in advance to the Permit Sonoma.**

7. **Noise. Cannabis events must not exceed the general plan noise standards Table NE-2, measured in accordance with the Sonoma County noise guidelines.**

Section 26-20-025 Centralized Cannabis Processing is added as follow:

Sec. 26-20-025. Centralized cannabis processing

A. **Definition. Cannabis processing facility for plant materials grown on- and off site.**
B. **Permits.**
   1. **Cannabis license (Chapter 4 Article X).**
   2. **Use Permit required within the Agricultural Zoning Districts.**
C. **Standards.**
   1. **LEA, LIA, DA zones: centralized processing must conform to the minimum parcel size setbacks and odor control required for cannabis cultivation (Sec. 26-18-115)**
   2. **LEA, LIA, DA zones: centralized processing must be consistent with General Plan Policy AR-5e.**

Amendments to the following, Section 26-20-040 Laboratories, Section 26-20-08 Manufacturing/processing, medium and Section 26-20-160 Storage: Wholesale and Distribution of the Sonoma County Code is modified as follows.

Sec. 26-20-040. Laboratories.

A. **Definition.** A facility for scientific research and the design, development, and testing of products in advance of product manufacturing.
   1. Includes: Assembly of related products from parts produced off site where the manufacturing activity is secondary to the research and development activities; **cannabis testing laboratory**.
B. **Permits.**
   1. **Cannabis license (Chapter 4, Article X).**
C. **Standards.** No unique use-specific standards.

Sec. 26-20-080. Manufacturing/processing, medium.

A. **Definition.** A facility accommodating manufacturing processes that involve and/or produce food products, **cannabis products**, building materials, fabricated metal products, machinery, and/or transportation equipment, where the intensity and/or scale of operations is greater than those classified under manufacturing/processing light but where impacts on surrounding land uses or the community can typically be mitigated to acceptable levels.
   1. Includes: Bakeries and catering services, cooperage and bottling works; food and beverage processing, cabinet shops, welding, sheet metal and machine shops, furniture shops, machinery manufacturing, metal product fabrication.
B. **Permits.**
   1. **Cannabis license (Chapter 4, Article X)**
C. **Standards.** No unique use-specific standards.

Sec. 26-20-165. Cannabis distribution.

A. **Definition. A facility that sells cannabis or cannabis products to retailers; or professional business users; to other wholesalers; or acts as agents or brokers in buying merchandise for or selling merchandise to customers.**
   1. **Includes: Storage, processing; packaging; and shipping facilities for mail order and e- commerce retail facilities and cannabis non storefront retailers.**

2. **Excludes: Cannabis storefront retail (dispensaries).**

B. Permits.

1. **Cannabis license (Chapter 4, Article X)**

C. Standards. No unique use-specific standard

Amendments to Section 26-22-120 Periodic Special Events of the Sonoma County Code is modified as follows:

Sec. 26-22-120. Periodic special events.

A. **Definition.** A periodic event such as a parade, concert, festival, race or gathering which attracts a large gathering of people either by direct participation, or as spectators.

B. **Zoning Permit Required.** A zoning permit is required for all periodic special events, except the following, which are not considered periodic special events:

1. Events conducted entirely within dedicated rights-of-way where event organizers have secured necessary encroachment or other permits;

2. Events conducted entirely within a building for which all necessary county permits have been secured, provided that the events are within the scope of the use for which the building was permitted;

3. Events conducted at fairgrounds or events conducted at outdoor spectator facilities for which a use permit has been obtained, provided that the outdoor event is within the scope of the use permit;

4. An event which has all of the following characteristics:

    a. Has no live amplified music;

    b. Does not involve an admission fee either for participants or spectators;

    c. Is a one (1) day event conducted between the hours of seven a.m. and eleven p.m.;

    d. Does not involve overnight sleeping of participants or spectators;

    e. Is not conducted more than one (1) calendar day in a thirty-day period;

    f. Is not accompanied by newspaper, internet, social media, radio or television advertising or printed leaflets distributed to the public at large; and

    g. Does not involve the sale of food or beverages.

    h. Does not involve sale or consumption of cannabis.

5. All periodic special events may be subject to requirements of sheriff, public health, fire services, building inspection, public works, or other permitting agencies not specified in this article. Event hosts are responsible for securing approvals from applicable agencies.

C. **Standards.**

1. Periodic special events subject to a zoning permit shall comply with the following requirements, in addition to the requirements of other applicable agencies:

    a. The event shall comply with all local and state fire codes.

    b. Noise shall be managed in accordance with the noise element of the Sonoma County general plan.

    c. A courtesy notice shall be posted on the property at least ten (10) days in advance of the event, which states the nature and duration of the event. Notice of the event and contact information for the event host, including a telephone number at which the event host can be reached before and at all times during the event, shall be provided at least forty-eight (48) hours before the event to at least one (1) resident of each adjacent lot. The notice shall state that a request for a public hearing may be submitted to the project planner at least 10 days in advance of the date specified on the notice.

    d. Periodic Special Events are "restricted nonagricultural uses" in the LEA, LIA, and DA Districts. See Section 26-06-030.E for additional applicable provisions.

Section 26-26-025 Cannabis Storefront Retail is added as follows:

Sec. 26-26-025. Cannabis storefront retail (dispensary)

A. **Definition. A facility that sells and delivers cannabis or cannabis products to customers.**
B. **Permits. Cannabis license (Chapter 4 Article X).**
C. **Standards.**

   1. **Accessory packaging and labeling of cannabis products sold by the retailer.**
   2. **On-site consumption in conformance with Chapter 14, Article VI and/or Chapter 32 Health Code.**

Amendments to Section 26-86-010 Required Parking of the Sonoma County Code is modified as follows:

~~**Medical**~~ Cannabis storefront retail (dispensary)	~~**2 spaces, including at least 1 van-accessible space; plus**~~ 1 ~~**additional**~~ space**/** ~~**for every**~~ 200 square feet ~~**of gross**~~ floor area~~**, plus 1 additional space for each employee on maximum shift; but in no case less than 5 off-street parking spaces**~~

Appendix B

Table: Allowed Cannabis Land Uses

Key of symbols for Table

P = Permitted Use

P* = Permitted Use, subject to discretionary approval criteria

C = Conditional Use

- = Prohibited Use

† = Permit requirement indicated in use regulations column

Land Use	RR Zone	AR Zone	LEA Zone	LIA Zone	DA Zone	RRD Zone	MP Zone	M1 Zone	M2 Zone	M3 Zone	C1 Zone	C2 Zone	C3 Zone	LC Zone	Use Standards
Cannabis Cultivation	-	-	P*/C	P*/C	P*/C	P*/C	P/C	P/C	P/C	P/C	-	-	-	-	26-18-115; 26-18-020
Cannabis Wholesale Nursery	-	-	C	C	C	C	P	P	P	P	-	-	-	-	26-18-115; 26-18-020
Testing Laboratories	-	-	-	-	-	-	P	P	P	P	-	-	C	-	26-20-040
Cannabis Storefront Retail (Dispensary)	-	-	-	-	-	-	-	-	-	-	P	P	P	P	26-26-025
Cannabis Non-storefront Retail (Delivery Only)	-	-	-	-	-	-	P	P	P	P	-	-	P	-	26-20-165
Cannabis Distribution	-	-	-	-	-	-	P	P	P	P	-	-	P	-	26-20-165
Cannabis Centralized Processing	-	-	C	C	C	-	P	P	P	P	-	-	P	-	26-20-025
Manufacturing	-	-	-	-	-	-	P	P	P	P	-	-	P	-	26-20-080
Cannabis Events	-	-	C	C	C	C	-	-	-	-	-	-	-	-	26-18-270

Sonoma County
UNIFORM RULES
for
Agricultural Preserves and Farmland Security Zones

Adopted: December 13, 2011 (Resolution No. 11-0678)
Amended: July 31, 2012 (Resolution No. 12-0379)
Amended: May 7, 2013 (Resolution No. 13-0186)
Amended: December 20, 2016 (Resolution No. 16-0485)
Amended: October 31, 2017 (Resolution No. 17-0426)
Amended: November 7, 2017 (Resolution No. 17-0438)

Contents

Uniform Rule 1.0 - General Provisions.

1.1 Title.

These uniform rules are and may be cited as the Sonoma County Uniform Rules for Agricultural Preserves and Farmland Security Zones or as the Sonoma County Uniform Rules for the Land Conservation Act Program.

1.2 Purpose of Uniform Rules and Agricultural Preserve Program.

These uniform rules set forth the rules and regulations governing the administration of the County's agricultural preserve program under the California Land Conservation Act, also known as the Williamson Act. The purpose of the Land Conservation Act is the long-term preservation of agricultural and open space lands. County and landowner participation in the County's agricultural preserve program is voluntary.

The Board of Supervisors first implemented the Land Conservation Act in 1967 by promulgating rules for the administration of agricultural preserves. Those rules were amended in 1970 and again in 1989. These uniform rules comprehensively revise, update, and supersede the County's prior rules.

The Board of Supervisors recognizes that the continuation of the County's agricultural preserve program is necessary to preserve a maximum amount of the limited supply of agricultural, open space, scenic, and critical habitat lands within the county, to discourage premature and unnecessary conversion of such lands to urban land uses, to promote vitality in the agricultural economy, and to ensure an adequate, varied, and healthy supply of food and fiber for current and future generations.

The Land Conservation Act allows counties to establish agricultural preserves, and to enter into land conservation contracts for eligible land located within an existing preserve. Under a land conservation contract, land within an agricultural preserve is enforceably restricted to agricultural or open space uses, and uses compatible with agricultural or open space uses, for a minimum term of 10 years, in exchange for reduced property tax assessments.

Under certain circumstances, the Land Conservation Act also allows the County to establish farmland security zones within existing agricultural preserves and to enter into farmland security zone contracts within such zones. The minimum term of a farmland security zone contract is 20 years and land restricted by the contract receives a greater tax benefit than does land restricted by a land conservation contract. In addition, procedures and requirements for terminating or phasing out of a farmland security zone contract differ from those that apply to terminating or phasing out of a land conservation contract. On October 2, 2001, the Board of Supervisors by Resolution 01-1207 authorized the creation of farmland security zones within existing agricultural preserves within the county and execution of farmland security zone contracts within such zones. Farmland security zone contracts are governed by their terms, the Land Conservation Act, and these uniform rules.

These uniform rules establish the basic requirements for agricultural preserves, farmland security zones, land conservation contracts, and farmland security zone contracts in the County's agricultural preserve program. These uniform rules are incorporated as a part of each land conservation contract and farmland security zone contract. Any change to these uniform rules applies to every land conservation contract and farmland security zone contract currently in effect, unless the contract or the Land Conservation Act expressly provide otherwise.

1.3 Relationship of the Agricultural Preserve Program to Other Laws.

These uniform rules implement the Land Conservation Act by establishing procedures and eligibility requirements to which each participating landowner must adhere in order to receive a reduction in tax assessment. These uniform rules, which list allowable uses for contracted land, do not authorize any development on contracted land that is not otherwise permitted by the underlying zoning. These uniform rules may be more restrictive than the underlying zoning. However, these uniform rules do not supersede the County's land use requirements contained in the General Plan and Zoning Code, nor obviate the need for permits.

If there is any irreconcilable conflict between any provision of these uniform rules and any federal or state law, the federal or state law prevails. Any provision of these uniform rules that is more stringent than federal or state law is intended to supplement, not conflict with, federal or state law and to apply unless a court of law conclusively determines that the provision is preempted.

1.4 Interpretations.

A. Authority to interpret. The Director shall have the authority to interpret the provisions of these uniform rules. Whenever the Director determines it necessary or appropriate, he or she may issue an official written interpretation or, in the alternative, may refer the issue of interpretation to the Board of Supervisors for determination.

B. Language. When used in these uniform rules, the words “shall,” “must,” “will,” “is to,” and “are to” are always mandatory. “Should” is not mandatory but is strongly recommended; and “may” is permissive. The present tense includes the past and future tenses; and the future tense includes the present. The singular number includes the plural number, and the plural the singular, unless the natural construction of the word indicates otherwise. The words “include,” “includes,” and “including” shall mean “including but not limited to.”

C. Time limits. Whenever a number of days is specified in these uniform rules, or in any notice provided in compliance with these uniform rules, the number of days shall be construed as calendar days, unless business days are specified. A time limit shall extend to 5 p.m. on the following business day where the last of the specified number of days falls on a weekend, County-observed holiday, or other day the County is not open for business.

D. State law requirements. Where these uniform rules reference applicable provisions of state law, the reference shall be construed to be to the applicable state law provisions as they may be amended from time to time.

1.5 Schedule of Fees.

The Board of Supervisors shall establish a schedule of fees for the processing of applications required by these uniform rules. The fees shall cover County costs for staff time and other activities involved in processing such applications. The Board may also establish an annual fee for the administration of the County’s agricultural preserve program.

Uniform Rule 2.0 - Definitions.

2.1 List of Terms and Phrases.

As used in these uniform rules, the following terms and phrases shall have the meanings ascribed to them in this section, unless the context in which they are used clearly requires otherwise. Some of the terms and phrases defined in this section are taken directly from the Land Conservation Act. The definitions in the Land Conservation Act may be amended from time to time by state legislation. Any changes to the Land Conservation Act's definitions shall supercede the definitions included in this section. The definition of a term or phrase applies to any of that term's or phrase's variants.

"Agricultural Commodity" means any and all plant and animal products produced within the county for commercial purposes, including plant products used for producing biofuels~~**, but excluding cannabis**~~.

"Agricultural Contracted Land" means any agricultural land restricted by a land conservation contract.

"Agricultural Land" means prime and non-prime agricultural land.

"Agricultural Preserve" means an area devoted to agricultural or open space uses and which is established in accordance with the provisions of the Land Conservation Act and these uniform rules.

"Agricultural Use" means use of land, including greenhouses, for the purpose of producing an agricultural commodity for commercial purposes. ~~**Notwithstanding any provisions of these Uniform Rules to the contrary, "agricultural use," does not include or mean the use of land for the purpose of cultivating or producing cannabis or cannabis related products.**~~

"Annual Renewal Date" means January 1st of each year.

"Board of Supervisors" means the Board of Supervisors of Sonoma County, California.

"Cannabis" **All parts of the plant Cannabis sativa Linnaeus, Cannabis indica, or Cannabis ruderalis, or any other strain or varietal of the genus Cannabis whether growing or not; "Cannabis" does not include "industrial hemp" as defined by Section 81000 of the California Food and Agriculture Code.** ~~**means all parts of the plant Cannabis sativa Linnaeus, Cannabis indica, or Cannabis**~~

~~**ruderalis, or any other strain or varietal of the genus Cannabis that may exist or hereafter be discovered or developed that has psychoactive or medicinal properties, whether growing or not, including the seeds thereof. "Cannabis" also means marijuana**~~ ~~as defined by Section 11018~~ ~~**of the Health and Safety Code as enacted by Chapter 1407 of the Statutes of 1972. For the purpose of this Uniform Rules, "cannabis" does not mean "industrial hemp" as defined by Section 81000 of the Food and Agricultural Code or Section 11018.5 of the Health and Safety Code.**~~

"Clerk of the Board" means the Clerk of the Board of Supervisors.

"Compatible Use" means any use determined by the County pursuant to the Land Conservation Act and these uniform rules to be compatible with the primary agricultural or open space use of land within the preserve and subject to contract. Compatible use includes agricultural use, recreational use, or open space use unless the Board of Supervisors finds after notice and hearing that the use is not compatible with the

agricultural or open space use to which the land is restricted by contract pursuant to the Land Conservation Act and these uniform rules.

"Contiguous" means sharing a common boundary or boundaries. Land shall be considered contiguous even if it is separated by roads, streets, utility fees or easements, or railroad rights-of-way.

"Contracted Land" means any agricultural or open space land restricted by a land conservation contract.

"County" means the county of Sonoma, in the state of California.

"Devoted to Agricultural or Open Space Uses" means when agricultural or open space land is used or maintained in compliance with the requirements of Section 4.2.B of these uniform rules.

"Director" means the Director of the Permit and Resource Management Department or his or her authorized representative.

"Dwelling" means single-family dwelling.

"Farmland Security Zone Contract" means a farmland security zone contract entered into pursuant to the Land Conservation Act and these uniform rules.

"Farm Stay" means transient lodging accommodations containing five or fewer guestrooms in a single-family dwelling or guest quarters provided as part of a farming operation, with an on-site farmer in residence, that includes all meals provided in the price of the lodging, and that meets all of the standards in the Zoning Code.

"General Plan" means the Sonoma County General Plan and the Sonoma County Local Coastal Plan.

"Guest Quarters" means an accessory building that consists of a detached living area of a permanent type of construction with no provisions for appliances or fixtures for the storage or preparation of food, including refrigerators, dishwashers, and cooking facilities. The building shall not be leased, subleased, rented, or sub-rented separately from the primary dwelling. The floor area of a guest quarters shall be a maximum of 640 square feet. Floor area shall be calculated by measuring the exterior perimeter of the guest quarters and the length of any common walls. In the case of straw bale or similar construction, floor area may be calculated using interior dimensions. For the purposes of calculating the maximum size of a guest quarters, any storage area attached to the guest quarters, excluding garage, shall be included. A guest quarters shall be located not more than 100 feet from the primary dwelling on the subject parcel.

"Immediate Family Member" means a spouse, natural or adopted child, parent, or sibling.

"Land Conservation Act" means the California Land Conservation Act of 1965, Government Code section 51200 et seq.

"Land Conservation Contract" or "Contract" means a land conservation contract entered into pursuant to the Land Conservation Act and these uniform rules.

"Land Conservation Plan" means a plan detailing the agricultural or open space uses of the land restricted by a land conservation contract or farmland security zone contract, including the types of uses and land areas involved.

"Managed Wetland Area" means an area, which may be an area diked off from the ocean or any bay, river, or stream to which water is occasionally admitted, and which, for at least three consecutive years immediately prior to being placed within an agricultural preserve was used and maintained as a waterfowl hunting preserve or game refuge or for agricultural purposes.

"Non-prime Agricultural Land" means land in agricultural use that is not prime agricultural land. Non-prime agricultural land includes land used for grazing, hay production, rotational crops such as seasonal or year round row crops, ornamental trees or flowers, and dry farming.

"Open Space Contracted Land" means any open space land restricted by a land conservation contract.

"Open Space Land" means land in open space use.

"Open Space Use" means the use or maintenance of land in a manner that preserves its natural characteristics, beauty, or openness for the benefit and enjoyment of the public, to provide habitat for wildlife, or for the solar evaporation of seawater in the course of salt production for commercial purposes, if the land is within any of the following:

1. A scenic highway corridor.

2. A wildlife habitat area.

3. A saltpond.

4. A managed wetland area.

5. A submerged area.

6. An area enrolled in the United States Department of Agriculture Conservation Reserve Program or Conservation Reserve Enhancement Program.

"Parcel" means legal parcel.

"Permit and Resource Management Department" means the Sonoma County Permit and Resource Management Department.

"Primary dwelling" means a single-family dwelling that meets the requirements of Sections 8.3.A.1 or 8.5.A.1 of these uniform rules.

"Prime Agricultural Land" means any of the following:

1. Land that qualifies for rating as class I or class II in the National Resource Conservation Service land use capability classifications.

2. Land that qualifies for rating 80 through 100 in the Storie Index Rating.

3. Land that is planted with fruit- or nut-bearing trees, vines, bushes, or crops which have a nonbearing period of less than five years and meet the minimum income requirements in Table 4-2 of these uniform rules.

4. Land that has returned from the production of unprocessed agricultural plant products an annual gross value which meets the minimum income requirements in Table 4-2 of these uniform rules.

"Private Family Burial Plots" means up to five graves for the landowner and immediate family members of the landowner.

"Recreational Use" means the use of land in its agricultural or natural state by the public, with or without charge, for any of the following: walking, hiking, picnicking, swimming, boating, fishing, hunting, or other outdoor games or sports for which facilities are provided for public participation. Any fee charged for the recreational use of land shall be in a reasonable amount and shall not have the effect of unduly limiting its use by the public. Specific recreational uses and accessory structures necessary for a recreational use are allowed on contracted land only if they are listed as a compatible use under these uniform rules.

"Saltpond" means an area which, for at least three consecutive years immediately prior to being placed within an agricultural preserve, has been used for the solar evaporation of seawater in the course of salt production for commercial purposes.

"Scenic Highway Corridor" means an area adjacent to, and within view of, the right-of-way of:

1. An existing or proposed state scenic highway in the state scenic highway system established by the Legislature pursuant to Article 2.5 (commencing with Section 260) of Chapter 2 of Division 1 of the Streets and Highways Code and which has been officially designated by the California Department of Transportation as an official state scenic highway; or

2. A county scenic highway established pursuant to Article 2.5 (commencing with Section 260) of Chapter 2 of Division 1 of the Streets and Highways Code, if each of the following conditions have been met:

   a. The scenic highway is included in the General Plan;

   b. The scenic highway corridor is included in an adopted specific plan of the County; and

   c. Specific proposals for implementing the plan, including regulation of land use, have been approved by the Advisory Committee on a Master Plan for Scenic Highways, and the county highway has been officially designated by the California Department of Transportation as an official county scenic highway.

"Single-Family Dwelling" means a building designed and/or occupied exclusively by one family.

"Special Event" means a festival, concert, theatrical presentation, wedding, wedding reception, party, race, rally, rodeo, or other activity that attracts a large gathering of people, either as participants or spectators.

"State Designated Farmland of Local Importance" means land designated as predominantly farmland of local importance on the Important Farmland Series map for Sonoma County compiled by the California Department of Conservation's Farmland Mapping and Monitoring Program pursuant to Government Code section 65570.

"State Designated Farmland of Statewide Importance" means land designated as predominantly farmland of statewide importance on the Important Farmland Series map for Sonoma County compiled by the California Department of Conservation's Farmland Mapping and Monitoring Program pursuant to Government Code section 65570.

"State Designated Important Farmland" means state designated prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance.

"State Designated Prime Farmland" means land designated as predominantly prime farmland on the Important Farmland Series map for Sonoma County compiled by the California Department of Conservation's Farmland Mapping and Monitoring Program pursuant to Government Code section 65570.

"State Designated Unique Farmland" means land designated as predominantly unique farmland on the Important Farmland Series map for Sonoma County compiled by the California Department of Conservation's Farmland Mapping and Monitoring Program pursuant to Government Code section 65570.

"Submerged Area" means any land determined by the Board of Supervisors to be submerged or subject to tidal action and found by the Board to be of great value to the state as open space.

"Timber/Forestry Land"means land in timber or forestry use.

"Wildlife Habitat Area" means a land or water area designated by the Board of Supervisors, after consulting with and considering the recommendation of the California Department of Fish and Game, as an area of importance for the protection or enhancement of the wildlife resources of the state. Wildlife habitat area shall include any land area designated in the General Plan as a biotic habitat area or riparian corridor.

"Zoning Code" means the Sonoma County Zoning Code and the Sonoma County Coastal Zoning Code.

Uniform Rule 3.0 - Agricultural Preserves.

3.1 Introduction.

The Land Conservation Act and these uniform rules authorize the Board of Supervisors to establish agricultural preserves as areas devoted to agricultural or open space uses. Once an agricultural preserve has been established, the County and an owner of land within the preserve may enter into a land conservation contract pursuant to the Land Conservation Act and these uniform rules. An agricultural preserve may be created prior to or concurrently with the creation and execution of a land conservation contract restricting land within the preserve. It is possible for land to be located within an agricultural preserve, but not be under a land conservation contract. However, all land under a land conservation contract must be located within an agricultural preserve.

3.2 Uniformity of Agricultural Preserves.

Under the County's prior rules, the County had two different types of agricultural preserves - Type I and Type II preserves. Type I preserves were for prime agricultural land and Type II preserves were for non-prime agricultural land and open space land. It is the intent of the Board of Supervisors in enacting these uniform rules to eliminate the distinction between the two types of preserves. Under these uniform rules, once an agricultural preserve is established, a land conservation contract may be executed for any qualifying agricultural or open space land within the preserve.

3.3 Requirements for Establishing, Disestablishing, or Altering Agricultural Preserves.

All of the following requirements shall apply to establishing, disestablishing, or altering an agricultural preserve, whether initiated by a landowner or the County:

A. Each agricultural preserve must contain at least 100 contiguous acres of land unless the Board of Supervisors finds that a smaller preserve is necessary due to the unique characteristics of the agricultural enterprises in the area and that such preserve is consistent with the General Plan and Zoning Code. Only whole parcels shall be accepted into an agricultural preserve.

B. The use of any land within an agricultural preserve must be restricted by zoning that is compatible with the agricultural or open space uses of the land within the preserve subject to land conservation contracts.

C. No agricultural preserve may be disestablished or altered to remove land from the preserve if removal of the land would cause or contribute to the premature or unnecessary conversion of agricultural land to urban uses or to significant encroachment of incompatible land uses into the immediate vicinity of contracted land.

D. No agricultural preserve may be disestablished or altered to remove land from the preserve if to do so would breach a land conservation contract restricting land located within the preserve.

E. All agricultural preserves must be consistent with the General Plan and Zoning Code.

3.4 Landowner Proposals to Establish, Disestablish, or Alter Agricultural Preserves.

A. A landowner whose land is devoted to agricultural or open space uses, but is not within an agricultural preserve, may file an application with the Permit and Resource Management Department to establish a new preserve or alter an existing preserve to include the land. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

B. A landowner whose land is within an agricultural preserve and wishes to have the land removed from the preserve may file an application with the Permit and Resource Management Department to disestablish or alter the preserve to remove the land. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

C. Each application to establish, disestablish, or alter an agricultural preserve shall be filed on a County application form and shall include all required fees, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and all required information and materials have been submitted.

D. Within 60 days after receipt of a complete application to establish, disestablish, or alter an agricultural preserve, the Permit and Resource Management Department shall review the application for compliance with the Land Conservation Act and these uniform rules, schedule the application for consideration by the Board of Supervisors, and transmit a report and recommendation to the Board containing the analysis required by Government Code section 51234. The Board may not take final action on the application until the report is received or the 60 days have elapsed.

E. No application to establish, disestablish, or alter an agricultural preserve shall be approved unless the Board of Supervisors finds that the application is consistent with the General Plan and meets all of the applicable requirements in Section 3.2 of these uniform rules.

F. An application to establish or alter an agricultural preserve may be considered concurrently with an application for a new or replacement contract pursuant to Uniform Rule 6.0 of these uniform rules. However, such concurrent application shall not alter the requirements of Government Code section 51234.

3.5 Notice and Hearing Requirements.

A. A public hearing shall be required before any final action is taken to establish, disestablish, or alter an agricultural preserve.

B. Notice of the public hearing to establish, disestablish, or alter an agricultural preserve shall be provided in compliance with all of the following:

1. By publication pursuant to Government Code section 6061;

2. By written, mailed notice to the Sonoma County Local Agency Formation Commission at least 14 days prior to the hearing;

3. By written, mailed notice to any city within one mile of the exterior boundaries of the agricultural preserve proposed to be established, disestablished, or altered at least 14 days prior to the hearing;

4. By written, mailed notice to the applicant; and

5. If land is to be removed from an agricultural preserve, by written notice sent by certified mail to each owner of contracted land within one mile of the exterior boundary of the land to be removed.

3.6 Agricultural Preserve Maps.

Whenever an agricultural preserve is established, disestablished, or altered, the Permit and Resource Management Department shall record the adopted resolution and map showing the agricultural preserve or preserves, as established, disestablished, or altered, with the County Recorder's Office.

Uniform Rule 4.0 - Eligibility of Land for Contract.

4.1 Introduction.

Before land may qualify for a land conservation contract, it must meet the eligibility requirements specified in Section 4.2 of these uniform rules. Once land is under contract, it must continue to meet those eligibility requirements for the duration of the contract.

4.2 Eligibility Requirements.

No application for a new or replacement land conservation contract shall be approved by the Board of Supervisors unless all of the following requirements are met:

A. The land proposed to be restricted by the contract must be located within an existing agricultural preserve. The Board of Supervisors may approve an application for the establishment or alteration of an agricultural preserve concurrently with its approval of an application for a contract or contracts within the preserve.

B. The land proposed to be restricted by the contract must be agricultural or open space land devoted to agricultural or open space uses. Mere intent to devote agricultural or open space land to agricultural or open space uses shall be insufficient to qualify the land for a contract. For the purposes of these uniform rules, agricultural or open space land shall be deemed to be devoted to agricultural or open space uses when:

   1. Except as otherwise specified in Subsections 2 and 3 below, a minimum of 50 percent of the land is continuously used or maintained for agricultural uses, open space uses, or a combination of agricultural and open space uses, unless the Board of Supervisors finds that:

      a. More than 50 percent of the land is not suitable for agricultural or open space uses due to soil, slope, geologic, or other significant constraints;

b. The remainder of the land is continuously used or maintained for agricultural uses, open space uses, or a combination of agricultural and open space uses; and

c. Placing the land under contract is consistent with the purpose and intent of the Land Conservation Act and these uniform rules.

2. For less than 40 acres of prime agricultural land devoted to a combination of agricultural and open space uses, a minimum of 10 acres is planted in a permanent crop.

3. For less than 12 acres of prime agricultural land devoted to agricultural uses, a minimum of six acres is planted in a permanent crop.

C. The land proposed to be restricted by the contract must be comprised of a single parcel that meets the minimum parcel size requirements in Table 4-1.

Table 4-1 - Minimum Parcel Size Requirements

Land Type	**Minimum Parcel Size**
Prime Agricultural Land	10 Acres
Non-Prime Agricultural Land, Open Space Land, Timber/Forestry Land	40 Acres

D. The land proposed to be restricted by the contract must meet the annual income requirements in Table 4-2. Except as otherwise specified in Table 4-2, annual income shall be computed on the basis of annual gross revenue per planted acre per year. For the purposes of these uniform rules, annual income may be calculated using actual income data, or if actual data is not available, using projected income figures for existing permanent planted crops, and may be calculated as an average of three of the previous five years' annual income. Only income data from agricultural use of the land shall be used to determine whether the annual income requirement is met.

Table 4-2 - Annual Income Requirements

Land Type/Crop Type	Annual Income
Prime Agricultural Land - Vines and Bushes (i.e., Grapes, Berries, Hops)	Not less than $1,000.00 per Planted Acre
Prime Agricultural Land - Fruit or Nut Trees (i.e., Apples, Olives, Pears, Walnuts)	Not less than $300.00 per Planted Acre
Prime Agricultural Land - Other Unprocessed Agricultural Plant Products	Not less than $200.00 per Planted Acre
Non-Prime Agricultural Land - Grazing, Hay Production, Non-Permanent Row Crops, Livestock Production, Horse Breeding, or Other Unprocessed Agricultural Plant or Animal Products	Not less than $2,000.00 Gross Total Income per Farm Operation and $2.50 Gross Income per Acre of Production
Open Space	Not Applicable
Timber/Forestry	Not Applicable

E. Any use of the land proposed to be restricted by the contract, other than permitted agricultural or open space uses, must be a compatible use allowed under Uniform Rule 8.0 of these uniform rules.

Uniform Rule 5.0. - Contract Applicability.

5.1 Single Parcel and Multi-Parcel Contracts.

A. A new or replacement land conservation contract may only restrict a single parcel.

B. Any existing land conservation contract entered into prior to January 1, 2012, that restricts more than one parcel shall be subject to the following policies and requirements, consistent with Government Code section 51243:

1. The land under the contract shall be deemed divided and the contract shall apply separately and independently to each parcel under the contract, except that, at the election of the owner, multiple contiguous parcels under the contract may be considered a single undivided parcel for the purposes of determining contract eligibility and compliance when the parcels are in the same ownership, farmed together, and individually meet the minimum parcel size requirements in Section 4.2.C of these uniform rules.

2. The contract shall be deemed to run with the land. Whenever land under the contract is divided by subdivision, transfer, sale, or recordation of a certificate of compliance or conditional certificate of compliance under the Subdivision Map Act, the owner of any parcel under the contract may exercise, independent of any other owner, any of the rights created by the original contract.

3. The owner of each parcel under the contract shall independently have all of the rights and responsibilities conferred by the contract, including the right to nonrenew the contract, and the responsibility to comply with all requirements of the contract.

4. A replacement contract shall be required for any qualifying parcel under the contract prior to transfer or sale.

5.2 Uniformity of Contracts.

Under the County's prior rules, the County had two different forms of land conservation contracts - Type I and Type II contracts. Type I contracts were for prime agricultural land and Type II contracts were for non-prime agricultural land

and open space land. It is the intent of the Board of Supervisors in enacting these uniform rules to eliminate the distinction between the two forms of contracts. Under these uniform rules, all existing contracts will continue in full force and effect, and all new or replacement contracts will be a single form and include a land conservation plan detailing the agricultural or open space uses of the land restricted by the contract.

5.3 Contract Term.

Unless otherwise specified by the Board of Supervisors, all land conservation contracts shall have a minimum term of 10 years, renewing automatically at the end of each year, unless a notice of nonrenewal has been timely recorded.

Uniform Rule 6.0. - Contract Applications and Process.

6.1 Application Filing and Processing.

A. A landowner may file an application with the Permit and Resource Management Department for a new or replacement land conservation contract for qualifying agricultural or open space land. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

B. Each application for a new or replacement land conservation contract shall be filed on a County application form and shall include all required fees, a land conservation plan, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and the land conservation plan and all required information and materials have been submitted.

C. All applications for new or replacement land conservation contracts shall be processed in the same manner. A separate application shall be required for each new or replacement contract requested by the landowner.

D. A complete application for a new or replacement land conservation contract must be submitted on or before May 1st of the year prior to the year in which the contract is desired to take effect, or on such other date as established by the Director. Upon receipt of a complete application, the Permit and Resource Management Department shall review the application for compliance with the Land Conservation Act and these uniform rules, schedule the application for consideration by the Board of Supervisors, transmit a report and recommendation to the Board, and place a completed contract on file with the Clerk of the Board. The contract shall include a land conservation plan for the land restricted by the contract and all other required attachments and legal descriptions. The contract shall require that the land restricted by the contract be managed in accordance with the land conservation plan. Prior to the Board's consideration of the application, all landowners and encumbrance holders under the contract must execute the contract and have their signatures notarized, and all legal descriptions must be reviewed and found to be accurate by the Assessor's Office. If the Board approves the application, the contract shall go into effect the January 1st following the date the contract is recorded.

E. No application for a new or replacement land conservation contract shall be approved unless the Board of Supervisors finds that the land proposed to be restricted by the contract meets all of the eligibility requirements in Uniform Rule 4.0 of these uniform rules.

6.2 Joint Applications for Preserve Designation and Contract.

Applications for new or replacement land conservation contracts may be considered by the Board of Supervisors concurrently with applications for the establishment or alteration of an agricultural preserve, pursuant to Uniform Rule 3.0 of these uniform rules. However, such concurrent application shall not alter the requirements of Government Code section 51234.

6.3 Recording of Contracts.

The Clerk of the Board shall record an executed land conservation contract with the County Recorder's Office no later than 20 days after the Board of Supervisors executes it, and shall endeavor to record it no later than December 31st of the calendar year in which it was executed.

6.4 Amendment of Land Conservation Plan.

A. Any substantial change in the operation or the qualifying agricultural or open space uses specified in the land conservation plan for which the Board of Supervisors approved a land conservation contract shall require amendment of the plan.

B. A landowner may file an application with the Permit and Resource Management Department to amend the land conservation plan for the landowner's contracted land. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

C. Each application to amend a land conservation plan shall be filed on a County application form and shall include all required fees, an amended land conservation plan, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and the amended land conservation plan and all required information and materials have been submitted.

D. Upon receipt of a complete application to amend a land conservation plan, the Permit and Resource Management Department shall review the application for compliance with the Land Conservation Act and these uniform rules, schedule the application for consideration by the Board of Supervisors or its designee, and, if the Board considers the application, transmit a report and recommendation to the Board. If the Board or its designee approves the application, the amended plan shall be deemed automatically incorporated into the contract as though fully set forth therein without the need for a replacement contract. The Permit and Resource Management Department shall record the amended plan with the County Recorder's Office no later than 20 days after its approval by the Board of Supervisors or its designee.

Uniform Rule 7.0 - Agricultural and Open Space Uses.

7.1 Introduction.

Land restricted by a land conservation contract must be devoted to agricultural or open space uses.

7.2 Agricultural Uses.

A. Qualifying agricultural uses. To be a qualifying agricultural use a use must meet the definition of "agricultural use," under Uniform Rule 2.0, and be one or more of the following:

1. General farming and the raising, growing, and harvesting of vegetables, field, orchard, bush and berry crops, vineyards, and trees.

2. Commercial growing of flowers.

3. Stock nurseries, greenhouses, floriculture, and horticulture.

4. Commercial growing of irrigated pasture crops.

5. Commercial growing of ornamental trees.

6. Commercial raising of livestock, swine, goats, llamas, poultry, rabbits, birds, fish, frogs, and similar animals produced for food or fiber.

7. Commercial growing of mushrooms.

8. Commercial vermiculture.

9. Beekeeping.

10. Commercial raising of fur-bearing animals.

11. Commercial horse breeding, when the annual breeding operation consists of at least 15 brood mares.

12. Forestry, when at least 50 percent of the parcel is classified as timberland and is subject to an approved timber management plan.

13. **<u>Commercial growing of cannabis, which includes propagation and research and development.</u>**

B. Accessory Agricultural Uses and Structures. The following uses and structures, provided that they are incidental, related, and subordinate to a qualifying agricultural use:

1. Preparation for market of agricultural commodities in their natural state, which are grown or raised on-site or in the local area, including the following activities: sorting, grading, sizing, polishing, cleaning, packing, cooling, and shipping. Preparation under this subsection shall not include processing of an agricultural commodity beyond the natural state.

2. Facilities and structures utilized in conjunction with the preparation of an agricultural commodity described in Subsection 1 above.

3. Storage of agricultural commodities in their natural state, and facilities for such storage, including barns, silos, and other structures for the storage of agricultural commodities in their natural state.

4. Non-commercial composting.

5. Agricultural wells.

6. Wastewater treatment ponds where the recycled water is used for irrigation purposes.

7. Wind machines, reservoirs, and other structures used for frost protection.

8. Irrigation infrastructure, including reservoirs, pumps, windmill powered pumps, tanks, and wells.

9. Structures used to store equipment, vehicles, and other items or goods used exclusively for the production of an agricultural commodity or commodities on the contracted land.

10. Fencing, corrals, paddocks, and other similar structures used in the commercial raising of plants or animals for food or fiber.

11. Renewable energy power generation facilities providing power primarily for on-site use.

12. Private internal and access roads for farm equipment and farm operations.

13. Accessory uses in support of the onsite cannabis cultivation, including but not limited to propagation, research and development, processing, packaging and labeling, and distribution would be considered accessory agricultural uses and structures.

7.3 Open Space Uses.

Qualifying open space uses shall be limited to those uses that meet the definition of “open space use” under these uniform rules.

Uniform Rule 8.0 - Compatible and Incompatible Uses.

8.1 Introduction.

Land under a land conservation contract must be devoted to agricultural or open space uses. However, the County recognizes that it may be appropriate to allow other uses of contracted land that are compatible with the agricultural or open space uses on the land. This uniform rule enumerates certain uses that the County considers compatible on contracted land if they are limited in area. This uniform rule also enumerates certain uses that the County considers incompatible on contracted land. The limitation on area of compatible uses, as provided herein, may only be exceeded if the requirements of Section 8.2.B of these uniform rules are met, to ensure that use of the contracted land is consistent with the purposes and intent of the Land Conservation Act and these uniform rules.

8.2 Area limitation and exceptions.

A. The compatible uses enumerated under this uniform rule may be allowed on contracted land if they collectively occupy no more than 15% of the contracted land as a whole, or 5 acres, whichever is less, excluding public roads, private access roads, and driveways.

B. The area limitation imposed by Subsection A above may be exceeded for a proposed compatible use only where the Board of Supervisors finds that:

1. The use is enumerated as a compatible use by these uniform rules;

2. The contracted land will continue to be devoted to agricultural or open space uses;

3. The use complies with the requirements of Government Code sections 51238.1 through 51238.3;

4. The use will not result in a significant increase in the density of the temporary or permanent human population that could hinder or impair agricultural operations on the contracted land;

5. The use will not require and will not encourage the extension of urban services such as public sewer or water, or the upgrade of

public roads to urban standards that could encourage premature conversion of agricultural land to non-agricultural uses;

6. The use will not include a residential subdivision on the subject parcel;

7. The use is consistent with the General Plan and Zoning Code; and

8. The use will not significantly change the character, appearance, or operation of the agricultural or open space uses of the contracted land.

8.3 Compatible Uses - Agricultural Contracted Land.

The following uses are considered compatible with agricultural uses on any agricultural contracted land, if allowed by the underlying zoning.

A. Residential Uses.

1. Primary dwelling. A single-family dwelling occupied by the landowner or farm operator.

2. Farm family dwelling. An additional single-family dwelling, provided that:

   a. The dwelling is incidental to the primary dwelling in terms of size, location, and architecture;

   b. The dwelling is not leased, subleased, rented, or sub-rented separately from the primary residence, nor divided by sale; and

   c. The dwelling is occupied by the farm operator or an immediate family member of the landowner or farm operator.

3. Agricultural employee dwellings. Additional single-family dwellings, provided that each dwelling is occupied by a full-time agricultural employee or employees.

4. Farmworker housing. Housing for seasonal and year-round farmworkers.

6. Temporary disaster housing.

   a. The temporary disaster housing allowed under this subsection 6 may not displace or impair current or foreseeable agricultural operations, may not displace agricultural workers, and may not require the extension of urban services or infrastructure.

   b. Primary dwellings and farm family dwellings listed in subsections 1 and 2 of this Rule 8.3.A, may be temporarily used to house persons who were displaced by wildfires covered by Presidential Declaration of Major Disaster DR-4344.

   c. Guest quarters and pool houses that are allowed as residential accessory structures under subsection 5 of this Rule 8.3.A, may be temporarily used to house persons who were displaced by wildfires covered by Presidential Declaration of Major Disaster DR-4344.

   d. Marketing accommodations that are allowed under subsection 2 of Rule 8.3.B, may be temporarily used to house persons who were displaced by wildfires covered by Presidential Declaration of Major Disaster DR-4344.

   e. If adequate water, wastewater, and approved source of electricity are available on the parcel to support recreational vehicles, then recreational vehicles may be temporarily located on the contracted land in order to house persons who were displaced by wildfires covered by Presidential Declaration of Major Disaster DR-4344.

   f. Nothing in this subsection 6 of Rule 8.3.A. removes or suspends regulatory requirements or authority of the State Department of Housing and Community Development to regulate residential use of recreational vehicles as special occupancy parks or otherwise, other than as such provisions are suspended or modified by State law and/or Executive Order or emergency proclamation by the Governor.

g. Every recreational vehicle placed on contracted land as temporary disaster housing under this subsection 6 of Rule 8.3.A, and any temporary installation or hook up for water, wastewater, or electric service, shall be removed no later than the expiration date of this subsection 6 of Rule 8.3.A.

h. As used in this subsection 6, "displaced person(s)" means a county resident or residents whose residential dwelling has been destroyed or damaged by the Sonoma Complex Fire, such that the resident(s) cannot occupy the dwelling. Displaced person(s) may be required to provide verification to the county to substantiate their eligibility for temporary disaster housing under this subsection 6 of Rule 8.3.A. Evidence may consist of verification by Federal Emergency Management Agency (FEMA) registration or damage assessment, and /or a driver's license or other government-issued identification card or utility bill, etc. with a physical address showing the resident resided on a legal parcel impacted by the Sonoma Complex Fire, as determined by the county. Such determination may be made by the director or other county personnel.

i. As used in this subsection 6, "recreational vehicle," means a motor home, travel trailer, truck camper or camping trailer that is (1) self-contained and designed for human habitation for recreational or emergency occupancy; (2) self-propelled, truck-mounted, or permanently towable on California roadways; and (3) a California Department of Motor Vehicles licensed vehicle; or a similar vehicle or structure as determined by the director.

j. This subsection 6 of Rule 8.3.A. expires on December 31, 2019, unless extended or modified by resolution of the Board of Supervisors.

5. Accessory uses and structures. The following uses and structures, provided that they are incidental, related, and subordinate to a compatible residential use:

a. Private garage.

b. Workshop.

c. Patios, decks, gazebos, and similar structures.

d. Domestic wells and septic systems.

e. Fences.

f. Sport courts (i.e. tennis, bocce ball, or basketball).

g. Swimming pool with or without a pool house.

h. Guest quarters.

i. Home occupation.

j. Small family day care home providing day care to 8 or fewer children, including children under the age of 12 who reside at the home.

B. Agricultural Support Uses.

1. Processing of agricultural commodities beyond the natural state, including processing by pressing, pasteurizing, slaughtering, cooking, freezing, dehydrating, and fermenting. This use includes facilities for processing and storage of agricultural commodities beyond the natural state such as wineries, dairies, slaughterhouses, and mills. **<u>This includes processing of cannabis grown off-site and cannabis manufacturing.</u>**

2. Sale and marketing of agricultural commodities in their natural state or beyond, including winery tasting rooms, promotional activities, marketing accommodations, farmer's markets, stands for the sampling and sale of agricultural products, livestock auction or sale yards, and related signage.

3. Facilities for and the conduct of services supporting the production of an agricultural commodity for commercial purposes within the

county, including veterinary services and farm equipment repair services.

4. Wells, septic systems, and wastewater treatment ponds necessary for agricultural support uses.

C. Recreational Uses.

1. Fishing or hunting of wildlife, including fishing and hunting clubs.

2. Unpaved trails, when used for hiking, horseback riding, or non-motorized cycling.

3. Picnicking, swimming, or non-motorized boating.

4. Passive recreational activities, including frisbee or paintball, when there is no alteration to terrain.

5. Accessory structures incidental, related, and subordinate to allowed recreational uses.

D. Raising, Breeding, and Boarding of Animals.

1. Raising, breeding, and boarding of domestic animals.

2. Raising, breeding, and boarding of horses, including training and rentals, riding or equestrian clubs, riding academies, riding arenas, and individual or group riding lessons.

3. Raising, breeding, and boarding of farm animals, including livestock, goats, llamas, poultry, rabbits, pigs, birds, fish, frogs and similar animals.

E. Resource Extraction and Energy Production Facilities.

1. Water, oil, gas, and steam wells.

2. Renewable energy power generation facilities providing power primarily for off-site use, when the facilities are located on non-prime agricultural land that is not state designated prime farmland, farmland of statewide importance, or unique farmland.

3. Mining or mineral extraction, quarrying, and screening, but not including crushing or other refining, preparing, or processing of raw materials. While the mining or mineral extraction, quarrying, or screening activity continues, raw materials mined on the contracted land may be stored or stockpiled on the contracted land for a reasonable time, but not more than 90 days, prior to being transported off-site for such crushing, refining, preparing, or processing.

4. Forestry and logging, but no processing of raw materials, logging mills (other than portable mills for temporary use), or mill ponds.

F. Communication and Utility Transmission Facilities.

1. Communication transmission facilities, including antennas, towers, transmitters, cables, and wires.

2. Gas, electric, or water transmission facilities.

~~**G. Cannabis. The cultivation of cannabis, including the planting, growing, harvesting, drying, curing, grading, or trimming of cannabis in its natural state. This compatible use category expressly excludes manufacturing, retail sales, distributing, dispensing, and marketing of cannabis or cannabis products.**~~

H. Miscellaneous.

1. Special events, when directly related to agricultural education or the promotion or sale of agricultural commodities and products produced on the contracted land, provided that:

a. The events last no longer than two consecutive days and do not provide overnight accommodations: and

b. No permanent structure dedicated to the events is constructed or maintained on the contracted land.

2. Farm Stays, provided that:

a. Guest occupancy is limited to a maximum of 10 guests; and

b. Agricultural commodities produced on the contracted land are marketed to the guests.

3. Public roads, private access roads, and driveways.

4. Mitigation sites for preservation of habitat for rare, threatened, or endangered species.

5. Carbon sequestration areas acknowledged by a federal, state, or local governmental agency as offsetting greenhouse gas impacts and contributing to the attainment of established greenhouse gas reduction goals.

6. Private family burial plots.

7. Any other use determined by the Board of Supervisors pursuant to Government Code section 51238.1 to be compatible with the agricultural or open space use of land within an agricultural preserve and subject to contract.

8.4 Incompatible Uses - Agricultural Contracted Land.

The following uses are considered incompatible with agricultural uses on any agricultural contracted land:

A. Golf courses.

B. Public, commercial, or private club use of motorized boats, motorcycles, vehicles, aircraft, or similar motorized uses for recreation.

C. Public, commercial, or private club use of land for field sports, including baseball, softball, polo, soccer, lacrosse, and football, or similar activities.

D. Public, commercial, or private club use of land for camping. Tent platforms, structures, and other facilities to support camping are not permitted.

8.5 Compatible Uses - Open Space Contracted Land.

The following uses are considered compatible with open space uses on any open space contracted land if allowed by the underlying zoning.

A. Residential Uses.

1. Primary dwelling. A single-family dwelling occupied by the landowner or caretaker of the contracted land. If the contract does not identify the location of the dwelling, it may be located anywhere on the contracted land where it is otherwise legally permitted and does not interfere with or impair the open space use of the contracted land.

2. Accessory uses and structures. The following uses and structures, provided that they are incidental, related, and subordinate to a compatible residential use:

   a. Private garage.

   b. Workshop.

   c. Patios, decks, gazebos, and similar structures.

   d. Domestic wells and septic systems.

   e. Fences.

   f. Swimming pool with or without a pool house.

   g. Guest quarters.

   h. Home occupation.

   i. Small family day care home providing day care to 8 or fewer children, including children under the age of 12 who reside at the home.

B. Passive Recreational Uses. Recreational uses that are limited, non-intensive, non-motorized, incidental, and passive, provided that such recreational uses, and limits and conditions on such uses, are expressly stated in the contract, which may preclude recreational uses completely. Passive recreational uses expressly stated in the contract may include hiking, horseback riding, non-motorized cycling, hunting, fishing, scenic viewing, and similar recreational activities.

C. Scientific and Educational Uses.
Scientific research and educational study, provided that it does not result in the removal or disturbance of significant vegetation, geologic or biological features, or land forms. Facilities exclusively for educational and scientific use may be constructed and maintained, but shall be limited to 2500 cumulative square feet for the contracted land.

D. Agricultural Uses. Limited agricultural uses, provided that such uses are expressly permitted in the contract and do not impair the open space use of the contracted land.

E. Miscellaneous.

1. Special events, when directly related to open space education, provided that:

    a. The events last no longer than two consecutive days and do not provide overnight accommodations; and

    b. No permanent structure dedicated to the events is constructed or maintained on the contracted land.

2. Mitigation sites for preservation of habitat for rare, threatened, or endangered species.

3. Carbon sequestration areas acknowledged by a federal, state, or local governmental agency as offsetting greenhouse gas impacts and contributing to the attainment of established greenhouse gas reduction goals.

4. Private family burial plots.

5. Any other use determined by the Board of Supervisors pursuant to Government Code section 51238.1 to be compatible with the

agricultural or open space use of land within an agricultural preserve and subject to contract.

8.6 Incompatible Uses - Open Space Contracted Land.

A. Permanent structures are considered incompatible with open space uses on any open space contracted land, except as provided in Sections 8.5.A and 8.5.C of these uniform rules.

B. The following uses are considered to be uses incompatible with open space uses on any contracted land: (1) the cultivation of cannabis, including the planting, growing, harvesting, drying, curing, grading, or trimming of cannabis; and (2) manufacturing, retail sales, distributing, dispensing, and marketing of cannabis or cannabis products.

Uniform Rule 9.0 - Contract Termination.

9.1 Introduction.

A land conservation contract may only be terminated in a manner consistent with the Land Conservation Act and these uniform rules.

9.2 Nonrenewal.

A. Nonrenewal Initiated by Landowner.

1. If a landowner desires in any year not to renew a land conservation contract, the landowner shall file an application with the Permit and Resource Management Department for nonrenewal by the September 1st preceding the contract's annual renewal date. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

2. Each application for nonrenewal shall be filed on a County application form and shall include all required fees, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed

complete, and processing shall not commence on any application, until all required fees have been paid, and all required information and materials have been submitted.

3. Upon receipt of a complete application for nonrenewal, the Permit and Resource Management Department shall prepare the notice of nonrenewal and deliver the notice to the applicant. To be effective, the notice of nonrenewal must be (i) signed by the landowner and the signature notarized; and (ii) served by the landowner on the County by delivering it to the Clerk of the Board at least 90 days prior to the contract's annual renewal date. Service may be made in person, or by U.S. Mail postmarked no later than the 90^{th} day before the contract's annual renewal date. The Clerk of the Board shall record the notice of nonrenewal with the County Recorder's Office within 20 days of receipt of the served notice of nonrenewal.

4. If a notice of nonrenewal is inadequate or rejected for recording by the County Recorder's Office, the Clerk of the Board shall return it to the landowner and notify the Permit and Resource Management Department.

5. The Permit and Resource Management Department shall deliver a copy of the notice of nonrenewal to the California Department of Conservation within 30 days of receipt of the landowner's served notice of nonrenewal.

6. If a notice of nonrenewal is served after the applicable deadline in Subsection A.3 above, the notice shall be deemed to apply to the contract's next annual renewal date.

7. On or before March 1^{st} of each year, the Permit and Resource Management Department, in cooperation with the Assessor's Office and the Clerk of the Board, shall prepare an annual report to the Board of Supervisors identifying the land conservation contracts for which notices of nonrenewal were recorded during the prior calendar year, and which were not renewed as of the January 1^{st} tax lien date.

B. Partial Nonrenewal Initiated by Landowner.

1. If a landowner desires in any year not to renew a land conservation contract as to a portion of the landowner's land under the contract,

the landowner may file an application with the Permit and Resource Management Department for authorization to serve a notice of partial nonrenewal. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

2. Each application for authorization to serve a notice of partial nonrenewal shall be filed on a County application form and shall include all required fees, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and all required information and materials have been submitted.

3. Upon receipt of a complete application for authorization to serve a notice of partial nonrenewal, the Permit and Resource Management Department shall review the application for compliance with the Land Conservation Act and these uniform rules, schedule the application for consideration by the Board of Supervisors, and transmit a report and recommendation to the Board. In determining whether to approve the application, the Board may consider the effect of the proposed partial nonrenewal on the balance of the contracted land not subject to the nonrenewal, including whether the balance of the contracted land would continue to qualify for the contract. Notice of the Board meeting at which the application will be considered shall be provided to the owners of all parcels subject to the contract. If the Board approves the application, the Permit and Resource Management Department shall prepare the notice of partial nonrenewal and deliver the notice to the applicant. To be effective, the notice of partial nonrenewal must be (a) signed by the landowner and the signature notarized; and (b) served by the landowner on the County by delivering it to the Clerk of the Board at least 90 days prior to the contract's annual renewal date. Service may be made in person, or by U.S. Mail postmarked no later than the 90th day before the contract's annual renewal date. The Clerk of the Board shall record the notice of partial nonrenewal with the County Recorder's Office within 20 days of receipt of the served notice of partial nonrenewal.

4. If a notice of partial nonrenewal is inadequate or rejected for recording by the County Recorder's Office, the Clerk of the Board

shall return it to the landowner and notify the Permit and Resource Management Department.

5. The Permit and Resource Management Department shall deliver a copy of the notice of partial nonrenewal to the California Department of Conservation within 30 days of receipt of the landowner's served notice of partial nonrenewal.

6. If a notice of partial nonrenewal is served after the applicable deadline in Subsection A.3 above, the notice shall be deemed to apply to the contract's next annual renewal date.

7. On or before March 1st of each year, the Permit and Resource Management Department, in cooperation with the Assessor's Office and the Clerk of the Board, shall prepare an annual report to the Board of Supervisors identifying the land conservation contracts for which notices of partial nonrenewal were recorded during the prior calendar year, and which were not renewed as of the January 1st tax lien date.

C. Nonrenewal Initiated by County.[1]

1. If the County desires in any year not to renew a land conservation contract, it shall serve written notice of nonrenewal upon each owner of the contracted land. Service shall be no later than 60 days prior to the contract's annual renewal date.

2. The Clerk of the Board shall record the notice of nonrenewal with the County Recorder's Office within 20 days after the County serves such notice.

3. A landowner may file a written protest of the notice of nonrenewal with the County. A protest shall be filed with the Permit and Resource Management Department no later than December 2nd of the year in which the notice of nonrenewal is served. The protest must contain sufficient information to identify the notice of nonrenewal for which the protest is submitted.

4. The County may withdraw a recorded notice of nonrenewal by recording a notice of withdrawal of notice of nonrenewal, any time prior to the contract's annual renewal date. The notice of nonrenewal may be withdrawn where the affected parcel is in compliance with the contract, or there is a

[1] Amended May 7, 2013 by Board of Supervisors Resolution No. 13-0186.

demonstrated commitment by the owner to bring the parcel into compliance. The Permit and Resource Management Department may execute the notice of withdrawal of a notice of nonrenewal on behalf of the County.

5. The Clerk of the Board shall record the notice of withdrawal of notice of nonrenewal with the County Recorder's Office within 20 days after the County serves such notice.

6. The Clerk of the Board shall deliver a copy of the notice of nonrenewal or a notice of withdrawal of notice of nonrenewal to the California Department of Conservation within 30 days of serving the notice.

7. The Clerk of the Board shall deliver a copy of all recorded notices of nonrenewal and notices of withdrawal of a notice of nonrenewal to the landowners, the Permit and Resource Management Department, the Assessor's Office, and County Counsel. Such copy shall show the date of recording and the County Recorder's instrument number.

8. If the notice of nonrenewal is served after the applicable deadline, the notice will be deemed to apply to the contract's next annual renewal date.

9. Notwithstanding the prior service and recordation of a notice of nonrenewal, a landowner may apply to rescind the contract in nonrenewal and to simultaneously replace it with a new contract with an automatically renewing term

9.3 Cancellation.

A. Applications for cancellation of a land conservation contract shall be processed in accordance with the requirements of the Land Conservation Act and these uniform rules.

B. A landowner may file an application with the Permit and Resource Management Department for cancellation of a land conservation contract as to all or part of the landowner's contracted land. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

C. Each application for cancellation of a land conservation contract shall be filed on a County application form and shall include all required fees, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and all required information and materials have been submitted.

D. The Board of Supervisors shall not approve any application for cancellation of a land conservation contract unless the cancellation fee equals the cancellation fee specified in Government Code section 51283(b), except in those cases where the Board, pursuant to Government Code section 51283(c), finds that it is in the public interest to waive all or part of the cancellation fee. In the event the Board determines to waive all or part of the cancellation fee, the Board shall specify the cancellation fee payable. No cancellation shall be effective unless and until the cancellation fee is paid.

E. Notwithstanding any contract term to the contrary, cancellation shall not be required to terminate a land conservation contract as to all or a portion of contracted land that is acquired by a public agency by condemnation or eminent domain, or in lieu of condemnation or eminent domain. The provisions of Government Code section 51290 et seq., governing public acquisitions of land within an agricultural preserve, or contracted land within a preserve, apply to contracted land within the county. Where required by Government Code section 51290 et seq., the County shall deem a contract null and void as to the land area acquired by a public agency by condemnation or in lieu of condemnation.

9.4 Rescission and Replacement with New Land Conservation Contract.

A. A landowner and the County may mutually agree to rescind an existing land conservation contract in order to simultaneously enter into a replacement contract or contracts, where the replacement contract or contracts would enforceably restrict the same land for an initial term at least as long as the unexpired term of the contract being so rescinded, but not less than 10 years unless otherwise specified by the Board of Supervisors. Applications for replacement contracts shall be reviewed and processed in accordance with the Land Conservation Act and these uniform rules. Replacing a contract that is in nonrenewal with a replacement contract or contracts effectively terminates the nonrenewal process previously initiated.

B. If a parcel restricted by an existing multi-parcel land conservation contract is transferred or sold, the new owner and the County shall mutually agree to rescind the contract as to the transferred parcel and simultaneously replace it with a replacement contract, if the transferred parcel independently meets all requirements for a contract under these uniform rules. If the transferred parcel does not meet all requirements for a contract under these uniform rules, the new owner shall initiate nonrenewal of the contract as to the transferred parcel.

9.5 Rescission and Replacement with Open Space Easement.

A landowner and the County may mutually agree to rescind a land conservation contract in order to simultaneously enter into an open space easement agreement pursuant to the Open Space Easement Act of 1974, Government Code section 51070 et seq., provided that the requirements of Government Code section 51255 are met. This action may be taken notwithstanding the prior serving of a notice of nonrenewal.

9.6 Easement Exchange.

The County, upon an application by a landowner, may enter into an agreement with the landowner to rescind a land conservation contract in order to simultaneously place other land within the county under an agricultural conservation easement (Public Resources Code section 10200 et seq.), provided that the requirements of Government Code section 51256 are met.

9.7 Annexation by City.

A. On the annexation by any city within the county of any land under a land conservation contract, the city shall succeed to (i.e. legally take over) all rights, duties, and powers of the County as a party to the contract, including the power to initiate nonrenewal of the contract. Under certain limited circumstances defined in Government Code section 51243.5, a city may elect not to succeed to the rights, duties, and powers of the County under the contract. For farmland security zone contracts, see the provisions of Government Code sections 51296.3 through 51296.6.

B. Whenever part of the land under a land conservation contract is removed from the County's jurisdiction through annexation to a city, the part remaining under contract in the County's jurisdiction must be able to independently meet the eligibility requirements in Section 4.2 of these uniform rules to remain under contract. In the event that unqualified land is left subject to contract, the County shall immediately serve a notice of nonrenewal for the contract, unless a notice of nonrenewal has already been recorded and the contract is in the process of phasing out.

C. In cases of annexation of land under a land conservation contract, coordination is encouraged between the annexing city, the Sonoma County Local Agency Formation Commission, the County, and the landowner to ensure that proper protocol is followed and that all parties are provided the opportunity to comment and work towards the best possible outcome for all parties involved.

9.8 Eminent Domain or Public Acquisitions in lieu of Eminent Domain.

Pursuant to the Land Conservation Act, a land conservation contract becomes void for land that is acquired by a federal, state, or local government agency for necessary public uses and facilities via eminent domain or by acquisition in lieu of eminent domain. Notwithstanding contract language to the contrary, there is no requirement that the acquiring or condemning federal, state, or local government agency seek or obtain cancellation of the contract as to the land so acquired.

The Land Conservation Act contains policies and restrictions to avoid public acquisitions of land subject to land conservation contracts or containing prime agricultural land. The Land Conservation Act imposes certain requirements on public agencies seeking to acquire contracted land or place public improvements within an agricultural preserve, or on contracted land. For example, state and local governments proposing to acquire land within an agricultural preserve are required by the Land Conservation Act to refer proposals for such acquisitions to the California Department of Conservation for its review and response prior to acquisition.

Uniform Rule 10.0 - Land Divisions, Lot Line Adjustments, and Certificates of Compliance.

10.1 Subdivision of Contracted Land.

A. No land subject to a land conservation contract shall be subdivided unless the Board of Supervisors finds that:

1. The subdivision is consistent with the General Plan and Zoning Code;

2. Each resulting parcel will separately qualify for a land conservation contract and be consistent with the requirements of the Land Conservation Act and these uniform rules; and

3. The subdivision and each resulting parcel will conform with the requirements of the Subdivision Map Act, including Government Code section 66474.4.

B. The County shall require an owner of contracted land that has been or will be subdivided to apply, pursuant to Uniform Rule 9.0 of these uniform rules, for rescission of the existing contract and simultaneous replacement of that contract with a separate new contract for each qualifying parcel resulting from the subdivision. This requirement may be waived by the County if a notice of nonrenewal has been recorded for the contract restricting the land that has been or will be subdivided, and the phase out period has begun.

10.2 Lot Line Adjustments Involving Contracted Land.

A. To facilitate a lot line adjustment of contracted land, a landowner and the County may mutually agree to rescind a land conservation contract or contracts and to simultaneously enter into a new contract or contracts, provided that:

1. The new contract or contracts satisfy all requirements of the Land Conservation Act and these uniform rules; and

2. The Board of Supervisors makes the findings required by Government Code section 51257.

B. If the Board of Supervisors is unable to make the findings required by Government Code section 51257, it shall not approve a lot line adjustment of contracted land.

10.3 Certificates of Compliance.

A. The approval of the Board of Supervisors shall be required prior to the issuance of any certificate of compliance or conditional certificate of compliance under the Subdivision Map Act for land restricted by a new or replacement land conservation contract entered into on or after January 1, 2012. In such cases, the Board may only approve the issuance of a certificate of compliance or conditional certificate of compliance if the Board finds that:

1. Each resulting parcel is consistent with the Land Conservation Act and these uniform rules;

2. Each resulting parcel is capable of sustaining an agricultural use, open space use, or both;

3. Each resulting parcel has the improvements or infrastructure necessary to sustain an agricultural use, open space use, or both;

4. Each resulting parcel independently meets all requirements for a contract under these uniform rules;

5. Each resulting parcel conforms to the General Plan and Zoning Code;

6. Each resulting parcel is entitled to a certificate of compliance or conditional certificate of compliance under the Subdivision Map Act;

7. Issuance of the certificate of compliance or conditional certificate of compliance will not compromise the long-term agricultural use, open space use, or both of the contracted land, other agricultural or open

space land subject to a contract or contracts, or other agricultural or open space land in the preserve or proximate preserves;

8. Issuance of the certificate of compliance or conditional certificate of compliance will not result in the removal of adjacent land from agricultural use, open space use, or both; and

9. Issuance of the certificate of compliance or conditional certificate of compliance will not result in residential development not incidental to the agricultural use, open space use, or both of the contracted land.

Uniform Rule 11.0 - Contract Compliance and Enforcement.

11.1 Land Conservation Act Compliance Determination Required Before Permit Issuance.

A. Compliance Determination by Permit and Resource Management Department.

Prior to issuance of any permit for development or use of contracted land, other than qualifying agricultural or open space uses, the landowner shall obtain clearance from the Permit and Resource Management Department that the contracted land is in compliance with the land conservation contract, and that the proposed development or use will comply with the contract and these uniform rules. The Permit and Resource Management Department shall not issue any permit for development or use of contracted land if the contracted land is not in compliance with the contract, or the proposed development or use will not comply with the contract and these uniform rules. The Director may authorize an exception to this requirement for health or safety reasons.

B. Appeals to Director.

Any interested person may appeal any determination made pursuant to Subsection A above to the Director. An appeal must be filed within 10 days after the decision and be accompanied by payment of the required appeal fee.

C. Appeal to Board of Supervisors.

Any interested person may appeal any decision by the Director made pursuant to Subsection B above to the Board of Supervisors. An appeal to the Board must be filed within 10 days after the Director's decision and be accompanied by payment of the required appeal fee.

11.2 Information Requests.

A. The Assessor's Office may mail agricultural preserve questionnaires to the owners of contracted land. Each owner of contracted land receiving a questionnaire shall return the completed questionnaire to the Assessor's

Office within 30 days after receipt of the questionnaire, unless an extension of time is obtained from the Assessor's Office. The Assessor's Office may provide a copy of the non-confidential information on each returned questionnaire, and a list of parcels for which no completed questionnaire was returned, to the Permit and Resource Management Department. Those properties for which a completed questionnaire was not returned, and those properties for which non-confidential information indicates a potential breach, may be subject to an investigation by the Permit and Resource Management Department or the Assessor's Office regarding whether the property is in compliance with the land conservation contract restricting it, the Land Conservation Act, these uniform rules, and other state and local laws, regulations, and guidelines.

B. The Permit and Resource Management Department may mail requests for information concerning contract compliance to the owners or users of contracted land. Each owner or user of contracted land receiving a request for information shall return the completed request to the Permit and Resource Management Department within 30 days after receipt of the request, unless an extension of time is obtained from the Permit and Resource Management Department.

C. Any income or production data submitted to the Assessor's Office or the Permit and Resource Management Department pursuant to this section shall be proprietary and shall be confidential for a minimum of 5 years.

11.3 Audits & Inspections.

A. The County may audit any contracted land for compliance with the land conservation contract, the Land Conservation Act, these uniform rules, and other state and local laws, regulations, and guidelines. Such audits may include reviewing available documentation such as aerial photographs and non-confidential portions of completed agricultural preserve questionnaires and contacting the landowner or manager to obtain additional information or documentation. The Permit and Resource Management Department is authorized to develop procedures and guidelines for the conduct of audits under this section.

B. If the County has probable cause to suspect that contracted land is not in compliance, it may contact the landowner to arrange for an inspection of the property by the County's officers, employees, contractors, or agents.

The County shall give the landowner at least 48 hours written notice of the inspection date, approximate time, the person(s) who will be participating in the inspection, and the reason for the inspection. When scheduling an inspection, the County must make a reasonable attempt to accommodate the landowner's schedule. Any such inspection shall occur during normal business hours (Monday through Friday, 8:00 A.M. to 5 P.M.).

11.4 Material Breaches.

The County will fulfill its enforcement responsibilities for material breach of land conservation contracts pursuant to Government Code section 51250.

11.5 Contract Enforcement.

Land conservation contracts are binding agreements between landowners and the County that require the terms of the contract to continue to be met in exchange for reduced property tax assessments based on the contract restriction. As such, landowners must remain in compliance during the entire life of the contract, even after transfer of ownership or during phase out after nonrenewal has been initiated. If, at any time, the County finds that the terms of a contract, including the requirements set forth in the Land Conservation Act and these uniform rules, are no longer being met, the Board of Supervisors may serve a notice of nonrenewal pursuant to Uniform Rule 9.0 of these uniform rules or take other appropriate action to enforce the terms of the contract and these uniform rules.

11.6 Owner Annual Report.

Every owner of land under contract shall annually report in writing to PRMD information demonstrating that the owner's contracted land is in compliance Uniform Rule 4.0. "Eligibility of Land for Contract." The report shall include information on income, parcel size, and agricultural, open space, and compatible uses occurring on the property. PRMD may develop an annual owner's reporting form for use by owners, and make it available to owners to assist them in reporting under this section. In the absence of a reporting form developed by PRMD, owners may report the required information in any format. The absence of a reporting form does not excuse the owner from making the annual report required under this section.

Uniform Rule 12.0 – Farmland Security Zones and Farmland Security Zone Contracts.

12.1 Introduction.

Farmland security zones are special zones within existing agricultural preserves. A farmland security zone contract is a longer term voluntary enforceable restriction that is an alternative to a land conservation contract. Establishment of farmland security zones and farmland security zone contracts are governed by the Land Conservation Act and these uniform rules.

12.2 Requirements for Establishing Farmland Security Zones and Farmland Security Zone Contracts.

A. Minimum parcel size.

1. The land proposed to be designated a farmland security zone must be a minimum of 100 contiguous acres and be comprised of a whole parcel or parcels, none of which may be less than 10 acres in size for prime agricultural land, or 40 acres in size for non-prime agricultural land. If more than one landowner requests the creation of a farmland security zone, and the parcels are contiguous, the County shall place those parcels in the same farmland security zone.

2. The land proposed to be restricted by a farmland security zone contract must be comprised of a single parcel that meets the minimum parcel size requirements in Table 13-1.

Table 13-1 - Minimum Parcel Size Requirements

Land Type	Minimum Parcel Size
Prime Agricultural Land	10 Acres
Non-Prime Agricultural Land	40 Acres

B. Additional requirements. Only land that meets all of the following requirements may be designated a farmland security zone and qualify for rescission of the existing land conservation contract and simultaneous replacement with a farmland security zone contract:

1. The land is located within an existing agricultural preserve.

2. The land is restricted under an existing land conservation contract, and in full compliance with the existing contract, the Land Conservation Act, and these uniform rules.

3. The land is either prime agricultural land or state designated important farmland.

4. The land is devoted to agricultural use.

5. Any use of the land, other than its primary agricultural use, shall meet the requirements of Uniform Rule 8.0 of these uniform rules governing compatible and incompatible uses. However, pursuant to Government Code section 51296.7 and notwithstanding the provisions of Uniform Rule 8.0 of these uniform rules, no use of land within a designated farmland security zone may be approved based on the compatible use provisions contained in Government Code section 51238.1(c).

6. The land is consistent with the General Plan and Zoning Code.

C. City sphere of influence. Land located within a city's sphere of influence may not be included in a farmland security zone, unless the creation of the farmland security zone within the sphere of influence has been expressly approved by resolution by the city with jurisdiction within the sphere of influence.

12.3 Farmland Security Zone Contract Term.

All farmland security zone contracts shall have a minimum term of 20 years, renewing automatically at the end of each year, unless a notice of nonrenewal has been timely recorded. If a notice of nonrenewal of a farmland security zone contract has been properly recorded pursuant to the Land Conservation Act and these uniform rules, the contract shall not automatically renew at the end of the year in which the notice of nonrenewal is recorded, and the contract shall terminate at the natural end of its 20-year term, unless cancelled prior to the end of that term.

12.4 Farmland Security Zone Contract Application and Process.

A. A landowner may file an application with the Permit and Resource Management Department for creation of a farmland security zone, rescission of an existing land conservation contract, and simultaneous replacement with a farmland security zone contract. With the Director's approval, an application may also be filed by an authorized agent of the landowner, or other person with the written consent of the landowner.

B. Each application for creation of a farmland security zone, rescission of an existing land conservation contract, and simultaneous replacement with a farmland security zone contract shall be filed on a County application form and shall include all required fees, a land conservation plan, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and the land conservation plan and all required information and materials have been submitted.

C. All applications for creation of a farmland security zone, rescission of an existing land conservation contract, and simultaneous replacement with a farmland security zone contract shall be processed in a manner that is consistent with the procedures of Uniform Rule 3.0 of these uniform rules governing establishment of agricultural preserves, and Uniform Rule 6.0 of these uniform rules governing new or replacement land conservation contracts, unless required otherwise by this uniform rule or Government Code section 51296 et seq. Designated farmland security zone maps shall be recorded and kept current, consistent with Section 3.5 of these uniform rules.

D. The Board of Supervisors may only approve rescission of an existing land conservation contract and simultaneous replacement with a farmland security zone contract if the land subject to the land conservation contract is located in a designated farmland security zone.

E. Pursuant to Government Code section 51297.4, the Board of Supervisors may rescind a portion or portions of a land conservation contract for the purpose of immediately enrolling the land in a farmland security zone contract, so long as the remaining land is retained in a land conservation contract and the Board determines that its action would improve the conservation of agricultural land within the county. The creation of multiple contracts pursuant to this uniform rule and Government Code section 51297.4 does not constitute a subdivision of land.

12.5 Compatible uses.

The provisions of Uniform Rule 8.0 of these uniform rules governing compatible uses allowed on land under land conservation contracts and incompatible uses not allowed on land under land conservation contracts are applicable to farmland security zone contracts, except that no use of land shall be permitted within a designated farmland security zone based on the compatible use provisions contained in Government Code section 51238.1(c).

12.6 Termination of Farmland Security Zone and Farmland Security Zone Contract.

Upon termination of a farmland security zone contract, the underlying farmland security zone designation for that parcel shall simultaneously be terminated in accordance with Government Code section 51296.1(e). A Farmland Security Zone contract may only be terminated by one of the following methods:

A. Nonrenewal.

Either party to a farmland security zone contract may serve a notice of nonrenewal for the farmland security zone contract. Nonrenewal of a farmland security zone contract shall be pursuant to the requirements of Government Code sections 51296.9 and 51245, and the procedures established by Uniform Rule 9.0 of these uniform rules. A farmland security zone shall terminate at the end of its natural 20 year term following the timely service and recordation of a notice of nonrenewal.

B. Cancellation.

1. A landowner may file an application with the Permit and Resource Management Department for cancellation of a farmland security zone contract and simultaneous termination of the corresponding farmland security zone.

2. Each application for cancellation of a farmland security zone contract and simultaneous termination of the corresponding farmland security zone shall be filed on a County application form and shall include all required fees, and all information and materials required by the Permit and Resource Management Department. No application shall be deemed complete, and processing shall not commence on any application, until all required fees have been paid, and all required information and materials have been submitted.

3. All applications for cancellation of a farmland security zone contract and simultaneous termination of the corresponding farmland security zone shall be processed in accordance with the requirements of Government Code section 51280 et seq., Government Code section 51297, and these uniform rules.

4. The cancellation fee shall equal the cancellation fee specified in Government Code section 51283(b). The cancellation fee may not be waived in whole or in part. No cancellation shall be effective unless and until the cancellation fee is paid.

C. Rescission and replacement.

1. A farmland security zone contract may be rescinded and simultaneously replaced with another farmland security zone contract over the same land.

2. A farmland security zone contract may not be rescinded and simultaneously replaced with a land conservation contract.

D. Eminent domain or other acquisition by a public agency. All of the provisions of Government Code section 51290 et seq. governing acquisition of land located within agricultural preserves by a public agency shall apply to farmland security zones and farmland security zone contracts, unless otherwise provided by Government Code section 51296 et seq.

Appendix C

Air Quality, Energy, Greenhouse Gas
Modeling Data and Odor Studies

Occupational Exposure Limit (OEL) Monograph for Beta-Myrcene

Prepared for: Sonoma County

Prepared by: N. Olive Ngalame, Ph.D. and Matthew J. Linman, Ph.D.

SafeBridge® Consultants, Inc.

Date: 12 May 2025

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Occupational Exposure Limit (OEL) Monograph for Beta-Myrcene
Summary Table

Substance Name(s):	Beta-myrcene
CAS Number:	123-35-3

Substance Profile:

- Beta-myrcene, a naturally occurring monoterpene found in a wide variety of plants, primarily has uses as a flavoring and fragrance, but also as an intermediate in chemical manufacturing.
- No adverse effects are reported at levels approved for use in food and fragrances.
- Over exposure to pure beta-myrcene can result in irritation (skin, eye). Chronic repeated oral (gavage) exposure in rodents to extraordinarily high levels of beta-myrcene resulted in tumors and a classification by the NTP of "clear evidence" of carcinogenicity in male rats/mice and "equivocal evidence" of carcinogenicity in female rats/mice. However, as the animal exposures were 145,000 times the daily exposures in typical food uses, the FDA determined the study is irrelevant for human health risk assessments.

Basis for the OEL:

- The critical effect used for the OEL calculation was the absence of adverse effects observed following 90 day oral (dietary) administration of beta-myrcene to rats. The NOAEL is based upon a lack of observed effects at the highest dose level (115 mg/kg bw/day) [1], which was chosen as the point of departure; and was adjusted for a 70 kg worker, extrapolation between species, inter-individual variability, extrapolation from short duration studies, route-to-route extrapolation, and a breathing volume of 10 m^3 for a worker doing moderate work in an 8-hour day.

Recommended OEL:

- 5 mg/m^3 as an 8-hour TWA

Standard Abbreviations

α –	route-to-route adjustment factor
ADE –	acceptable daily exposure
AF_A –	variability between species (F1)
AF_C –	composite adjustment factor
AF_D –	incomplete data set (F4)
AF_H –	variability between subjects (F2)
AF_L –	LOAEL to NOAEL extrapolation (F5)
AF_S –	extrapolation study duration (F3)
API –	active pharmaceutical ingredient
AUC –	area under the curve
BSA –	body surface area
BW –	body weight
C_{max} –	maximum blood concentration
CSAF –	chemical-specific adjustment factor
EMA –	European Medicines Agency
EU –	European Union
FEMA –	Flavor and Extract Manufacturers Association of the United States
Fl. No –	Flavis Number
HBEL –	health-based exposure limit
ICH –	International Conference on Harmonization
IN –	intranasal
IPCS –	International Programme on Chemical Safety
ISPE –	International Society of Pharmaceutical Engineering
IV –	intravenous
JECFA –	Joint FAO/WHO Expert Committee on Food Additives
LD_{50} –	lethal dose of 50% of the study population
LOAEL –	lowest-observed-adverse-effect level
LTD –	lowest therapeutic dose
MF –	modifying factor
NOAEL –	no-observed-adverse-effect level
OEL –	occupational exposure limit
PD –	pharmacodynamics
PK –	pharmacokinetics
POD –	point of departure
S –	accumulation factor
SC –	subcutaneous
SD –	standard deviation
STEL –	short-term exposure limit
$T_{1/2}$ –	half-life
T_{max} –	time to maximum plasma concentration
TWA –	time-weighted average
US –	United States

1. Introduction

The synthesis, formulation, and overall production of chemicals, consumer products and pharmaceuticals involves the handling of numerous substances that have the potential to create worker health and safety concerns. The purpose of this report is to recommend an OEL for beta-myrcene, in order to address these concerns. This document describes the development of an OEL for beta-myrcene. An OEL is the airborne concentration of a substance that, if not exceeded, is considered protective of the health of nearly all workers who may be exposed to that substance for up to 8 hours per day, or 40 hours per week, over their working lifetime. It is usually derived using a health-based methodology and is a tool that industry has relied upon for more than 50 years to protect workers [2,3].

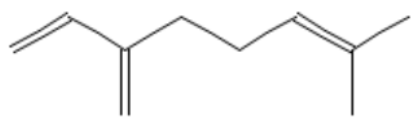
In order to develop the OEL for beta-myrcene, a review of available and relevant pharmacokinetic, pharmacodynamic, clinical safety, and non-clinical toxicology data was conducted. From these data, appropriate health-based endpoints on which to base the OEL were identified. A summary of the available data, selection and justification of appropriate endpoints, and the calculation of the OEL are described in this report.

2. Data Collection, Review, and Analysis

In performing the following hazard assessment, a search of the readily available open literature was conducted. Specific databases searched included ToxPlanet (*Enhesa*), National Library of Medicine (PubMed and PubChem) and databases maintained by US, EU and Canadian regulatory agencies and other relevant sources. A list of references with their full citations is included in Section 13 of this document. After reviewing the available and relevant data, it is the opinion of SafeBridge that sufficient information on beta-myrcene was available to perform the hazard assessment using compound-specific data.

3. Physical and Chemical Properties

Full Chemical Name/Synonyms:	• 1,6-Octadiene, 7-methyl-3-methylene-.beta.-Myrcene • MYRCENE • 123-35-3 • beta-Myrcene • beta-geraniolene • Myrcene (natural) • FEMA No. 2762 • JECFA 1327 • Flavis No. 01.008 • 2-Methyl-6-methylene-2,7-octadiene • b-Myrcene • 3-Methylene-7-methyl-1,6-octadiene

	• .beta.-Geraniolene • 7-Methyl-3-methyleneocta-1,6-diene • 7-Methyl-3-methylene-1,6-octadiene
Molecular Formula:	$C_{10}H_{16}$
Structural Formula:	
Molecular Weight:	136.23 g/mol
Physical State and Appearance:	Yellow oily liquid with a pleasant peppery, spicy, or balsam odor.
Solubility:	Insoluble in water, but soluble in alcohol, chloroform, ether, and glacial acetic acid
Melting Point:	< -10 °C
Vapor Pressure:	2.09 mmHg
Partition Coefficient ($LogK_{ow}$):	5.1 at 35 °C
References	[4-6]

4. Background

Beta-myrcene is part of a class of terpene hydrocarbons which are commercially manufactured and occur naturally at high levels in a large variety of foods with different flavor profiles such as citrus fruits, hop pellets and oil; most common spices, such as cardamom seed, marjoram, nutmeg, sage, rosemary; and mint oils [1,5,7]. It is present in the emissions of many trees in different parts of the world [5]. The concentration of beta-myrcene in essential oils of plants varies considerably between plant species and varieties, geographical areas, season of harvesting, part of the plant and agronomical factors [8,9].

Beta-myrcene is used as an intermediate in the production of terpene alcohols (menthol geraniol, nerol, and linalool), which in turn serve as intermediates in the production of aroma and flavor chemicals [5,7]. It is also used in a wide variety of consumer products, such as cosmetics, soaps, and detergents. It is used in the manufacture of alcoholic beverages from hop and bay oils of which beta-myrcene is a major constituent [5,7]. Dozens of other terpene hydrocarbons, widely naturally occurring in plant varieties mentioned above for beta-myrcene, are also used as flavors and fragrances [10].

Beta-myrcene may be safely used in food (21 CFR § 172.510). It has been evaluated by regulatory and scientific expert bodies and has been determined safe under conditions of intended use as a flavoring substance by the Flavor and Extract Manufacturers Association (FEMA) Expert Panel [10,11], the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and the European Food Safety Authority (EFSA). [12-15].

Based on information obtained as part of the FEMA 2015 Poundage and Technical Effects Survey [16], industry volume of use of beta-myrcene as a flavoring substance and adjuvant in food was 860 kg [10,17]. FEMA also estimated that 14,177,215 kg of beta-myrcene are available for consumption annually in the United States from its natural presence in foods (e.g., citrus juices). Thus, exposure to beta-myrcene from natural food sources is estimated to be 16,500 times more than from its use as a flavoring substance and adjuvant [17]. The dietary exposure to myrcene as a synthetic flavoring substance was estimated by the Food and Drug Administration (FDA) to be 74 µg/person/day, or 1.23 µg/kg bw/day for a 60 kg person [17].

Despite its long history of use as a flavoring substance and wide consumption via its natural occurrence in foods, the safety of beta-myrcene was reviewed recently by the FDA. This review was based on the perceived risk of beta-myrcene as a potential human carcinogen as a result of studies conducted by the National Toxicology Program (NTP) that reported increased incidence of neoplasms in rodents [5]. FDA concluded that beta-myrcene did not demonstrate genotoxic potential and was unlikely to induce tumors in humans at its current exposure level as a food additive. As described in a peer-reviewed evaluation [18] and stated in the Federal Register, 2018 [17], FDA concluded *"Despite FDA's scientific analysis and determination that these substances do not pose a risk to public health under the conditions of their intended use, under the Delaney Clause this finding of carcinogenicity renders the additives ''unsafe'' as a matter of law and FDA is compelled to amend the authorizations for these substances as food additives to no longer provide for the use of these synthetic flavoring substances".* Thus, the removal of beta-myrcene from the food additive regulation (21 CFR § 172.515) is not because it poses health risk to the public but is a matter of law. The safety of beta-myrcene has been reviewed by many other authoritative bodies [8]. EFSA found no safety concern under conditions of intended use as a flavoring substance, with an adequate margin of safety based on a 90-day dietary study in rats [1,18], including no evidence of genotoxic or mutagenic activity of beta-myrcene [12]. These studies are described further later in this monograph. The FEMA Expert Panel evaluated beta-myrcene as part of an assessment of aliphatic and aromatic terpene hydrocarbons used as flavor ingredients is determined it was "generally recognized as safe (GRAS)" under their conditions of intended use [10]. When evaluating 54 citrus-derived natural flavor complexes (NFCs) inclusive of major constituent beta-myrcene, the FEMA Expert Panel confirmed these NFCs were GRAS under their conditions of intended use as flavoring ingredients based on an evaluation of each NFC and the constituents and congeneric groups therein [11]. JEFCA established that beta-myrcene is safe to use as a flavoring substance at its current estimated intake [13,15]. In 2020, the Expert Panel for Fragrance Safety, an independent body that selects its own members and establishes its own operating procedures concluded that beta-myrcene is safe under conditions of intended use as a fragrance ingredient, and that there is no evidence for genotoxicity, skin sensitization, developmental and reproductive toxicity, environmental toxicity, or phototoxicity/photoallergenicity [6].

5. Clinical/Human Health Effects

Although there is no clinical data, administration of beta-myrcene and other terpene hydrocarbons by various routes of administration have been associated with sedative [19], antinociceptive [20], anti-oxidant [21], anti-inflammatory [22], antibacterial [23] and anticancer [24] effects. The most common effects associated with beta-myrcene from oral consumption include itching, nasal congestion, dermatitis, conjunctivitis, drowsiness, and moderate skin and eye irritations [4,5,25,26]. There was an isolated case of respiratory hypersensitivity reaction to the beta-myrcene component of terpenes in hops reported in 1978 [25,26]. This isolated case does not support a sensitization classification, as the finding was not confirmed in a hypersensitivity assay, and there are no additional reports recorded since.

5.1. Reproductive/Developmental Effects in Humans

No data identified.

5.2. Carcinogenic Effects in Humans

No data identified.

6. Pharmacokinetics/Pharmacodynamics

6.1. Pharmacokinetics

No pharmacokinetics studies of beta-myrcene in humans were identified.

Following oral administration to female rats at 1 g/kg bw, beta-myrcene is widely distributed with an elimination half-life of 4.75 hours [5,27]. Beta-myrcene is metabolized in the liver and excreted primarily in the urine. In humans, beta-myrcene is bioavailable in human plasma within 30 minutes after a single dose [7]. In a single arm study, healthy volunteers were administered Mastiha oil composed of several terpene hydrocarbons including beta-myrcene where blood samples were collected as several timepoints over 24 hours [28]. Beta-myrcene reached the plasma unchanged with a peak concentration occurring between 2 and 4 hours [28]. Following dermal exposure, beta-myrcene was well absorbed through the skin of rats [5]. No information on inhalation pharmacokinetics was identified.

6.2. Pharmacodynamics

No relevant pharmacodynamic data identified.

6.3 Chemical Specific Adjustment Factor (CSAF)

According to the guidance document developed by the International Programme on Chemical Safety (IPCS), if sufficient chemical-specific data are available, then a default AF_H adjustment factor for intraspecies variability may be substituted by a CSAF [29,30].

Sufficient chemical-specific data were not identified for beta-myrcene; however, sensitive subpopulations are not expected in the workforce, therefore a default adjustment factor (AF_H) of 5 for intraspecies variability will be used for this hazard assessment [31-33].

6.4. Bioavailability Adjustment (α)

A bioavailability adjustment factor (α) is determined to adjust for differences in bioavailability between different species and/or routes of exposure [34,35]. As beta-myrcene is considered highly bioavailable [7], the oral and inhalation bioavailability are considered complete (α = 1).

6.5. Accumulation Adjustment (S)

Beta-myrcene has a relatively short half-life; therefore, no accumulation is expected upon daily exposure (S = 1).

7. Nonclinical Toxicology

7.1. Single-Dose Studies

Beta-myrcene has low acute toxicity [7]. The acute oral and dermal LD_{50} are >5000 mg/kg in rats [7,10,36]. The acute oral LD_{50} is >2000 mg/kg in mice [36]. The acute dermal LD_{50} is >5000 mg/kg (rabbit) [37].

7.2 Other Acute and Local Effects

Beta-myrcene did not induce delayed skin contact hypersensitivity in the murine Local Lymph Node Assay [38,39]. Undiluted beta-myrcene was moderately irritating to rabbit skin; but it was neither irritating nor sensitizing after being tested at 4% [7]. In an OECD 405 guideline compliant eye irritation study, exposure to 0.1 mL undiluted beta-myrcene was moderately irritating with moderate redness of the conjunctivae associated with slight to severe chemosis in all treated animals after 1 hour of instillation [40]. The irritation was reversible within 8 days.

Beta-myrcene, linalool, and cannabidiol (CBD) isolate (>98% purity) were administered to male and female mice by inhalation (short duration vapor pulls) to determine their anxiety reducing effects [41]. Mice were exposed to vape oil containing beta-myrcene or linalool at a concentration of 5%, or CBD at a concentration of 30 mg/mL. The intensity and duration of beta-myrcene exposure differentially impacted its anxiety reducing effects in mice. Beta-myrcene had anxiolytic effects in females when delivered in discrete vapor pulls over the course of 30 min, while in males, only a single vapor hit containing beta-myrcene had anxiolytic effects. The combination of sub-effective levels of beta-myrcene and CBD did not have synergistic anxiolytic effects in either sex. The authors concluded that their findings reveal sex-dependent differences in the anxiolytic effect of beta-myrcene.

7.3 Repeat-Dose Studies

Beta-myrcene was administered to male and female F344/N rats and B6C3F1 mice at doses of 0, 250, 500, 1000, 2000 or 4000 mg/kg in corn oil by gavage for 5 days/week for 14 weeks [5]. 100% Mortality was observed in the 4000 mg/kg group of both species/sexes, with additional deaths observed at doses ≥500 mg/kg. In animals that died prior to study termination, clinical signs observed included lethargy, ruffled fur (rats only), abnormal breathing, or thin appearance. In male mice, effects observed at the 1000 mg/kg dose included decreased mean body weight gain, increased mean relative liver weight, and decreased hematocrit, hemoglobin, and erythrocyte counts. In female mice, effects observed ≥500 mg/kg included decreased mean body weight and weight gain, increased absolute and relative liver and kidney weights, and decreased erythrocyte counts. There were no histopathological findings in mouse tissues. In rats, mean body weight and weight gains were decreased in males and females ≥500 mg/kg. Hematology effects observed ≥250 mg/kg included decreased leukocytes, lymphocytes, and creatinine. Organ weight changes observed in one or both sexes and at one or more doses ≥500 mg/kg included increased mean absolute and relative liver and kidney weights and decreased mean absolute and relative thymus weight. Increased incidences of renal tubular hyaline droplet formation and renal tubule necrosis were observed ≥250 mg/kg in both sexes of rats. Additional effects observed in rats >1000 mg/kg included increased incidence of olfactory epithelium degeneration, chronic inflammation of the nose, atrophy of the spleen, atrophy of the mesenteric lymph node, and acute inflammation of the forestomach were observed. A LOAEL of 250 mg/kg was reported.

Beta-myrcene was administered to male and female Sprague-Dawley rats (10/sex/group) in the diet at concentrations of 0, 700, 2100, or 4200 ppm (equivalent doses of 0, 50, 150, or 300 mg/kg) for 90 days following the OECD 408 guideline [1]. Due to the instability of beta-myrcene in dietary preparations, the estimated daily intakes of the test material based on weekly averages of body weight and food consumption were adjusted to 20.4, 58.8, and 115.2 mg/kg bw/day (males) and 24.2, 70.0, and 135.9 mg/kg bw/day (females). No effects on mortalities, clinical signs of toxicity, hematology and clinical chemistry parameters, and organ weights were observed. The NOAEL is the highest dose tested (115 and 136 mg/kg bw/day for males and females).

7.4 Reproductive and Developmental Toxicity Studies

In an OECD 414 guideline prenatal developmental toxicity study, beta-myrcene was administered via gavage to female Wistar rats at 0, 250, 500, or 1,200 mg/kg bw/day on gestation days (GDs) 6-15 [27]. At 1,200 mg/kg bw/day, effects observed included decreased maternal body weight gain during the first days of treatment, mortality in one dam, decreased fetal body weights, increased incidence of fetal skeletal malformations, and decreased number of visible implantation sites and number of live fetuses. As no other effects were reported at lower doses, the maternal and fetal toxicity NOAEL is 500 mg/kg bw/day.

In a peri- and post-natal developmental toxicity study, beta-myrcene was administered via gavage to female Wistar rats at doses of 0, 250, 500, 1000 or 1,500 mg/kg bw/day on GD 15 until postnatal day (PND) 21 [42]. At doses ≥500 mg/kg bw/day, effects observed included a dose-related decrease in birth weight, an increase in perinatal and postnatal mortality, and delayed developmental landmarks. Other effects observed included impaired fertility in female offspring at doses ≥1000 mg/kg bw/day, maternal toxicity at 1500 mg/kg bw/day, which was demonstrated by mortality of five dams within 4 days of treatment and decreased body weight in all dams (n=15) from GD 20 which persisted after delivery. Additionally, hyperkeratosis in the forestomach of dams and increased labor duration were observed at doses ≥1000 mg/kg bw/day. The number of stillbirths significantly increased at the1,500 mg/kg bw/day dose. A maternal and fetal toxicity NOAEL of 250 mg/kg bw/day was reported.

In an OECD 415 one-generation reproductive toxicity study, beta-myrcene (purity 95%) was administered in peanut oil via gavage to male and female Wistar rats at doses of 0, 100, 300, or 500 mg/kg bw/day [43]. Males were treated for 91 days prior to mating, as well as during mating, while females were treated continuously for 21 days prior to mating, until the offspring were weaned 21 days after birth. Effects observed at 500 mg/kg bw/day included slight increased relative and absolute liver and kidney weights in males and increased resorption rate associated with decreased number of live fetuses per implantation site. Delays in eye opening, incisor eruption, and primary coat appearance in offspring of treated dams were observed but not considered to be dose related. A maternal and fetal toxicity NOAEL of 300 mg/kg bw/day was reported due to the slight fetotoxic effects observed at 500 mg/kg bw/day.

It should be noted that the estimated daily intake of beta-myrcene as a flavoring agent in the US as estimated by the FDA (1.23 µg/kg bw/day) is more than 200,000 times lower than the lowest NOAEL (250 mg/kg bw/day) reported in the reproduction and developmental studies of beta-myrcene. Maternal and fetal adverse effects were observed at doses above the NOAEL which are exposure levels that are not relevant to potential worker exposure. The overall developmental toxicity potential of beta-myrcene is low.

7.5 Genotoxicity Studies

Beta-myrcene was negative for mutagenicity and genotoxicity *in vitro* (reverse mutation bacteria (Ames) assay, *hprt* mutation assay in hamster V79 cells, chromosomal aberration or sister chromatid exchange assay in V79 cells) and *in vivo* (chromosomal aberration assay in rat bone marrow cells) [5,44-47].

7.6 Carcinogenicity Studies

In a carcinogenicity study conducted by the National Toxicology Program (NTP), beta-myrcene was administered via gavage to male and female F344/N rats and B6C3F1 mice at doses of 0, 250, 500, or 1000 mg/kg bw, 5 days per week for 105 weeks [5]. When dose levels are adjusted for the non-continuous dosing protocol (e.g., 5 days/week dosing), these dose levels equate to 179, 357 or 714 mg/kg bw/day. There was significant mortality in the top dose group of both species. Mortality in rats (100%) was attributed to renal toxicity, whereas the source of mortality in mice was uncertain. In both species, beta-myrcene decreased the mean body weights of one or both sexes in one or more dose groups during the course of the study. However, in rats, slightly increased mean body weights were observed in males of the 179 and 357 mg/kg bw/day dose groups after 11 weeks. NTP concluded that there was "clear evidence" of carcinogenicity in male rats and "equivocal evidence" of carcinogenicity in female rats based on increased incidences of renal tubule tumors (adenoma or carcinoma) and "clear evidence" of carcinogenicity in male mice and "equivocal evidence" of carcinogenicity in female mice based on increased incidences of hepatocellular tumors (adenoma or carcinoma) at all doses (i.e., doses ≥179 mg/kg bw/day). Other adverse effects observed in rats included increased incidences of renal tubule nephrosis, papillary mineralization, nephropathy, hyperplasia of the transitional epithelium lining the pelvis and overlying the renal papilla, focal suppurative inflammation, and chronic active inflammation of the nose and forestomach. In mice, other adverse effects observed included increased incidences of hepatocellular hypertrophy, mixed cell focus, bone marrow atrophy, lymph node follicle atrophy in the spleen, and inflammation and epithelial hyperplasia in the forestomach. A carcinogenicity LOAEL of 179 mg/kg bw/day was reported for both animal species. It should be noted that the estimated daily intake of beta-myrcene as a flavoring agent in the US as estimated by the FDA (1.23 µg/kg bw/day) is more than 145,000 times lower than the lowest dose level in this NTP study. It is argued that the findings of rat kidney and mouse liver tumors in this study are not relevant to humans. As discussed in Bastaki et al., 2018 [1], the increases in tumors were only seen in those that are associated with spontaneous pathologies (i.e., with a high background) in the strains of mice and rats used in the studies. The male F344/N is one of two rat strains (along with Sprague-Dawley) that demonstrate unique susceptibility to renal pathology and increased occurrence of related tumors with age and high intake of certain substances including hydrocarbons [48-56]. Similarly, the B6C3F1 mouse liver tumors are broadly recognized as irrelevant to human cancer risk due to the high background and sensitivity of the specific mouse strain to development of liver tumors [57-59]. Based on this understanding of the pathogenesis of these tumors, beta-myrcene may have worsened the spontaneous pathologies to which these two species and specific strains show historically high susceptibility [1]. Furthermore, supporting data show that beta-myrcene was not mutagenic or genotoxic *in vitro* or *in vivo*, and none of the kidney and liver effects observed in the NTP gavage study were observed in the 90-day dietary study in male and female Sprague-Dawley rats, which used an exposure route that is more relevant to human exposures to beta-myrcene as a food flavoring substance. This conclusion of lack of kidney and liver carcinogenic risks to humans by beta-myrcene was concurred by EFSA [60]. Overall, the carcinogenic potential of beta-myrcene is low.

8. Other Considerations

There were no additional considerations.

9. Standard Methodology for Determination of the OEL

The traditional approach for determining health-based OELs is to identify a POD from animal or human studies and then to apply appropriate adjustment factors, based on the perceived robustness of the data [3,61-67].

A typical equation used for determining an OEL is:

$$OEL = \frac{POD}{AF_c \times \alpha \times S \times MF \times V}$$

Where:

- POD = Point of Departure (dose for the critical effect of concern) can be LTD or LOAEL/NOAEL x BW (or BSA)
  - LTD = Lowest therapeutic dose (clinical study) [mg/day or mg/m^2]
  - NOAEL = No-observed-adverse-effect level (animal study) [mg/kg/day]
  - LOAEL = Lowest-observed-adverse-effect level (animal study) [mg/kg/day]
  - BW = Body weight – 70 kg is used for the average adult worker [68]
  - BSA = Body surface area – 1.8 m^2 is estimated for a 70-kg adult [69]

- AF_C = a composite adjustment factor, which is the product of subfactors which consider uncertainties and variability in the selected POD [9,33,70]
  - AF_A = accounts for variability between species
  - AF_H = accounts for variability amongst the worker population

- AF_S = extrapolates from short-duration studies
- AF_D = accounts for deficits in the quality or quantity of toxicological information
- AF_L = extrapolates from a LOAEL to a NOAEL (when the lowest clinical dose is selected as the endpoint from which to calculate the OEL, it is regarded as a LOAEL)

Additional adjustment factors that may be considered include:

- α = adjusts for differences in bioavailability between different species and/or routes of exposure
- S = adjusts for accumulation after repeated dosing when POD is not at steady state
- MF = accounts for residual uncertainties not covered by AF_C
- V = the volume of air inhaled during the assessed period
  - 10 m^3/day for an 8-hour work shift for a 70-kg adult doing moderate work [66,68].

10. Selection of Critical Endpoints and Points of Departure

The first step in developing an OEL is to identify the most relevant critical endpoints [2,65,70-72]. The dose associated with this endpoint or lack thereof, is then used as a POD. A NOAEL for the critical effect is frequently selected as a point of departure. If an appropriate NOAEL cannot be identified, then a LOAEL may be used. As effects (either adverse or pharmacological) are noted at the lowest therapeutic dose, this would be considered a LOAEL in setting an OEL to protect from inadvertent exposure in the workplace [33,72,73]. For beta-myrcene, two critical endpoints and PODs were identified:

- the oral (dietary) dose of 115 mg/kg bw/day in rats after 90 continuous days of dosing (considered a NOAEL due to its lack of adverse effects)
- the oral (gavage) dose of 250 mg/kg bw in rats after 14 weeks of 5 days/week dosing (adjusted to 179 mg/kg bw/day to account for non-continuous dosing)

11. Derivation of the OEL

11.1 OEL Derivation 1: NOAEL from the oral dietary 90-day toxicity study with rats

11.1.1 Description of a Critical Endpoint and POD

The NOAEL of 115 mg/kg bw/day was selected as the POD. This is the highest oral dose in rats that did not cause adverse effects in a 90 day study [1].

11.1.2 Selection of Adjustment Factors

Adjustment factors used to derive the OEL are summarized below [9,29,32,33,61,65,70,74-76]

Adjustment Factor	Default Value	Value Used	Explanation
Interspecies differences (AF_A)	1 – 12	5	POD is from rats

Adjustment Factor	Default Value	Value Used	Explanation
Intraspecies differences (AF_H)	5	5	Default factor
Sub-chronic-to-chronic (AF_S)	3	3	90-day oral
Database completeness (AF_D)	3	1	Database complete
LOAEL-to-NOAEL (AF_L)	3	1	NOAEL used
Total composite AF_C	**-**	**75**	$AF_A \times AF_H \times AF_S \times AF_D \times AF_L$

11.1.3 Selection of Modifying Factor (MF)

A modifying factor was not considered necessary as all uncertainties were accounted for in the other adjustment factors (MF = 1).

11.1.4 Calculation of OEL

$$\text{OEL} = \frac{\text{POD}}{AF_c \times \alpha \times S \times MF \times V}$$

$$\text{OEL} = \frac{115 \text{ mg/kg bw/day x } 70 \text{ kg}}{75 \times 1 \times 1 \times 1 \times 10 \text{ m}^3\text{/day}}$$

OEL = 10.7 mg/m^3

OEL = 10 mg/m^3 (rounded to one significant figure)

Note: While the OEL is calculated to be 10 mg/m^3, SafeBridge recommends following OHSA guidelines with values no higher than maximum permissible exposure limit (PEL) of 5 mg/m^3 for respirable dust [77]. Accordingly, this OEL is set at 5 mg/m^3.

11.2 OEL Derivation 2: LOAEL from the oral gavage 14 week toxicity study with rats

11.2.1 Description of a Critical Endpoint and POD

The LOAEL of 179 mg/kg bw/day was selected as the POD. This is the lowest oral dose in rats that caused adverse effects in a 14 week study [5].

11.2.2 Selection of Adjustment Factors

Adjustment factors used to derive the OEL are summarized below [9,29,32,33,61,65,70,74-76]

Adjustment Factor	Default Value	Value Used	Explanation
Interspecies differences (AF_A)	1 – 12	5	POD is from rats

Adjustment Factor	Default Value	Value Used	Explanation
Intraspecies differences (AF_H)	5	5	Default factor
Sub-chronic-to-chronic (AF_S)	3	3	90-day oral
Database completeness (AF_D)	3	1	Database complete
LOAEL-to-NOAEL (AF_L)	3	3	LOAEL used
Total composite AF_C	**-**	**225**	$AF_A \times AF_H \times AF_S \times AF_D \times AF_L$

11.2.3 Selection of Modifying Factor (MF)

A modifying factor was not considered necessary as all uncertainties were accounted for in the other adjustment factors (MF = 1).

11.2.4 Calculation of OEL

$$OEL = \frac{POD}{AF_c \times \alpha \times S \times MF \times V}$$

$$OEL = \frac{179 \text{ mg/kg bw/day x } 70 \text{ kg}}{225 \times 1 \times 1 \times 1 \times 10 \text{ m}^3\text{/day}}$$

OEL = 5.6 mg/m^3

OEL = 5 mg/m^3 (rounded to one significant figure)

12. Conclusions

Based on a review of readily available clinical and nonclinical data, The OEL derived for beta-myrcene is presented in the table below.

	Description	Proposed OEL (mg/m^3)
POD 1 TWA	NOAEL from the oral 90-day toxicity study with rats	5
POD 2 TWA	LOAEL from the oral 14-week toxicity study with rats	5

No PODs from inhalation exposure were available; two potential OELs were calculated for beta-myrcene. The value derived from the 90-day dietary study [1] in rats was considered the most relevant for workers rather than the NTP study [5] because 1) the route of administration (dietary) reflects the dietary administration (consumption with food matrix, over a more extended period of time) in consumers more closely that oral gavage; 2) the rat strain used in the 90 day study (Sprague-Dawley rats) does not have background toxicities which can produce misleading adverse effects that are not relevant to humans; 3) the exposure levels, while high, are irrelevant to human exposures although still high enough (93,000 times higher than estimated daily intakes for humans) to provide a high margin of safety; and 4) a NOAEL could be derived from the study that was lower than the LOAEL derived from the NTP study. Accordingly, an OEL of **5 mg/m^3** as an 8-hour TWA is recommended. This is protective against pharmacological/adverse effects (e.g., sneezing, itching, nasal congestion and irritation, drowsiness, moderate skin and eye irritations), as well as nonclinical effects (reproductive and developmental effects at extremely high doses [>145,000 times higher than human exposures] irrelevant to human exposures), which may occur in an overexposed worker.

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1. Statement of Author Qualifications and Signatures

This monograph was researched, compiled, and written by N. Olive Ngalame, Ph.D. and Matthew J. Linman, Ph.D.

Dr. Ngalame is a Toxicologist for SafeBridge Consultants, Inc. and has more than 15 years of experience in toxicology and risk assessment from positions in academia, government, and consulting. Dr. Ngalame has prepared numerous monographs for health-based exposure limits including ADEs, PDEs, and OELs, and has assisted with preparation of hazard and exposure assessments for pharmaceutical excipients, food and beverage ingredients, and cosmetic ingredients. Dr. Ngalame earned her Ph.D. in Pharmacology and Toxicology from the University of Louisville, Kentucky. Her full Curriculum Vitae is available upon request. By signing below, Dr. Ngalame affirms that the risk assessment was performed using sufficient data resources.

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N. Olive Ngalame, Ph.D.
Toxicologist

Dr. Linman is a Senior Consultant at SafeBridge Consultants, Inc. and has nearly 15 years of experience as a scientific professional representing the flavor industry and performing risk assessments. He holds a Ph.D. in analytical chemistry from the University of California, Riverside. His full *Curriculum Vitae* is available upon request. By signing below, Dr. Linman affirms that the risk assessment was performed using sufficient data resources.

____

Matthew J. Linman, Ph.D.
Senior Consultant

2. Statement of Reviewer Qualifications and Signature

This monograph was reviewed by Dr. Anne Chappelle, Ph.D., DABT.

Dr. Anne Chappelle, Ph.D., DABT. Dr. Chappelle is a Senior Managing Toxicologist for SafeBridge Consultants, Inc. and has 25 years of experience as a toxicologist in the pharmaceutical and chemical industry performing risk assessments. She is certified by the American Board of Toxicology and holds a Ph.D. in Pharmacology and Toxicology from the Philadelphia College of Pharmacy and Science (now the University of the Sciences). Her full *Curriculum Vitae* is available upon request. By signing below, Dr. Chappelle affirms that she has read the above monograph in its entirety, and that it is properly formatted, reads well, and is free from significant typographical errors. Dr. Chappelle also affirms that the derived value is based on sound scientific rationale, and that the principal studies used in the risk assessment have been properly cited.

Anne H. Chappelle

Anne Chappelle, Ph.D., DABT
Senior Managing Toxicologist

Trinity Consultants

MEMORANDUM

To: Crystal Acker, Sonoma County

cc: Pat Angell, Ascent Environmental

From: Angie Wanger, Trinity Consultants; John Ke, Trinity Consultants

Date: May 12, 2025

RE: Modeling to estimate ground-level beta-myrcene concentrations

A screening-level air dispersion modeling simulation was completed to assist Sonoma County's (Sonoma) Cannabis Program Update and Environmental Impact Report. Sonoma requested a cannabis cultivation industry modeling assessment to understand potential community exposure to beta-myrcene.

Model Assumptions

Air dispersion models can be utilized to simulate atmospheric conditions, including meteorology and topographical influences, to quantify the ground-level impact of air pollution from a source or activity to nearby locations.

The United States Environmental Protection Agency (US EPA) model AERSCREEN was used to evaluate ground-level impacts of beta-myrcene from two hypothetical outdoor cannabis growing operations:

- 1-acre facility
- 10-acre facility

Modeled impacts will be compared against a reference exposure level (REL) of 0.5 mg/m^3. A chronic REL is an airborne level of a chemical at or below which is considered safe for people to be exposed to every day for their entire lives without any health problems. This REL is based on the occupational exposure limit (OEL) of 5 mg/m^3 developed by SafeBridge, lowered by a factor of 10 in consideration of protecting the general public.[1] Because the REL is a chronic threshold (i.e., related to long-term exposure), modeled results will be evaluated on an annual averaging period.

AERSCREEN Setup

The model AERSCREEN was selected because it allows the user to incorporate base-level assumptions to minimize the amount of site-specific information needed for a hypothetical modeling assessment. These assumptions include:

- Default meteorological conditions
  - Temperature range of -9.67 °F to 98.33 °F
  - Minimum wind speed of 1.11 mph
  - "Average" climate profile (rather than wet or dry climate)
- "Cultivated Land" Land Use
- Default Terrain

[1] Ngalame, N., Linman, M. (2025). Occupational Exposure Limit (OEL) Monograph for Beta-Myrcene.

As the REL is an annual standard, short-term effects from meteorological or terrain influences would have minimal impact on the modeled result. Thus, the default parameters for meteorology and terrain used in the AERSCREEN modeling analysis are appropriate for this demonstration.

Emission Rate

The beta-myrcene emission rate used in AERSCREEN was derived from academic research papers. Plant density in outdoor cannabis cultivation facilities (CCFs) can range from 1,000 – 2,000 plants per acre.[2] In a study of Cannabis producers in California and Nevada, researchers found that emissions of biogenic volatile organic compounds (BVOCs) were at 744 mg/day/plant.[3] Beta-myrcene is a BVOC and can be found in varying concentrations up to 70%.[2,4,5] Based on these assumptions, the calculated beta-myrcene emission rate for a CCF with a plant density of 2,000 plants/acre is 0.012 g/s/acre.

Model Results

The results of the modeling assessment are summarized in Table 1, below.

Table 1. Annual Concentrations of Beta-myrcene 100 ft from Operational Boundary

REL (mg/m^3)	1-Acre Annual Modeled Concentration (mg/m^3)	10-Acre Annual Modeled Concentration (mg/m^3)
0.5	0.116 (23% of REL)	0.319 (64% of REL)

As shown in both scenarios, the annual modeled concentration is below the REL at 100 ft, which is the minimum distance from the outdoor grow to facility's property line. Figures 1 and 2 show that the concentration decreases as distance from the plot increases. It is important to note that this analysis conservatively assumes the operations are emitting at the peak daily emission rate every day of the year. Actual emissions, and thus ambient concentrations, are expected to be below these modeled estimates. This means that people living near these cannabis fields are very unlikely to experience any health issues from beta-myrcene exposure.

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[2] https://canvastsupplyco.com/blogs/news/cannabis-hemp-growers-frequently-asked-questions

[3] Samburova, V., McDaniel, M., Campbell, D., Wolf, M., Stockwell, W. R., & Khlystov, A. (2019). Dominant volatile organic compounds (VOCs) measured at four *Cannabis* growing facilities: Pilot study results. *Journal of the Air & Waste Management Association*, *69*(11), 1267–1276. https://doi.org/10.1080/10962247.2019.1654038

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Figure 1. 1-Acre Plot Concentration

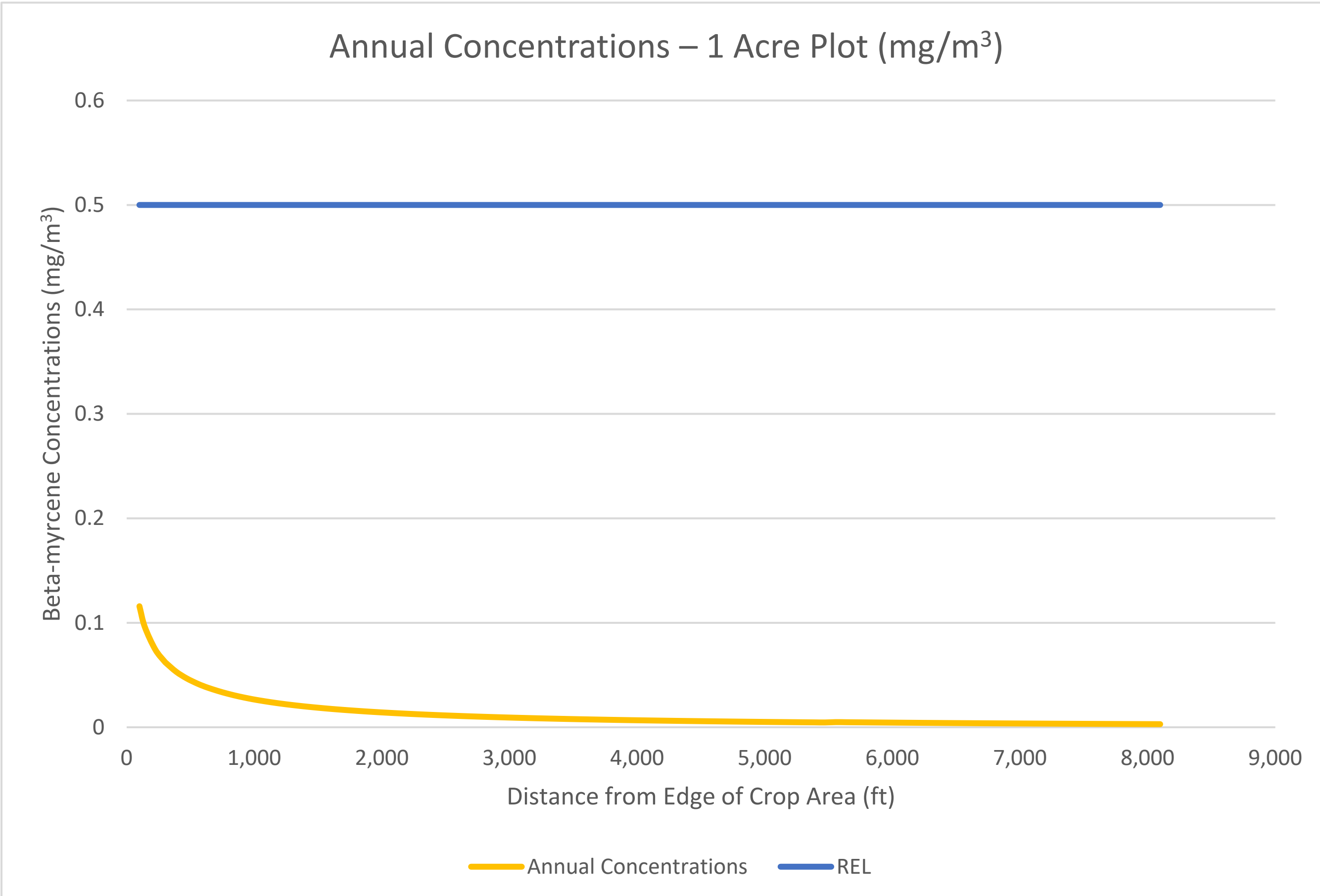
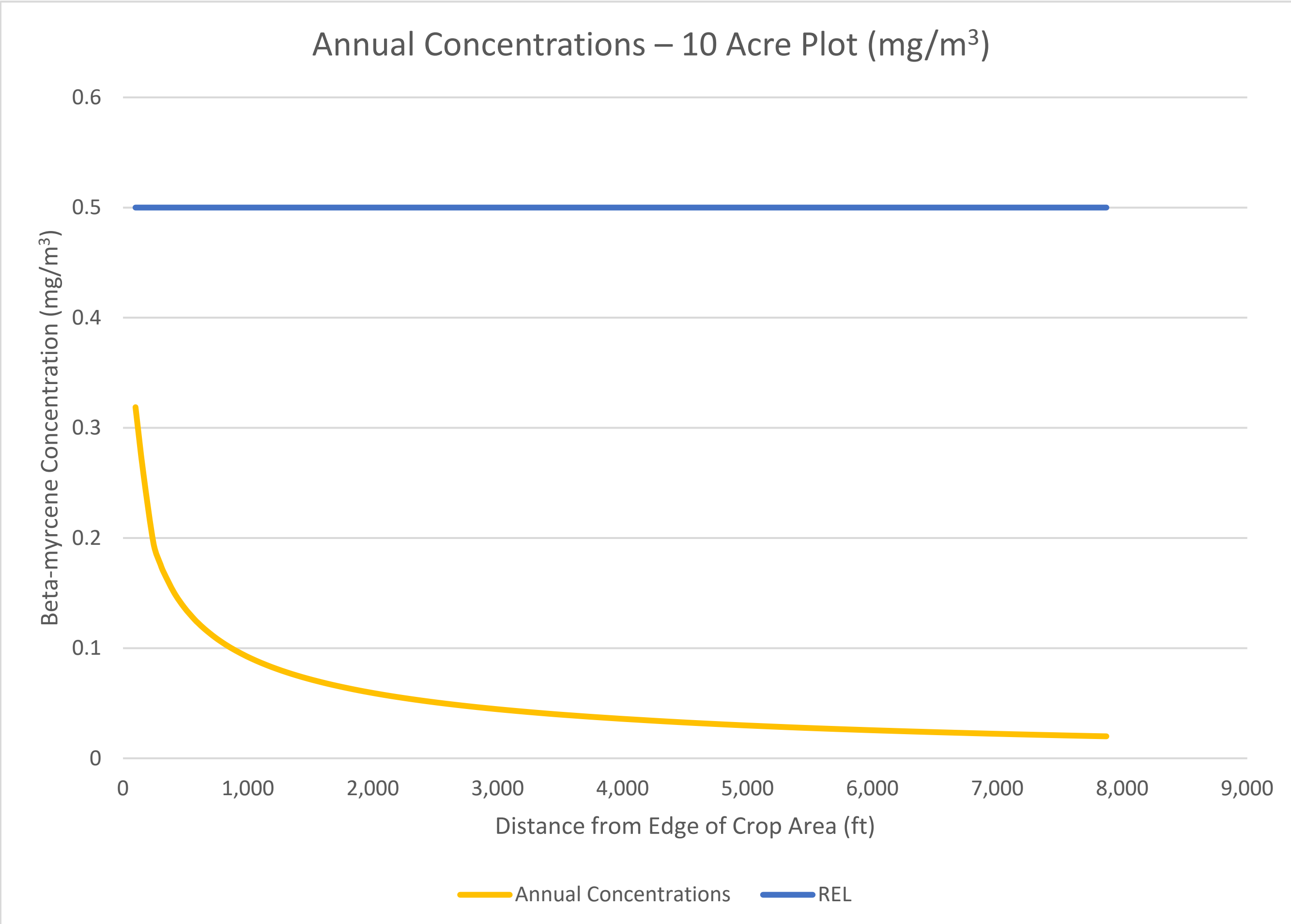


Figure 2. 10-Acre Plot Concentration



Sonoma Cannabis Indoor Detailed Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Sonoma Cannabis Indoor
Construction Start Date	4/1/2025
Operational Year	2026
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.20
Precipitation (days)	48.0
Location	Sonoma County, CA, USA
County	Sonoma-North Coast
City	Unincorporated
Air District	Northern Sonoma County APCD
Air Basin	North Coast
TAZ	889
EDFZ	2
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.28

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Research & Development	12.0	1000sqft	0.28	12,022	4,000	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-10-A	Water Exposed Surfaces
Construction	C-11	Limit Vehicle Speeds on Unpaved Roads

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	11.3	11.3	10.1	10.5	0.02	0.46	5.37	5.84	0.43	2.58	3.01	—	1,779	1,779	0.07	0.02	0.66	1,786
Mit.	11.3	11.3	10.1	10.5	0.02	0.46	2.13	2.60	0.43	1.02	1.44	—	1,779	1,779	0.07	0.02	0.66	1,786
% Reduced	—	—	—	—	—	—	60%	56%	—	61%	52%	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	11.3	11.3	0.89	1.18	< 0.005	0.03	0.01	0.03	0.03	< 0.005	0.03	—	140	140	0.01	< 0.005	< 0.005	140
Mit.	11.3	11.3	0.89	1.18	< 0.005	0.03	0.01	0.03	0.03	< 0.005	0.03	—	140	140	0.01	< 0.005	< 0.005	140
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.53	0.50	1.80	2.46	< 0.005	0.08	0.05	0.13	0.07	0.02	0.09	—	464	464	0.02	0.01	0.05	466
Mit.	0.53	0.50	1.80	2.46	< 0.005	0.08	0.03	0.11	0.07	0.01	0.08	—	464	464	0.02	0.01	0.05	466
% Reduced	—	—	—	—	—	—	39%	16%	—	47%	10%	—	—	—	—	—	—	—

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.10	0.09	0.33	0.45	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.02	—	76.8	76.8	< 0.005	< 0.005	0.01	77.2
Mit.	0.10	0.09	0.33	0.45	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.01	—	76.8	76.8	< 0.005	< 0.005	0.01	77.2
% Reduced	—	—	—	—	—	—	39%	16%	—	47%	10%	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	11.3	11.3	10.1	10.5	0.02	0.46	5.37	5.84	0.43	2.58	3.01	—	1,779	1,779	0.07	0.02	0.66	1,786
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	11.3	11.3	0.89	1.18	< 0.005	0.03	0.01	0.03	0.03	< 0.005	0.03	—	140	140	0.01	< 0.005	< 0.005	140
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.53	0.50	1.80	2.46	< 0.005	0.08	0.05	0.13	0.07	0.02	0.09	—	464	464	0.02	0.01	0.05	466
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.10	0.09	0.33	0.45	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.02	—	76.8	76.8	< 0.005	< 0.005	0.01	77.2

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	11.3	11.3	10.1	10.5	0.02	0.46	2.13	2.60	0.43	1.02	1.44	—	1,779	1,779	0.07	0.02	0.66	1,786

Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	11.3	11.3	0.89	1.18	< 0.005	0.03	0.01	0.03	0.03	< 0.005	0.03	—	140	140	0.01	< 0.005	< 0.005	140
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.53	0.50	1.80	2.46	< 0.005	0.08	0.03	0.11	0.07	0.01	0.08	—	464	464	0.02	0.01	0.05	466
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.10	0.09	0.33	0.45	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.01	—	76.8	76.8	< 0.005	< 0.005	0.01	77.2

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.19	1.12	0.92	6.39	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,444	1,456	1.30	0.09	5.13	1,521
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.09	1.02	1.03	5.79	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,399	1,411	1.30	0.10	0.43	1,473
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.93	0.88	0.75	4.56	0.01	0.02	0.75	0.77	0.02	0.19	0.21	11.8	1,125	1,137	1.29	0.08	1.87	1,195
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.17	0.16	0.14	0.83	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	1.96	186	188	0.21	0.01	0.31	198

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Area	0.38	0.37	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	1.19	1.12	0.92	6.39	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,444	1,456	1.30	0.09	5.13	1,521
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Area	0.29	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	1.09	1.02	1.03	5.79	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,399	1,411	1.30	0.10	0.43	1,473
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.59	0.54	0.67	4.24	0.01	0.01	0.75	0.76	0.01	0.19	0.20	—	878	878	0.04	0.05	1.57	895
Area	0.33	0.33	< 0.005	0.26	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.06	1.06	< 0.005	< 0.005	—	1.06
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	0.93	0.88	0.75	4.56	0.01	0.02	0.75	0.77	0.02	0.19	0.21	11.8	1,125	1,137	1.29	0.08	1.87	1,195

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148
Area	0.06	0.06	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18
Energy	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	38.3	38.3	0.01	< 0.005	—	38.6
Water	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05
Total	0.17	0.16	0.14	0.83	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	1.96	186	188	0.21	0.01	0.31	198

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Area	0.38	0.37	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	1.19	1.12	0.92	6.39	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,444	1,456	1.30	0.09	5.13	1,521
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Area	0.29	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5

Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	1.09	1.02	1.03	5.79	0.01	0.02	1.03	1.05	0.02	0.26	0.28	11.8	1,399	1,411	1.30	0.10	0.43	1,473
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.59	0.54	0.67	4.24	0.01	0.01	0.75	0.76	0.01	0.19	0.20	—	878	878	0.04	0.05	1.57	895
Area	0.33	0.33	< 0.005	0.26	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.06	1.06	< 0.005	< 0.005	—	1.06
Energy	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	231	231	0.03	< 0.005	—	233
Water	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	0.93	0.88	0.75	4.56	0.01	0.02	0.75	0.77	0.02	0.19	0.21	11.8	1,125	1,137	1.29	0.08	1.87	1,195
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148
Area	0.06	0.06	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18
Energy	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	38.3	38.3	0.01	< 0.005	—	38.6
Water	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05
Total	0.17	0.16	0.14	0.83	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	1.96	186	188	0.21	0.01	0.31	198

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	4.16	5.57	0.01	0.21	—	0.21	0.20	—	0.20	—	859	859	0.03	0.01	—	862
Dust From Material Movement	—	—	—	—	—	—	0.53	0.53	—	0.06	0.06	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.71	4.71	< 0.005	< 0.005	—	4.72
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.78	0.78	< 0.005	< 0.005	—	0.78
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.31	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	43.7	43.7	< 0.005	< 0.005	0.19	44.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.23	0.23	< 0.005	< 0.005	< 0.005	0.23
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.2. Site Preparation (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.56	0.47	4.16	5.57	0.01	0.21	—	0.21	0.20	—	0.20	—	859	859	0.03	0.01	—	862
Dust From Material Movement	—	—	—	—	—	—	0.21	0.21	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.71	4.71	< 0.005	< 0.005	—	4.72
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.78	0.78	< 0.005	< 0.005	—	0.78
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.31	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	43.7	43.7	< 0.005	< 0.005	0.19	44.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.23	0.23	< 0.005	< 0.005	< 0.005	0.23
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.3. Grading (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.29	1.09	10.1	10.0	0.02	0.46	—	0.46	0.43	—	0.43	—	1,714	1,714	0.07	0.01	—	1,720

Dust From Material Movement	—	—	—	—	—	—	5.31	5.31	—	2.57	2.57	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.39	9.39	< 0.005	< 0.005	—	9.42
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.55	1.55	< 0.005	< 0.005	—	1.56
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.4. Grading (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.29	1.09	10.1	10.0	0.02	0.46	—	0.46	0.43	—	0.43	—	1,714	1,714	0.07	0.01	—	1,720
Dust From Material Movement	—	—	—	—	—	—	2.07	2.07	—	1.00	1.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.39	9.39	< 0.005	< 0.005	—	9.42
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.55	1.55	< 0.005	< 0.005	—	1.56
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.5. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.62	0.52	5.14	6.94	0.01	0.22	—	0.22	0.20	—	0.20	—	1,305	1,305	0.05	0.01	—	1,309
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.55	2.09	< 0.005	0.07	—	0.07	0.06	—	0.06	—	393	393	0.02	< 0.005	—	395

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.28	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	65.1	65.1	< 0.005	< 0.005	—	65.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.02	0.24	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	33.6	33.6	< 0.005	< 0.005	0.14	34.2
Vendor	< 0.005	< 0.005	0.08	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	52.4	52.4	< 0.005	0.01	0.14	54.9
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.07	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	9.94
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	15.8	15.8	< 0.005	< 0.005	0.02	16.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.62	1.62	< 0.005	< 0.005	< 0.005	1.65
Vendor	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	2.62	2.62	< 0.005	< 0.005	< 0.005	2.73
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.6. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.62	0.52	5.14	6.94	0.01	0.22	—	0.22	0.20	—	0.20	—	1,305	1,305	0.05	0.01	—	1,309
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.55	2.09	< 0.005	0.07	—	0.07	0.06	—	0.06	—	393	393	0.02	< 0.005	—	395
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.28	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	65.1	65.1	< 0.005	< 0.005	—	65.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.02	0.02	0.24	0.00	0.00	0.03	0.03	0.00	0.01	0.01	—	33.6	33.6	< 0.005	< 0.005	0.14	34.2
Vendor	< 0.005	< 0.005	0.08	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	52.4	52.4	< 0.005	0.01	0.14	54.9
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.07	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	9.78	9.78	< 0.005	< 0.005	0.02	9.94
Vendor	< 0.005	< 0.005	0.02	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	15.8	15.8	< 0.005	< 0.005	0.02	16.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	1.62	1.62	< 0.005	< 0.005	< 0.005	1.65
Vendor	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	2.62	2.62	< 0.005	< 0.005	< 0.005	2.73
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Paving (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	4.37	5.31	0.01	0.19	—	0.19	0.18	—	0.18	—	823	823	0.03	0.01	—	826
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.02	0.01	0.12	0.15	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	22.6	22.6	< 0.005	< 0.005	—	22.6
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.74	3.74	< 0.005	< 0.005	—	3.75
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.05	4.05	< 0.005	< 0.005	0.01	4.11
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.67	0.67	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.8. Paving (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	4.37	5.31	0.01	0.19	—	0.19	0.18	—	0.18	—	823	823	0.03	0.01	—	826
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.12	0.15	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	22.6	22.6	< 0.005	< 0.005	—	22.6
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.74	3.74	< 0.005	< 0.005	—	3.75
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.05	4.05	< 0.005	< 0.005	0.01	4.11
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.67	0.67	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Architectural Coating (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134

Architectural	11.1	11.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	11.1	11.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.66	3.66	< 0.005	< 0.005	—	3.67
Architectural Coatings	0.31	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.61	0.61	< 0.005	< 0.005	—	0.61
Architectural Coatings	0.06	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.72	6.72	< 0.005	< 0.005	0.03	6.84
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.38	6.38	< 0.005	< 0.005	< 0.005	6.47
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.18	0.18	< 0.005	< 0.005	< 0.005	0.18
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.03	0.03	< 0.005	< 0.005	< 0.005	0.03
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.10. Architectural Coating (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	11.1	11.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	11.1	11.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.66	3.66	< 0.005	< 0.005	—	3.67
Architectural Coatings	0.31	0.31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.61	0.61	< 0.005	< 0.005	—	0.61
Architectural Coatings	0.06	0.06	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.72	6.72	< 0.005	< 0.005	0.03	6.84
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.05	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	6.38	6.38	< 0.005	< 0.005	< 0.005	6.47
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.18	0.18	< 0.005	< 0.005	< 0.005	0.18
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.03	0.03	< 0.005	< 0.005	< 0.005	0.03
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Total	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Total	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148
Total	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Total	0.81	0.74	0.84	5.81	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,196	1,196	0.05	0.06	4.82	1,220
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Total	0.79	0.72	0.95	5.73	0.01	0.01	1.03	1.04	0.01	0.26	0.27	—	1,153	1,153	0.06	0.07	0.13	1,175
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148
Total	0.11	0.10	0.12	0.77	< 0.005	< 0.005	0.14	0.14	< 0.005	0.03	0.04	—	145	145	0.01	0.01	0.26	148

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Total	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Total	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	23.4	23.4	< 0.005	< 0.005	—	23.7
Total	—	—	—	—	—	—	—	—	—	—	—	—	23.4	23.4	< 0.005	< 0.005	—	23.7

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Total	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Total	—	—	—	—	—	—	—	—	—	—	—	—	142	142	0.02	< 0.005	—	143
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	23.4	23.4	< 0.005	< 0.005	—	23.7
Total	—	—	—	—	—	—	—	—	—	—	—	—	23.4	23.4	< 0.005	< 0.005	—	23.7

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Total	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Total	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research & Development	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	14.9	14.9	< 0.005	< 0.005	—	14.9
Total	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	14.9	14.9	< 0.005	< 0.005	—	14.9

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Total	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Total	0.01	< 0.005	0.08	0.06	< 0.005	0.01	—	0.01	0.01	—	0.01	—	89.8	89.8	0.01	< 0.005	—	90.1
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	14.9	14.9	< 0.005	< 0.005	—	14.9
Total	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	14.9	14.9	< 0.005	< 0.005	—	14.9

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.26	0.26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.03	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.09	0.09	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Total	0.38	0.37	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.26	0.26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.03	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.29	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architect Coatings	0.01	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.01	0.01	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18
Total	0.06	0.06	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.26	0.26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.03	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.09	0.09	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Total	0.38	0.37	< 0.005	0.52	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.15	2.15	< 0.005	< 0.005	—	2.16
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.26	0.26	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coating	0.03	0.03	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.29	0.29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.01	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.01	0.01	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18
Total	0.06	0.06	< 0.005	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.18	0.18	< 0.005	< 0.005	—	0.18

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Total	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Total	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5
Total	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Total	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5
Total	—	—	—	—	—	—	—	—	—	—	—	11.3	14.8	26.1	1.16	0.03	—	63.5

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5
Total	—	—	—	—	—	—	—	—	—	—	—	1.88	2.45	4.32	0.19	< 0.005	—	10.5

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Total	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Total	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29
Total	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Total	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Total	—	—	—	—	—	—	—	—	—	—	—	0.49	0.00	0.49	0.05	0.00	—	1.72
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29
Total	—	—	—	—	—	—	—	—	—	—	—	0.08	0.00	0.08	0.01	0.00	—	0.29

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.31	0.31
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.05	0.05

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	4/1/2025	4/2/2025	5.00	2.00	—
Grading	Grading	4/3/2025	4/4/2025	5.00	2.00	—
Building Construction	Building Construction	4/5/2025	9/5/2025	5.00	110	—
Paving	Paving	9/6/2025	9/19/2025	5.00	10.0	—
Architectural Coating	Architectural Coating	9/20/2025	10/3/2025	5.00	10.0	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	6.00	148	0.41
Grading	Rubber Tired Dozers	Diesel	Average	1.00	6.00	367	0.40
Grading	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	4.00	367	0.29
Building Construction	Forklifts	Diesel	Average	2.00	6.00	82.0	0.20
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	2.00	8.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	4.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	7.00	81.0	0.42
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38

Paving	Tractors/Loaders/Back	Diesel	Average	1.00	7.00	84.0	0.37
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	6.00	148	0.41
Grading	Rubber Tired Dozers	Diesel	Average	1.00	6.00	367	0.40
Grading	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	4.00	367	0.29
Building Construction	Forklifts	Diesel	Average	2.00	6.00	82.0	0.20
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	2.00	8.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	4.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	7.00	81.0	0.42
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	5.00	11.7	LDA,LDT1,LDT2

Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	7.50	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	3.85	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	1.97	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	17.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	0.77	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	5.00	11.7	LDA,LDT1,LDT2

Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	7.50	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	3.85	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	1.97	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	17.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	0.77	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	18,033	6,011	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	1.00	0.00	—
Grading	—	—	1.50	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Research & Development	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	204	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Research & Development	135	22.8	13.3	37,179	1,434	242	141	393,862

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Research & Development	135	22.8	13.3	37,179	1,434	242	141	393,862

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	18,033	6,011	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value

Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO_2 and CH_4 and N_2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Research & Development	253,374	204	0.0330	0.0040	280,254

5.11.2. Mitigated

Electricity (kWh/yr) and CO_2 and CH_4 and N_2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Research & Development	253,374	204	0.0330	0.0040	280,254

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Research & Development	5,911,145	34,558

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Research & Development	5,911,145	34,558

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Research & Development	0.91	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Research & Development	0.91	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Research & Development	Household refrigerators and/or freezers	R-134a	1,430	0.45	0.60	0.00	1.00
Research & Development	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Research & Development	Household refrigerators and/or freezers	R-134a	1,430	0.45	0.60	0.00	1.00
Research & Development	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	10.7	annual days of extreme heat
Extreme Precipitation	25.0	annual days with precipitation above 20 mm
Sea Level Rise	—	meters of inundation depth
Wildfire	24.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A

Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	11.7
AQ-PM	2.54
AQ-DPM	4.29
Drinking Water	47.7
Lead Risk Housing	30.6
Pesticides	70.0
Toxic Releases	0.70
Traffic	17.1
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	70.3

Haz Waste Facilities/Generators	68.4
Impaired Water Bodies	72.2
Solid Waste	72.4
Sensitive Population	—
Asthma	25.0
Cardio-vascular	13.3
Low Birth Weights	19.0
Socioeconomic Factor Indicators	—
Education	44.3
Housing	27.2
Linguistic	55.6
Poverty	31.5
Unemployment	—

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	58.4370589
Employed	11.71564224
Median HI	59.00166816
Education	—
Bachelor's or higher	70.21686129
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	66.18760426
Active commuting	69.03631464

Social	—
2-parent households	83.58783524
Voting	99.17875016
Neighborhood	—
Alcohol availability	83.69049147
Park access	8.302322597
Retail density	1.501347363
Supermarket access	30.39907609
Tree canopy	96.79199281
Housing	—
Homeownership	65.25086616
Housing habitability	80.17451559
Low-inc homeowner severe housing cost burden	47.26036186
Low-inc renter severe housing cost burden	96.95880919
Uncrowded housing	51.79006801
Health Outcomes	—
Insured adults	26.49813936
Arthritis	0.0
Asthma ER Admissions	75.0
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	43.8
Cognitively Disabled	22.1
Physically Disabled	33.4

Heart Attack ER Admissions	92.2
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	67.5
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	6.1
SLR Inundation Area	0.0
Children	94.5
Elderly	3.2
English Speaking	45.4
Foreign-born	29.0
Outdoor Workers	11.9
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.8
Traffic Density	12.5
Traffic Access	23.0
Other Indices	—
Hardship	40.3
Other Decision Support	—
2016 Voting	98.6

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	20.0
Healthy Places Index Score for Project Location (b)	70.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	7-month construction period.
Construction: Architectural Coatings	BAAQMD Reg 8, Rule 2
Operations: Architectural Coatings	BAAQMD Reg 8 Rule 2

Sonoma Cannabis Mixed-Light Detailed Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Sonoma Cannabis Mixed-Light
Construction Start Date	4/1/2025
Operational Year	2026
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.20
Precipitation (days)	48.0
Location	Sonoma County, CA, USA
County	Sonoma-North Coast
City	Unincorporated
Air District	Northern Sonoma County APCD
Air Basin	North Coast
TAZ	889
EDFZ	2
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.29

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Unrefrigerated Warehouse-No Rail	196	1000sqft	4.50	196,000	20,000	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-10-A	Water Exposed Surfaces
Construction	C-11	Limit Vehicle Speeds on Unpaved Roads

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	227	227	31.7	31.3	0.05	1.37	19.8	21.2	1.26	10.1	11.4	—	5,448	5,448	0.22	0.17	5.40	5,469
Mit.	227	227	31.7	31.3	0.05	1.37	7.81	9.18	1.26	3.97	5.23	—	5,448	5,448	0.22	0.17	5.40	5,469
% Reduced	—	—	—	—	—	—	61%	57%	—	61%	54%	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	227	227	0.98	2.11	< 0.005	0.03	0.14	0.16	0.03	0.03	0.06	—	270	270	0.01	0.01	0.02	273
Mit.	227	227	0.98	2.11	< 0.005	0.03	0.14	0.16	0.03	0.03	0.06	—	270	270	0.01	0.01	0.02	273
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	5.62	5.52	4.14	6.12	0.01	0.15	0.42	0.57	0.14	0.14	0.28	—	1,284	1,284	0.05	0.05	0.72	1,302
Mit.	5.62	5.52	4.14	6.12	0.01	0.15	0.33	0.48	0.14	0.10	0.24	—	1,284	1,284	0.05	0.05	0.72	1,302
% Reduced	—	—	—	—	—	—	21%	16%	—	32%	16%	—	—	—	—	—	—	—

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.03	1.01	0.76	1.12	< 0.005	0.03	0.08	0.10	0.03	0.03	0.05	—	213	213	0.01	0.01	0.12	215
Mit.	1.03	1.01	0.76	1.12	< 0.005	0.03	0.06	0.09	0.03	0.02	0.04	—	213	213	0.01	0.01	0.12	215
% Reduced	—	—	—	—	—	—	21%	16%	—	32%	16%	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	227	227	31.7	31.3	0.05	1.37	19.8	21.2	1.26	10.1	11.4	—	5,448	5,448	0.22	0.17	5.40	5,469
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	227	227	0.98	2.11	< 0.005	0.03	0.14	0.16	0.03	0.03	0.06	—	270	270	0.01	0.01	0.02	273
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	5.62	5.52	4.14	6.12	0.01	0.15	0.42	0.57	0.14	0.14	0.28	—	1,284	1,284	0.05	0.05	0.72	1,302
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.03	1.01	0.76	1.12	< 0.005	0.03	0.08	0.10	0.03	0.03	0.05	—	213	213	0.01	0.01	0.12	215

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	227	227	31.7	31.3	0.05	1.37	7.81	9.18	1.26	3.97	5.23	—	5,448	5,448	0.22	0.17	5.40	5,469

Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	227	227	0.98	2.11	< 0.005	0.03	0.14	0.16	0.03	0.03	0.06	—	270	270	0.01	0.01	0.02	273
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	5.62	5.52	4.14	6.12	0.01	0.15	0.33	0.48	0.14	0.10	0.24	—	1,284	1,284	0.05	0.05	0.72	1,302
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	1.03	1.01	0.76	1.12	< 0.005	0.03	0.06	0.09	0.03	0.02	0.04	—	213	213	0.01	0.01	0.12	215

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	8.27	7.98	2.51	23.4	0.03	0.07	2.58	2.66	0.07	0.66	0.73	186	4,643	4,829	19.2	0.39	12.2	5,438
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	6.72	6.53	2.72	14.7	0.03	0.06	2.58	2.64	0.06	0.66	0.72	186	4,501	4,687	19.2	0.40	0.32	5,288
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	7.46	7.22	2.59	18.6	0.03	0.07	2.51	2.57	0.06	0.64	0.70	186	4,553	4,739	19.2	0.40	5.25	5,343
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.36	1.32	0.47	3.40	0.01	0.01	0.46	0.47	0.01	0.12	0.13	30.8	754	785	3.18	0.07	0.87	885

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Area	6.21	6.09	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	8.27	7.98	2.51	23.4	0.03	0.07	2.58	2.66	0.07	0.66	0.73	186	4,643	4,829	19.2	0.39	12.2	5,438
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Area	4.69	4.69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	6.72	6.53	2.72	14.7	0.03	0.06	2.58	2.64	0.06	0.66	0.72	186	4,501	4,687	19.2	0.40	0.32	5,288
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.99	1.82	2.24	14.2	0.03	0.04	2.51	2.54	0.03	0.64	0.67	—	2,940	2,940	0.14	0.16	5.25	2,996
Area	5.44	5.38	0.04	4.20	< 0.005	0.01	—	0.01	0.01	—	0.01	—	17.3	17.3	< 0.005	< 0.005	—	17.3
Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	7.46	7.22	2.59	18.6	0.03	0.07	2.51	2.57	0.06	0.64	0.70	186	4,553	4,739	19.2	0.40	5.25	5,343
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496
Area	0.99	0.98	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87

Energy	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	245	245	0.04	< 0.005	—	247
Water	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6
Waste	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5
Total	1.36	1.32	0.47	3.40	0.01	0.01	0.46	0.47	0.01	0.12	0.13	30.8	754	785	3.18	0.07	0.87	885

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Area	6.21	6.09	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	8.27	7.98	2.51	23.4	0.03	0.07	2.58	2.66	0.07	0.66	0.73	186	4,643	4,829	19.2	0.39	12.2	5,438
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Area	4.69	4.69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	6.72	6.53	2.72	14.7	0.03	0.06	2.58	2.64	0.06	0.66	0.72	186	4,501	4,687	19.2	0.40	0.32	5,288
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.99	1.82	2.24	14.2	0.03	0.04	2.51	2.54	0.03	0.64	0.67	—	2,940	2,940	0.14	0.16	5.25	2,996
Area	5.44	5.38	0.04	4.20	< 0.005	0.01	—	0.01	0.01	—	0.01	—	17.3	17.3	< 0.005	< 0.005	—	17.3

Energy	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	1,483	1,483	0.21	0.02	—	1,495
Water	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Waste	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	7.46	7.22	2.59	18.6	0.03	0.07	2.51	2.57	0.06	0.64	0.70	186	4,553	4,739	19.2	0.40	5.25	5,343
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496
Area	0.99	0.98	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87
Energy	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	245	245	0.04	< 0.005	—	247
Water	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6
Waste	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5
Total	1.36	1.32	0.47	3.40	0.01	0.01	0.46	0.47	0.01	0.12	0.13	30.8	754	785	3.18	0.07	0.87	885

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	19.7	19.7	—	10.1	10.1	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.17	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	29.0	29.0	< 0.005	< 0.005	—	29.1
Dust From Material Movement	—	—	—	—	—	—	0.11	0.11	—	0.06	0.06	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.80	4.80	< 0.005	< 0.005	—	4.82
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.81	0.81	< 0.005	< 0.005	< 0.005	0.82
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.13	0.13	< 0.005	< 0.005	< 0.005	0.14
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.2. Site Preparation (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	3.94	3.31	31.6	30.2	0.05	1.37	—	1.37	1.26	—	1.26	—	5,295	5,295	0.21	0.04	—	5,314
Dust From Material Movement	—	—	—	—	—	—	7.67	7.67	—	3.94	3.94	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road	0.02	0.02	0.17	0.17	< 0.005	0.01	—	0.01	0.01	—	0.01	—	29.0	29.0	< 0.005	< 0.005	—	29.1
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.80	4.80	< 0.005	< 0.005	—	4.82
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.81	0.81	< 0.005	< 0.005	< 0.005	0.82
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.13	0.13	< 0.005	< 0.005	< 0.005	0.14
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.3. Grading (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.07	1.74	16.3	17.9	0.03	0.72	—	0.72	0.66	—	0.66	—	2,959	2,959	0.12	0.02	—	2,970
Dust From Material Movement	—	—	—	—	—	—	7.08	7.08	—	3.42	3.42	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.09	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.2	16.2	< 0.005	< 0.005	—	16.3
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.02	0.02	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.68	2.68	< 0.005	< 0.005	—	2.69
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.09	0.07	0.93	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	131	131	0.01	0.01	0.56	133
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.69	0.69	< 0.005	< 0.005	< 0.005	0.70
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.11	0.11	< 0.005	< 0.005	< 0.005	0.12
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.4. Grading (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	2.07	1.74	16.3	17.9	0.03	0.72	—	0.72	0.66	—	0.66	—	2,959	2,959	0.12	0.02	—	2,970
Dust From Material Movement	—	—	—	—	—	—	2.76	2.76	—	1.34	1.34	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.09	0.10	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	16.2	16.2	< 0.005	< 0.005	—	16.3
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.68	2.68	< 0.005	< 0.005	—	2.69
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.09	0.09	0.07	0.93	0.00	0.00	0.12	0.12	0.00	0.03	0.03	—	131	131	0.01	0.01	0.56	133
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.69	0.69	< 0.005	< 0.005	< 0.005	0.70
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.11	0.11	< 0.005	< 0.005	< 0.005	0.12
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.5. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.35	1.13	10.4	13.0	0.02	0.43	—	0.43	0.40	—	0.40	—	2,398	2,398	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.41	0.34	3.15	3.93	0.01	0.13	—	0.13	0.12	—	0.12	—	723	723	0.03	0.01	—	725
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.57	0.72	< 0.005	0.02	—	0.02	0.02	—	0.02	—	120	120	< 0.005	< 0.005	—	120
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.49	0.37	5.10	0.00	0.00	0.68	0.68	0.00	0.16	0.16	—	719	719	0.04	0.03	3.10	731
Vendor	0.05	0.04	1.29	0.49	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	855	855	< 0.005	0.12	2.31	894

Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.14	0.13	1.45	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	209	209	0.01	0.01	0.40	213
Vendor	0.02	0.01	0.40	0.15	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	258	258	< 0.005	0.04	0.30	269
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.26	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.7	34.7	< 0.005	< 0.005	0.07	35.2
Vendor	< 0.005	< 0.005	0.07	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.05	44.6
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.6. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.35	1.13	10.4	13.0	0.02	0.43	—	0.43	0.40	—	0.40	—	2,398	2,398	0.10	0.02	—	2,406
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.41	0.34	3.15	3.93	0.01	0.13	—	0.13	0.12	—	0.12	—	723	723	0.03	0.01	—	725
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.57	0.72	< 0.005	0.02	—	0.02	0.02	—	0.02	—	120	120	< 0.005	< 0.005	—	120
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.52	0.49	0.37	5.10	0.00	0.00	0.68	0.68	0.00	0.16	0.16	—	719	719	0.04	0.03	3.10	731
Vendor	0.05	0.04	1.29	0.49	0.01	0.01	0.23	0.24	0.01	0.06	0.07	—	855	855	< 0.005	0.12	2.31	894
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.15	0.14	0.13	1.45	0.00	0.00	0.20	0.20	0.00	0.05	0.05	—	209	209	0.01	0.01	0.40	213
Vendor	0.02	0.01	0.40	0.15	< 0.005	< 0.005	0.07	0.07	< 0.005	0.02	0.02	—	258	258	< 0.005	0.04	0.30	269
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.02	0.02	0.26	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	34.7	34.7	< 0.005	< 0.005	0.07	35.2
Vendor	< 0.005	< 0.005	0.07	0.03	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	42.7	42.7	< 0.005	0.01	0.05	44.6
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Paving (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.85	0.71	6.52	8.84	0.01	0.29	—	0.29	0.26	—	0.26	—	1,351	1,351	0.05	0.01	—	1,355
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.18	0.24	< 0.005	0.01	—	0.01	0.01	—	0.01	—	37.0	37.0	< 0.005	< 0.005	—	37.1
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.13	6.13	< 0.005	< 0.005	—	6.15
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.13	0.12	0.09	1.24	0.00	0.00	0.17	0.17	0.00	0.04	0.04	—	175	175	0.01	0.01	0.75	178
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.62	4.62	< 0.005	< 0.005	0.01	4.70
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.77	0.77	< 0.005	< 0.005	< 0.005	0.78
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.8. Paving (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.85	0.71	6.52	8.84	0.01	0.29	—	0.29	0.26	—	0.26	—	1,351	1,351	0.05	0.01	—	1,355
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.02	0.18	0.24	< 0.005	0.01	—	0.01	0.01	—	0.01	—	37.0	37.0	< 0.005	< 0.005	—	37.1
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.03	0.04	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	6.13	6.13	< 0.005	< 0.005	—	6.15
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.13	0.12	0.09	1.24	0.00	0.00	0.17	0.17	0.00	0.04	0.04	—	175	175	0.01	0.01	0.75	178
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.62	4.62	< 0.005	< 0.005	0.01	4.70

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.77	0.77	< 0.005	< 0.005	< 0.005	0.78
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Architectural Coating (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	227	227	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134

Architectural Coatings	227	227	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	4.98	4.98	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49
Architectural Coatings	0.91	0.91	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.10	0.07	1.02	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	144	144	0.01	0.01	0.62	146
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.09	0.09	0.97	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	137	137	0.01	0.01	0.02	139
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.04	3.04	< 0.005	< 0.005	0.01	3.09
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.50	0.50	< 0.005	< 0.005	< 0.005	0.51
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.10. Architectural Coating (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	227	227	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	227	227	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	4.98	4.98	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49
Architectural Coatings	0.91	0.91	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.10	0.07	1.02	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	144	144	0.01	0.01	0.62	146
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.10	0.09	0.09	0.97	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	137	137	0.01	0.01	0.02	139
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.04	3.04	< 0.005	< 0.005	0.01	3.09
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.50	0.50	< 0.005	< 0.005	< 0.005	0.51
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Total	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Total	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496
Total	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-No	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Total	2.03	1.87	2.12	14.6	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	3,012	3,012	0.13	0.15	12.2	3,074
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Total	1.99	1.82	2.40	14.4	0.03	0.04	2.58	2.62	0.03	0.66	0.69	—	2,905	2,905	0.15	0.17	0.32	2,959
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496
Total	0.36	0.33	0.41	2.59	0.01	0.01	0.46	0.46	0.01	0.12	0.12	—	487	487	0.02	0.03	0.87	496

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118

Total	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Total	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	183	183	0.03	< 0.005	—	185
Total	—	—	—	—	—	—	—	—	—	—	—	—	183	183	0.03	< 0.005	—	185

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Total	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Wareho Rail	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Total	—	—	—	—	—	—	—	—	—	—	—	—	1,107	1,107	0.18	0.02	—	1,118
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	183	183	0.03	< 0.005	—	185
Total	—	—	—	—	—	—	—	—	—	—	—	—	183	183	0.03	< 0.005	—	185

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Total	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Total	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrig Warehouse-No Rail	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	62.3	62.3	0.01	< 0.005	—	62.4
Total	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	62.3	62.3	0.01	< 0.005	—	62.4

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Total	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Total	0.03	0.02	0.32	0.26	< 0.005	0.02	—	0.02	0.02	—	0.02	—	376	376	0.03	< 0.005	—	377
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	62.3	62.3	0.01	< 0.005	—	62.4
Total	0.01	< 0.005	0.06	0.05	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	62.3	62.3	0.01	< 0.005	—	62.4

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	4.19	4.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.50	0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	1.52	1.40	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Total	6.21	6.09	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	4.19	4.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.50	0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4.69	4.69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer Product	0.77	0.77	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.09	0.09	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.14	0.13	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87
Total	0.99	0.98	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	4.19	4.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.50	0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	1.52	1.40	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Total	6.21	6.09	0.07	8.52	< 0.005	0.02	—	0.02	0.01	—	0.01	—	35.1	35.1	< 0.005	< 0.005	—	35.2
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consumer	4.19	4.19	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.50	0.50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	4.69	4.69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.77	0.77	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.09	0.09	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.14	0.13	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87
Total	0.99	0.98	0.01	0.77	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.86	2.86	< 0.005	< 0.005	—	2.87

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487

Total	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Total	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6
Total	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Total	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Wareho Rail	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Total	—	—	—	—	—	—	—	—	—	—	—	86.9	113	200	8.92	0.21	—	487
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6
Total	—	—	—	—	—	—	—	—	—	—	—	14.4	18.7	33.1	1.48	0.04	—	80.6

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347

Total	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5
Total	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Total	—	—	—	—	—	—	—	—	—	—	—	99.3	0.00	99.3	9.92	0.00	—	347
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5
Total	—	—	—	—	—	—	—	—	—	—	—	16.4	0.00	16.4	1.64	0.00	—	57.5

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	4/1/2025	4/2/2025	5.00	2.00	—

Grading	Grading	4/3/2025	4/4/2025	5.00	2.00	—
Building Construction	Building Construction	4/5/2025	9/5/2025	5.00	110	—
Paving	Paving	9/10/2025	9/23/2025	5.00	10.0	—
Architectural Coating	Architectural Coating	9/24/2025	10/3/2025	5.00	8.00	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	3.00	8.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	4.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Grading	Tractors/Loaders/Backhoes	Diesel	Average	3.00	8.00	84.0	0.37
Grading	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Cranes	Diesel	Average	1.00	7.00	367	0.29
Building Construction	Forklifts	Diesel	Average	3.00	8.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Welders	Diesel	Average	1.00	8.00	46.0	0.45
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	3.00	7.00	84.0	0.37
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	2.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	2.00	6.00	89.0	0.36
Paving	Rollers	Diesel	Average	2.00	6.00	36.0	0.38

Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Rubber Tired Dozers	Diesel	Average	3.00	8.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	4.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Excavators	Diesel	Average	1.00	8.00	36.0	0.38
Grading	Tractors/Loaders/Backhoes	Diesel	Average	3.00	8.00	84.0	0.37
Grading	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Cranes	Diesel	Average	1.00	7.00	367	0.29
Building Construction	Forklifts	Diesel	Average	3.00	8.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Welders	Diesel	Average	1.00	8.00	46.0	0.45
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	3.00	7.00	84.0	0.37
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	2.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	8.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	2.00	6.00	89.0	0.36
Paving	Rollers	Diesel	Average	2.00	6.00	36.0	0.38
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	17.5	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	15.0	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	82.3	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	32.1	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	20.0	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	16.5	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	17.5	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	15.0	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	82.3	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	32.1	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	20.0	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	16.5	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	294,000	98,000	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	3.00	0.00	—
Grading	—	—	2.00	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-No Rail	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	204	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-No Rail	341	341	341	124,480	3,613	3,613	3,613	1,318,689

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-No Rail	341	341	341	124,480	3,613	3,613	3,613	1,318,689

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	294,000	98,000	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-No Rail	1,980,125	204	0.0330	0.0040	1,173,289

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-No Rail	1,980,125	204	0.0330	0.0040	1,173,289

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-No Rail	45,325,000	172,789

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-No Rail	45,325,000	172,789

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-No Rail	184	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-No Rail	184	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	10.7	annual days of extreme heat
Extreme Precipitation	25.0	annual days with precipitation above 20 mm
Sea Level Rise	—	meters of inundation depth
Wildfire	24.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.

The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	11.7
AQ-PM	2.54
AQ-DPM	4.29
Drinking Water	47.7
Lead Risk Housing	30.6
Pesticides	70.0
Toxic Releases	0.70
Traffic	17.1
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	70.3
Haz Waste Facilities/Generators	68.4
Impaired Water Bodies	72.2
Solid Waste	72.4
Sensitive Population	—
Asthma	25.0
Cardio-vascular	13.3
Low Birth Weights	19.0

Socioeconomic Factor Indicators	—
Education	44.3
Housing	27.2
Linguistic	55.6
Poverty	31.5
Unemployment	—

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	58.4370589
Employed	11.71564224
Median HI	59.00166816
Education	—
Bachelor's or higher	70.21686129
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	66.18760426
Active commuting	69.03631464
Social	—
2-parent households	83.58783524
Voting	99.17875016
Neighborhood	—
Alcohol availability	83.69049147
Park access	8.302322597
Retail density	1.501347363

Supermarket access	30.39907609
Tree canopy	96.79199281
Housing	—
Homeownership	65.25086616
Housing habitability	80.17451559
Low-inc homeowner severe housing cost burden	47.26036186
Low-inc renter severe housing cost burden	96.95880919
Uncrowded housing	51.79006801
Health Outcomes	—
Insured adults	26.49813936
Arthritis	0.0
Asthma ER Admissions	75.0
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	43.8
Cognitively Disabled	22.1
Physically Disabled	33.4
Heart Attack ER Admissions	92.2
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	67.5
Physical Health Not Good	0.0
Stroke	0.0

Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	6.1
SLR Inundation Area	0.0
Children	94.5
Elderly	3.2
English Speaking	45.4
Foreign-born	29.0
Outdoor Workers	11.9
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.8
Traffic Density	12.5
Traffic Access	23.0
Other Indices	—
Hardship	40.3
Other Decision Support	—
2016 Voting	98.6

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	20.0
Healthy Places Index Score for Project Location (b)	70.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Assumed construction schedule of 7 months
Construction: Architectural Coatings	Revised to reflect consistency with architectural rules
Operations: Architectural Coatings	Revised to adhere to architectural rules
Land Use	Modeled to reflect average square footage of mixed-light use

Sonoma Cannabis Noncultivation Detailed Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Sonoma Cannabis Noncultivation
Construction Start Date	4/1/2025
Operational Year	2026
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.20
Precipitation (days)	48.0
Location	Sonoma County, CA, USA
County	Sonoma-North Coast
City	Unincorporated
Air District	Northern Sonoma County APCD
Air Basin	North Coast
TAZ	889
EDFZ	2
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.29

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Research & Development	20.0	1000sqft	0.46	20,037	3,000	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-10-A	Water Exposed Surfaces
Construction	C-11	Limit Vehicle Speeds on Unpaved Roads

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	23.4	23.4	10.1	10.5	0.02	0.46	5.37	5.84	0.43	2.58	3.01	—	1,779	1,779	0.07	0.03	0.66	1,786
Mit.	23.4	23.4	10.1	10.5	0.02	0.46	2.13	2.60	0.43	1.02	1.44	—	1,779	1,779	0.07	0.03	0.66	1,786
% Reduced	—	—	—	—	—	—	60%	56%	—	61%	52%	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	23.4	23.4	0.89	1.22	< 0.005	0.03	0.01	0.04	0.03	< 0.005	0.03	—	144	144	0.01	< 0.005	< 0.005	145
Mit.	23.4	23.4	0.89	1.22	< 0.005	0.03	0.01	0.04	0.03	< 0.005	0.03	—	144	144	0.01	< 0.005	< 0.005	145
% Reduced	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.74	0.71	1.82	2.51	< 0.005	0.08	0.06	0.13	0.07	0.02	0.09	—	480	480	0.02	0.01	0.07	483
Mit.	0.74	0.71	1.82	2.51	< 0.005	0.08	0.04	0.11	0.07	0.01	0.08	—	480	480	0.02	0.01	0.07	483
% Reduced	—	—	—	—	—	—	33%	15%	—	42%	10%	—	—	—	—	—	—	—

Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.14	0.13	0.33	0.46	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.02	—	79.5	79.5	< 0.005	< 0.005	0.01	80.0
Mit.	0.14	0.13	0.33	0.46	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.01	—	79.5	79.5	< 0.005	< 0.005	0.01	80.0
% Reduced	—	—	—	—	—	—	33%	15%	—	42%	10%	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	23.4	23.4	10.1	10.5	0.02	0.46	5.37	5.84	0.43	2.58	3.01	—	1,779	1,779	0.07	0.03	0.66	1,786
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	23.4	23.4	0.89	1.22	< 0.005	0.03	0.01	0.04	0.03	< 0.005	0.03	—	144	144	0.01	< 0.005	< 0.005	145
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.74	0.71	1.82	2.51	< 0.005	0.08	0.06	0.13	0.07	0.02	0.09	—	480	480	0.02	0.01	0.07	483
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.14	0.13	0.33	0.46	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.02	—	79.5	79.5	< 0.005	< 0.005	0.01	80.0

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	23.4	23.4	10.1	10.5	0.02	0.46	2.13	2.60	0.43	1.02	1.44	—	1,779	1,779	0.07	0.03	0.66	1,786

Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	23.4	23.4	0.89	1.22	< 0.005	0.03	0.01	0.04	0.03	< 0.005	0.03	—	144	144	0.01	< 0.005	< 0.005	145
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.74	0.71	1.82	2.51	< 0.005	0.08	0.04	0.11	0.07	0.01	0.08	—	480	480	0.02	0.01	0.07	483
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.14	0.13	0.33	0.46	< 0.005	0.01	0.01	0.02	0.01	< 0.005	0.01	—	79.5	79.5	< 0.005	< 0.005	0.01	80.0

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.99	1.87	1.54	10.7	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,407	2,426	2.16	0.15	8.55	2,535
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.81	1.69	1.71	9.65	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,332	2,352	2.17	0.16	0.72	2,455
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.56	1.47	1.24	7.59	0.02	0.03	1.25	1.28	0.03	0.32	0.34	19.7	1,876	1,895	2.14	0.13	3.12	1,991
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.28	0.27	0.23	1.39	< 0.005	0.01	0.23	0.23	< 0.005	0.06	0.06	3.26	311	314	0.35	0.02	0.52	330

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Area	0.63	0.62	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.99	1.87	1.54	10.7	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,407	2,426	2.16	0.15	8.55	2,535
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Area	0.48	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.81	1.69	1.71	9.65	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,332	2,352	2.17	0.16	0.72	2,455
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.99	0.91	1.12	7.06	0.01	0.02	1.25	1.26	0.02	0.32	0.33	—	1,463	1,463	0.07	0.08	2.61	1,492
Area	0.56	0.55	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.77	1.77	< 0.005	< 0.005	—	1.77
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.56	1.47	1.24	7.59	0.02	0.03	1.25	1.28	0.03	0.32	0.34	19.7	1,876	1,895	2.14	0.13	3.12	1,991

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247
Area	0.10	0.10	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Energy	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	63.9	63.9	0.01	< 0.005	—	64.3
Water	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08
Total	0.28	0.27	0.23	1.39	< 0.005	0.01	0.23	0.23	< 0.005	0.06	0.06	3.26	311	314	0.35	0.02	0.52	330

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Area	0.63	0.62	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.99	1.87	1.54	10.7	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,407	2,426	2.16	0.15	8.55	2,535
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Area	0.48	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106

Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.81	1.69	1.71	9.65	0.02	0.03	1.71	1.74	0.03	0.44	0.47	19.7	2,332	2,352	2.17	0.16	0.72	2,455
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.99	0.91	1.12	7.06	0.01	0.02	1.25	1.26	0.02	0.32	0.33	—	1,463	1,463	0.07	0.08	2.61	1,492
Area	0.56	0.55	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.77	1.77	< 0.005	< 0.005	—	1.77
Energy	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	386	386	0.05	< 0.005	—	388
Water	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Waste	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	1.56	1.47	1.24	7.59	0.02	0.03	1.25	1.28	0.03	0.32	0.34	19.7	1,876	1,895	2.14	0.13	3.12	1,991
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247
Area	0.10	0.10	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Energy	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	63.9	63.9	0.01	< 0.005	—	64.3
Water	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5
Waste	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48
Refrig.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08
Total	0.28	0.27	0.23	1.39	< 0.005	0.01	0.23	0.23	< 0.005	0.06	0.06	3.26	311	314	0.35	0.02	0.52	330

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.56	0.47	4.16	5.57	0.01	0.21	—	0.21	0.20	—	0.20	—	859	859	0.03	0.01	—	862
Dust From Material Movement	—	—	—	—	—	—	0.53	0.53	—	0.06	0.06	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.71	4.71	< 0.005	< 0.005	—	4.72
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.78	0.78	< 0.005	< 0.005	—	0.78
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.31	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	43.7	43.7	< 0.005	< 0.005	0.19	44.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.23	0.23	< 0.005	< 0.005	< 0.005	0.23
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.2. Site Preparation (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.56	0.47	4.16	5.57	0.01	0.21	—	0.21	0.20	—	0.20	—	859	859	0.03	0.01	—	862
Dust From Material Movement	—	—	—	—	—	—	0.21	0.21	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.71	4.71	< 0.005	< 0.005	—	4.72
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.78	0.78	< 0.005	< 0.005	—	0.78
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.03	0.03	0.02	0.31	0.00	0.00	0.04	0.04	0.00	0.01	0.01	—	43.7	43.7	< 0.005	< 0.005	0.19	44.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.23	0.23	< 0.005	< 0.005	< 0.005	0.23
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.3. Grading (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.29	1.09	10.1	10.0	0.02	0.46	—	0.46	0.43	—	0.43	—	1,714	1,714	0.07	0.01	—	1,720

Dust From Material Movement	—	—	—	—	—	—	5.31	5.31	—	2.57	2.57	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.39	9.39	< 0.005	< 0.005	—	9.42
Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.55	1.55	< 0.005	< 0.005	—	1.56
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.4. Grading (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.29	1.09	10.1	10.0	0.02	0.46	—	0.46	0.43	—	0.43	—	1,714	1,714	0.07	0.01	—	1,720
Dust From Material Movement	—	—	—	—	—	—	2.07	2.07	—	1.00	1.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.06	0.06	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	9.39	9.39	< 0.005	< 0.005	—	9.42
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.55	1.55	< 0.005	< 0.005	—	1.56
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.5. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.62	0.52	5.14	6.94	0.01	0.22	—	0.22	0.20	—	0.20	—	1,305	1,305	0.05	0.01	—	1,309
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.55	2.09	< 0.005	0.07	—	0.07	0.06	—	0.06	—	393	393	0.02	< 0.005	—	395

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.28	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	65.1	65.1	< 0.005	< 0.005	—	65.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.40	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	56.0	56.0	< 0.005	< 0.005	0.24	57.0
Vendor	0.01	< 0.005	0.13	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	87.4	87.4	< 0.005	0.01	0.24	91.4
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.11	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	16.3	16.3	< 0.005	< 0.005	0.03	16.6
Vendor	< 0.005	< 0.005	0.04	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	26.3	26.3	< 0.005	< 0.005	0.03	27.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.70	2.70	< 0.005	< 0.005	0.01	2.74
Vendor	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	4.36	4.36	< 0.005	< 0.005	0.01	4.56
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.6. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.62	0.52	5.14	6.94	0.01	0.22	—	0.22	0.20	—	0.20	—	1,305	1,305	0.05	0.01	—	1,309
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.19	0.16	1.55	2.09	< 0.005	0.07	—	0.07	0.06	—	0.06	—	393	393	0.02	< 0.005	—	395
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.03	0.03	0.28	0.38	< 0.005	0.01	—	0.01	0.01	—	0.01	—	65.1	65.1	< 0.005	< 0.005	—	65.3
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.04	0.04	0.03	0.40	0.00	0.00	0.05	0.05	0.00	0.01	0.01	—	56.0	56.0	< 0.005	< 0.005	0.24	57.0
Vendor	0.01	< 0.005	0.13	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	87.4	87.4	< 0.005	0.01	0.24	91.4
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.11	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	16.3	16.3	< 0.005	< 0.005	0.03	16.6
Vendor	< 0.005	< 0.005	0.04	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	26.3	26.3	< 0.005	< 0.005	0.03	27.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.70	2.70	< 0.005	< 0.005	0.01	2.74
Vendor	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	4.36	4.36	< 0.005	< 0.005	0.01	4.56
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Paving (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	4.37	5.31	0.01	0.19	—	0.19	0.18	—	0.18	—	823	823	0.03	0.01	—	826
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.02	0.01	0.12	0.15	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	22.6	22.6	< 0.005	< 0.005	—	22.6
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.74	3.74	< 0.005	< 0.005	—	3.75
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.05	4.05	< 0.005	< 0.005	0.01	4.11
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.67	0.67	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.8. Paving (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.61	0.51	4.37	5.31	0.01	0.19	—	0.19	0.18	—	0.18	—	823	823	0.03	0.01	—	826
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.12	0.15	< 0.005	0.01	—	0.01	< 0.005	—	< 0.005	—	22.6	22.6	< 0.005	< 0.005	—	22.6
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.74	3.74	< 0.005	< 0.005	—	3.75
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.11	0.10	0.08	1.08	0.00	0.00	0.14	0.14	0.00	0.03	0.03	—	153	153	0.01	0.01	0.66	155
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	4.05	4.05	< 0.005	< 0.005	0.01	4.11
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.01	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.67	0.67	< 0.005	< 0.005	< 0.005	0.68
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Architectural Coating (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134

Architectural	23.2	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	23.2	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	0.51	0.51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49
Architectural Coatings	0.09	0.09	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.08	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.2	11.2	< 0.005	< 0.005	0.05	11.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.08	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	10.6	10.6	< 0.005	< 0.005	< 0.005	10.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.24	0.24	< 0.005	< 0.005	< 0.005	0.24
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.10. Architectural Coating (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	23.2	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	23.2	23.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	0.51	0.51	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49
Architectural Coatings	0.09	0.09	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.08	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	11.2	11.2	< 0.005	< 0.005	0.05	11.4
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.08	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	10.6	10.6	< 0.005	< 0.005	< 0.005	10.8
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.24	0.24	< 0.005	< 0.005	< 0.005	0.24
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.04	0.04	< 0.005	< 0.005	< 0.005	0.04
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Total	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Total	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247
Total	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Total	1.34	1.24	1.40	9.68	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,993	1,993	0.09	0.10	8.04	2,033
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Total	1.32	1.21	1.59	9.54	0.02	0.02	1.71	1.73	0.02	0.44	0.46	—	1,922	1,922	0.10	0.11	0.21	1,958
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247
Total	0.18	0.17	0.20	1.29	< 0.005	< 0.005	0.23	0.23	< 0.005	0.06	0.06	—	242	242	0.01	0.01	0.43	247

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Total	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Total	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	39.1	39.1	0.01	< 0.005	—	39.5
Total	—	—	—	—	—	—	—	—	—	—	—	—	39.1	39.1	0.01	< 0.005	—	39.5

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Total	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Total	—	—	—	—	—	—	—	—	—	—	—	—	236	236	0.04	< 0.005	—	238
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	39.1	39.1	0.01	< 0.005	—	39.5
Total	—	—	—	—	—	—	—	—	—	—	—	—	39.1	39.1	0.01	< 0.005	—	39.5

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Total	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Total	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Research & Development	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	24.8	24.8	< 0.005	< 0.005	—	24.9
Total	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	24.8	24.8	< 0.005	< 0.005	—	24.9

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Total	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Total	0.01	0.01	0.13	0.11	< 0.005	0.01	—	0.01	0.01	—	0.01	—	150	150	0.01	< 0.005	—	150
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	24.8	24.8	< 0.005	< 0.005	—	24.9
Total	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	24.8	24.8	< 0.005	< 0.005	—	24.9

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.16	0.14	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Total	0.63	0.62	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.48	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.08	0.08	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architect Coatings	0.01	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.01	0.01	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Total	0.10	0.10	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.16	0.14	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Total	0.63	0.62	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.60
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Architectural Coating	0.05	0.05	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.48	0.48	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.08	0.08	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.01	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.01	0.01	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Total	0.10	0.10	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Total	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Total	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5
Total	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Total	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106
Total	—	—	—	—	—	—	—	—	—	—	—	18.9	24.6	43.4	1.94	0.05	—	106

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5
Total	—	—	—	—	—	—	—	—	—	—	—	3.13	4.07	7.19	0.32	0.01	—	17.5

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Total	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Total	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48
Total	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Total	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Total	—	—	—	—	—	—	—	—	—	—	—	0.82	0.00	0.82	0.08	0.00	—	2.87
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48
Total	—	—	—	—	—	—	—	—	—	—	—	0.14	0.00	0.14	0.01	0.00	—	0.48

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.51	0.51
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Research & Development	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.08	0.08

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	4/1/2025	4/2/2025	5.00	2.00	—
Grading	Grading	4/3/2025	4/4/2025	5.00	2.00	—
Building Construction	Building Construction	4/5/2025	9/5/2025	5.00	110	—
Paving	Paving	9/6/2025	9/19/2025	5.00	10.0	—
Architectural Coating	Architectural Coating	9/20/2025	10/1/2025	5.00	8.00	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	6.00	148	0.41
Grading	Rubber Tired Dozers	Diesel	Average	1.00	6.00	367	0.40
Grading	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	4.00	367	0.29
Building Construction	Forklifts	Diesel	Average	2.00	6.00	82.0	0.20
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	2.00	8.00	84.0	0.37
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	4.00	6.00	10.0	0.56

Paving	Pavers	Diesel	Average	1.00	7.00	81.0	0.42
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	6.00	148	0.41
Grading	Rubber Tired Dozers	Diesel	Average	1.00	6.00	367	0.40
Grading	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Building Construction	Cranes	Diesel	Average	1.00	4.00	367	0.29
Building Construction	Forklifts	Diesel	Average	2.00	6.00	82.0	0.20
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	2.00	8.00	84.0	0.37
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	7.00	84.0	0.37
Paving	Cement and Mortar Mixers	Diesel	Average	4.00	6.00	10.0	0.56
Paving	Pavers	Diesel	Average	1.00	7.00	81.0	0.42
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	5.00	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	7.50	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	6.41	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	3.28	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	17.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	1.28	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—

Site Preparation	Worker	5.00	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	7.50	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT
Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	6.41	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	3.28	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	17.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	1.28	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	30,056	10,019	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	1.00	0.00	—
Grading	—	—	1.50	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Research & Development	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	204	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Research & Development	226	38.1	22.2	61,966	2,390	403	236	656,447

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Research & Development	226	38.1	22.2	61,966	2,390	403	236	656,447

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	30,056	10,019	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value

Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Research & Development	422,298	204	0.0330	0.0040	467,097

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Research & Development	422,298	204	0.0330	0.0040	467,097

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Research & Development	9,852,072	25,918

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Research & Development	9,852,072	25,918

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Research & Development	1.52	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Research & Development	1.52	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Research & Development	Household refrigerators and/or freezers	R-134a	1,430	0.45	0.60	0.00	1.00
Research & Development	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced
Research & Development	Household refrigerators and/or freezers	R-134a	1,430	0.45	0.60	0.00	1.00
Research & Development	Other commercial A/C and heat pumps	R-410A	2,088	< 0.005	4.00	4.00	18.0

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	10.7	annual days of extreme heat
Extreme Precipitation	25.0	annual days with precipitation above 20 mm
Sea Level Rise	—	meters of inundation depth
Wildfire	24.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A

Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	11.7
AQ-PM	2.54
AQ-DPM	4.29
Drinking Water	47.7
Lead Risk Housing	30.6
Pesticides	70.0
Toxic Releases	0.70
Traffic	17.1
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	70.3

Haz Waste Facilities/Generators	68.4
Impaired Water Bodies	72.2
Solid Waste	72.4
Sensitive Population	—
Asthma	25.0
Cardio-vascular	13.3
Low Birth Weights	19.0
Socioeconomic Factor Indicators	—
Education	44.3
Housing	27.2
Linguistic	55.6
Poverty	31.5
Unemployment	—

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	58.4370589
Employed	11.71564224
Median HI	59.00166816
Education	—
Bachelor's or higher	70.21686129
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	66.18760426
Active commuting	69.03631464

Social	—
2-parent households	83.58783524
Voting	99.17875016
Neighborhood	—
Alcohol availability	83.69049147
Park access	8.302322597
Retail density	1.501347363
Supermarket access	30.39907609
Tree canopy	96.79199281
Housing	—
Homeownership	65.25086616
Housing habitability	80.17451559
Low-inc homeowner severe housing cost burden	47.26036186
Low-inc renter severe housing cost burden	96.95880919
Uncrowded housing	51.79006801
Health Outcomes	—
Insured adults	26.49813936
Arthritis	0.0
Asthma ER Admissions	75.0
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	43.8
Cognitively Disabled	22.1
Physically Disabled	33.4

Heart Attack ER Admissions	92.2
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	67.5
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	6.1
SLR Inundation Area	0.0
Children	94.5
Elderly	3.2
English Speaking	45.4
Foreign-born	29.0
Outdoor Workers	11.9
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.8
Traffic Density	12.5
Traffic Access	23.0
Other Indices	—
Hardship	40.3
Other Decision Support	—
2016 Voting	98.6

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	20.0
Healthy Places Index Score for Project Location (b)	70.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Adjusted for a 7 month construction period.
Construction: Architectural Coatings	Adjusted to adhere to architectural rules
Operations: Architectural Coatings	Adjusted to adhere to architectural rules

Sonoma Cannabis Outdoor Detailed Report

Table of Contents

1. Basic Project Information

1.1. Basic Project Information

Data Field	Value
Project Name	Sonoma Cannabis Outdoor
Construction Start Date	4/1/2025
Operational Year	2026
Lead Agency	—
Land Use Scale	Project/site
Analysis Level for Defaults	County
Windspeed (m/s)	2.20
Precipitation (days)	48.0
Location	Sonoma County, CA, USA
County	Sonoma-North Coast
City	Unincorporated
Air District	Northern Sonoma County APCD
Air Basin	North Coast
TAZ	889
EDFZ	2
Electric Utility	Pacific Gas & Electric Company
Gas Utility	Pacific Gas & Electric
App Version	2022.1.1.29

1.2. Land Use Types

Land Use Subtype	Size	Unit	Lot Acreage	Building Area (sq ft)	Landscape Area (sq ft)	Special Landscape Area (sq ft)	Population	Description
Unrefrigerated Warehouse-No Rail	78.8	1000sqft	1.80	20,000	58,000	—	—	—

1.3. User-Selected Emission Reduction Measures by Emissions Sector

Sector	#	Measure Title
Construction	C-10-A	Water Exposed Surfaces
Construction	C-11	Limit Vehicle Speeds on Unpaved Roads

2. Emissions Summary

2.1. Construction Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	91.5	91.5	23.2	25.7	0.04	0.97	7.26	8.23	0.89	3.47	4.36	—	4,504	4,504	0.18	0.05	0.93	4,525
Mit.	91.5	91.5	23.2	25.7	0.04	0.97	2.94	3.91	0.89	1.38	2.27	—	4,504	4,504	0.18	0.05	0.93	4,525
% Reduced	—	—	—	—	—	—	60%	52%	—	60%	48%	—	—	—	—	—	—	—
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	2.45	2.37	3.04	3.56	0.01	0.11	0.10	0.22	0.10	0.04	0.15	—	649	649	0.03	0.01	0.08	653
Mit.	2.45	2.37	3.04	3.56	0.01	0.11	0.06	0.17	0.10	0.02	0.12	—	649	649	0.03	0.01	0.08	653
% Reduced	—	—	—	—	—	—	43%	21%	—	50%	15%	—	—	—	—	—	—	—
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.45	0.43	0.56	0.65	< 0.005	0.02	0.02	0.04	0.02	0.01	0.03	—	108	108	< 0.005	< 0.005	0.01	108
Mit.	0.45	0.43	0.56	0.65	< 0.005	0.02	0.01	0.03	0.02	< 0.005	0.02	—	108	108	< 0.005	< 0.005	0.01	108
% Reduced	—	—	—	—	—	—	43%	21%	—	50%	15%	—	—	—	—	—	—	—

2.2. Construction Emissions by Year, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	91.5	91.5	23.2	25.7	0.04	0.97	7.26	8.23	0.89	3.47	4.36	—	4,504	4,504	0.18	0.05	0.93	4,525
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.45	2.37	3.04	3.56	0.01	0.11	0.10	0.22	0.10	0.04	0.15	—	649	649	0.03	0.01	0.08	653
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.45	0.43	0.56	0.65	< 0.005	0.02	0.02	0.04	0.02	0.01	0.03	—	108	108	< 0.005	< 0.005	0.01	108

2.3. Construction Emissions by Year, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Year	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily - Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	91.5	91.5	23.2	25.7	0.04	0.97	2.94	3.91	0.89	1.38	2.27	—	4,504	4,504	0.18	0.05	0.93	4,525
Daily - Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	2.45	2.37	3.04	3.56	0.01	0.11	0.06	0.17	0.10	0.02	0.12	—	649	649	0.03	0.01	0.08	653
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2025	0.45	0.43	0.56	0.65	< 0.005	0.02	0.01	0.03	0.02	< 0.005	0.02	—	108	108	< 0.005	< 0.005	0.01	108

2.4. Operations Emissions Compared Against Thresholds

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Un/Mit.	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.65	1.55	1.35	7.16	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,087	2,162	7.72	0.15	4.89	2,406
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.48	1.39	1.46	6.21	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,040	2,115	7.73	0.16	0.13	2,356
Average Daily (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	1.56	1.46	1.40	6.54	0.01	0.05	1.01	1.06	0.05	0.26	0.31	74.8	2,056	2,131	7.73	0.16	2.11	2,373
Annual (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unmit.	0.28	0.27	0.26	1.19	< 0.005	0.01	0.18	0.19	0.01	0.05	0.06	12.4	340	353	1.28	0.03	0.35	393

2.5. Operations Emissions by Sector, Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236
Area	0.78	0.77	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.65	1.55	1.35	7.16	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,087	2,162	7.72	0.15	4.89	2,406

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Area	0.63	0.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.48	1.39	1.46	6.21	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,040	2,115	7.73	0.16	0.13	2,356
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.80	0.73	0.90	5.70	0.01	0.01	1.01	1.02	0.01	0.26	0.27	—	1,182	1,182	0.06	0.06	2.11	1,205
Area	0.70	0.70	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.76	1.76	< 0.005	< 0.005	—	1.77
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.56	1.46	1.40	6.54	0.01	0.05	1.01	1.06	0.05	0.26	0.31	74.8	2,056	2,131	7.73	0.16	2.11	2,373
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199
Area	0.13	0.13	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Energy	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	137	137	0.01	< 0.005	—	137
Water	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5
Waste	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1
Total	0.28	0.27	0.26	1.19	< 0.005	0.01	0.18	0.19	0.01	0.05	0.06	12.4	340	353	1.28	0.03	0.35	393

2.6. Operations Emissions by Sector, Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Sector	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236
Area	0.78	0.77	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.65	1.55	1.35	7.16	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,087	2,162	7.72	0.15	4.89	2,406
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Area	0.63	0.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.48	1.39	1.46	6.21	0.01	0.05	1.04	1.09	0.05	0.26	0.32	74.8	2,040	2,115	7.73	0.16	0.13	2,356
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.80	0.73	0.90	5.70	0.01	0.01	1.01	1.02	0.01	0.26	0.27	—	1,182	1,182	0.06	0.06	2.11	1,205
Area	0.70	0.70	< 0.005	0.43	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.76	1.76	< 0.005	< 0.005	—	1.77
Energy	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	826	826	0.09	0.01	—	830
Water	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Waste	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	1.56	1.46	1.40	6.54	0.01	0.05	1.01	1.06	0.05	0.26	0.31	74.8	2,056	2,131	7.73	0.16	2.11	2,373
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mobile	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199
Area	0.13	0.13	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Energy	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	137	137	0.01	< 0.005	—	137

Water	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5
Waste	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1
Total	0.28	0.27	0.26	1.19	< 0.005	0.01	0.18	0.19	0.01	0.05	0.06	12.4	340	353	1.28	0.03	0.35	393

3. Construction Emissions Details

3.1. Site Preparation (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.56	1.31	12.1	12.1	0.02	0.56	—	0.56	0.52	—	0.52	—	2,065	2,065	0.08	0.02	—	2,072
Dust From Material Movement	—	—	—	—	—	—	6.26	6.26	—	3.00	3.00	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.07	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.3	11.3	< 0.005	< 0.005	—	11.4

Dust From Material Movement	—	—	—	—	—	—	0.03	0.03	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.87	1.87	< 0.005	< 0.005	—	1.88
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06

Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.2. Site Preparation (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.56	1.31	12.1	12.1	0.02	0.56	—	0.56	0.52	—	0.52	—	2,065	2,065	0.08	0.02	—	2,072
Dust From Material Movement	—	—	—	—	—	—	2.44	2.44	—	1.17	1.17	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.07	0.07	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	11.3	11.3	< 0.005	< 0.005	—	11.4
Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	1.87	1.87	< 0.005	< 0.005	—	1.88
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.04	0.03	0.46	0.00	0.00	0.06	0.06	0.00	0.01	0.01	—	65.5	65.5	< 0.005	< 0.005	0.28	66.6
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.35	0.35	< 0.005	< 0.005	< 0.005	0.35
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.06	0.06	< 0.005	< 0.005	< 0.005	0.06
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.3. Grading (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.80	1.51	14.1	14.5	0.02	0.64	—	0.64	0.59	—	0.59	—	2,455	2,455	0.10	0.02	—	2,463
Dust From Material Movement	—	—	—	—	—	—	7.08	7.08	—	3.42	3.42	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.5	13.5	< 0.005	< 0.005	—	13.5
Dust From Material Movement	—	—	—	—	—	—	0.04	0.04	—	0.02	0.02	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.23	2.23	< 0.005	< 0.005	—	2.23

Dust From Material Movement	—	—	—	—	—	—	0.01	0.01	—	< 0.005	< 0.005	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.06	0.05	0.62	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	87.3	87.3	0.01	< 0.005	0.38	88.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.46	0.46	< 0.005	< 0.005	< 0.005	0.47
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.08	0.08	< 0.005	< 0.005	< 0.005	0.08
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.4. Grading (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.80	1.51	14.1	14.5	0.02	0.64	—	0.64	0.59	—	0.59	—	2,455	2,455	0.10	0.02	—	2,463
Dust From Material Movement	—	—	—	—	—	—	2.76	2.76	—	1.34	1.34	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.01	0.01	0.08	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	13.5	13.5	< 0.005	< 0.005	—	13.5
Dust From Material Movement	—	—	—	—	—	—	0.02	0.02	—	0.01	0.01	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.23	2.23	< 0.005	< 0.005	—	2.23
Dust From Material Movement	—	—	—	—	—	—	< 0.005	< 0.005	—	< 0.005	< 0.005	—	—	—	—	—	—	—

Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.06	0.06	0.05	0.62	0.00	0.00	0.08	0.08	0.00	0.02	0.02	—	87.3	87.3	0.01	< 0.005	0.38	88.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.46	0.46	< 0.005	< 0.005	< 0.005	0.47
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.08	0.08	< 0.005	< 0.005	< 0.005	0.08
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.5. Building Construction (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	1.28	1.07	8.95	10.0	0.02	0.33	—	0.33	0.30	—	0.30	—	1,801	1,801	0.07	0.01	—	1,807
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.32	2.70	3.02	0.01	0.10	—	0.10	0.09	—	0.09	—	543	543	0.02	< 0.005	—	545
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.07	0.06	0.49	0.55	< 0.005	0.02	—	0.02	0.02	—	0.02	—	89.9	89.9	< 0.005	< 0.005	—	90.2
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.04	0.52	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	73.3	73.3	< 0.005	< 0.005	0.32	74.6
Vendor	0.01	< 0.005	0.13	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	87.2	87.2	< 0.005	0.01	0.24	91.3
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Worker	0.02	0.01	0.01	0.15	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	21.4	21.4	< 0.005	< 0.005	0.04	21.7
Vendor	< 0.005	< 0.005	0.04	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	26.3	26.3	< 0.005	< 0.005	0.03	27.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.54	3.54	< 0.005	< 0.005	0.01	3.59
Vendor	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	4.35	4.35	< 0.005	< 0.005	0.01	4.55
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.6. Building Construction (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	1.28	1.07	8.95	10.0	0.02	0.33	—	0.33	0.30	—	0.30	—	1,801	1,801	0.07	0.01	—	1,807
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.39	0.32	2.70	3.02	0.01	0.10	—	0.10	0.09	—	0.09	—	543	543	0.02	< 0.005	—	545
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.07	0.06	0.49	0.55	< 0.005	0.02	—	0.02	0.02	—	0.02	—	89.9	89.9	< 0.005	< 0.005	—	90.2
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.05	0.05	0.04	0.52	0.00	0.00	0.07	0.07	0.00	0.02	0.02	—	73.3	73.3	< 0.005	< 0.005	0.32	74.6
Vendor	0.01	< 0.005	0.13	0.05	< 0.005	< 0.005	0.02	0.02	< 0.005	0.01	0.01	—	87.2	87.2	< 0.005	0.01	0.24	91.3
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.02	0.01	0.01	0.15	0.00	0.00	0.02	0.02	0.00	< 0.005	< 0.005	—	21.4	21.4	< 0.005	< 0.005	0.04	21.7
Vendor	< 0.005	< 0.005	0.04	0.02	< 0.005	< 0.005	0.01	0.01	< 0.005	< 0.005	< 0.005	—	26.3	26.3	< 0.005	< 0.005	0.03	27.5
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.03	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	3.54	3.54	< 0.005	< 0.005	0.01	3.59
Vendor	< 0.005	< 0.005	0.01	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	4.35	4.35	< 0.005	< 0.005	0.01	4.55
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.7. Paving (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.59	0.49	4.63	6.50	0.01	0.20	—	0.20	0.19	—	0.19	—	992	992	0.04	0.01	—	995
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.13	0.18	< 0.005	0.01	—	0.01	0.01	—	0.01	—	27.2	27.2	< 0.005	< 0.005	—	27.3
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.50	4.50	< 0.005	< 0.005	—	4.51
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.06	0.77	0.00	0.00	0.10	0.10	0.00	0.02	0.02	—	109	109	0.01	< 0.005	0.47	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.89	2.89	< 0.005	< 0.005	0.01	2.94
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.48	0.48	< 0.005	< 0.005	< 0.005	0.49
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.8. Paving (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.59	0.49	4.63	6.50	0.01	0.20	—	0.20	0.19	—	0.19	—	992	992	0.04	0.01	—	995
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.02	0.01	0.13	0.18	< 0.005	0.01	—	0.01	0.01	—	0.01	—	27.2	27.2	< 0.005	< 0.005	—	27.3

Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.03	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	4.50	4.50	< 0.005	< 0.005	—	4.51
Paving	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.08	0.07	0.06	0.77	0.00	0.00	0.10	0.10	0.00	0.02	0.02	—	109	109	0.01	< 0.005	0.47	111
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	0.02	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	2.89	2.89	< 0.005	< 0.005	0.01	2.94
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.48	0.48	< 0.005	< 0.005	< 0.005	0.49
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.9. Architectural Coating (2025) - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	91.3	91.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	2.00	2.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49

Architectural	0.37	0.37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	14.7	14.7	< 0.005	< 0.005	0.06	14.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.31	0.31	< 0.005	< 0.005	< 0.005	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.05	0.05	< 0.005	< 0.005	< 0.005	0.05
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

3.10. Architectural Coating (2025) - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Location	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Onsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Off-Road Equipment	0.15	0.13	0.88	1.14	< 0.005	0.03	—	0.03	0.03	—	0.03	—	134	134	0.01	< 0.005	—	134
Architectural Coatings	91.3	91.3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	0.02	0.02	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	2.93	2.93	< 0.005	< 0.005	—	2.94
Architectural Coatings	2.00	2.00	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Off-Road Equipment	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.48	0.48	< 0.005	< 0.005	—	0.49
Architectural Coatings	0.37	0.37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Onsite truck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Offsite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	0.01	0.01	0.01	0.10	0.00	0.00	0.01	0.01	0.00	< 0.005	< 0.005	—	14.7	14.7	< 0.005	< 0.005	0.06	14.9
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Average Daily	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.31	0.31	< 0.005	< 0.005	< 0.005	0.32
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Worker	< 0.005	< 0.005	< 0.005	< 0.005	0.00	0.00	< 0.005	< 0.005	0.00	< 0.005	< 0.005	—	0.05	0.05	< 0.005	< 0.005	< 0.005	0.05
Vendor	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00
Hauling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0.00	0.00	0.00	0.00	0.00	0.00

4. Operations Emissions Details

4.1. Mobile Emissions by Land Use

4.1.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrigerated Wareho Rail	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236
Total	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Total	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199
Total	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199

4.1.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236
Total	0.82	0.75	0.85	5.88	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,211	1,211	0.05	0.06	4.89	1,236

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Total	0.80	0.73	0.97	5.80	0.01	0.01	1.04	1.05	0.01	0.26	0.28	—	1,168	1,168	0.06	0.07	0.13	1,190
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199
Total	0.15	0.13	0.16	1.04	< 0.005	< 0.005	0.18	0.19	< 0.005	0.05	0.05	—	196	196	0.01	0.01	0.35	199

4.2. Energy

4.2.1. Electricity Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Total	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrig Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Total	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	39.3	39.3	0.01	< 0.005	—	39.7
Total	—	—	—	—	—	—	—	—	—	—	—	—	39.3	39.3	0.01	< 0.005	—	39.7

4.2.2. Electricity Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Total	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Total	—	—	—	—	—	—	—	—	—	—	—	—	238	238	0.04	< 0.005	—	240
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Unrefrig Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	—	39.3	39.3	0.01	< 0.005	—	39.7
Total	—	—	—	—	—	—	—	—	—	—	—	—	39.3	39.3	0.01	< 0.005	—	39.7

4.2.3. Natural Gas Emissions By Land Use - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Total	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Total	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	97.5	97.5	0.01	< 0.005	—	97.7
Total	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	97.5	97.5	0.01	< 0.005	—	97.7

4.2.4. Natural Gas Emissions By Land Use - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Total	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Total	0.05	0.03	0.49	0.41	< 0.005	0.04	—	0.04	0.04	—	0.04	—	589	589	0.05	< 0.005	—	590
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	97.5	97.5	0.01	< 0.005	—	97.7
Total	0.01	< 0.005	0.09	0.08	< 0.005	0.01	—	0.01	0.01	—	0.01	—	97.5	97.5	0.01	< 0.005	—	97.7

4.3. Area Emissions by Source

4.3.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.20	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.15	0.14	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Total	0.78	0.77	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.20	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.63	0.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.08	0.08	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.04	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Landsca Equipment	0.01	0.01	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Total	0.13	0.13	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29

4.3.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Source	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.20	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landscape Equipment	0.15	0.14	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Total	0.78	0.77	0.01	0.87	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	3.58	3.58	< 0.005	< 0.005	—	3.59
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Consumer Products	0.43	0.43	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architectural Coatings	0.20	0.20	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	0.63	0.63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Consum Products	0.08	0.08	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Architect ural Coating s	0.04	0.04	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Landsca pe Equipm ent	0.01	0.01	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29
Total	0.13	0.13	< 0.005	0.08	< 0.005	< 0.005	—	< 0.005	< 0.005	—	< 0.005	—	0.29	0.29	< 0.005	< 0.005	—	0.29

4.4. Water Emissions by Land Use

4.4.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrig erated Wareho use-No Rail	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Total	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrig erated Wareho use-No Rail	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Total	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196

Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5
Total	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5

4.4.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Total	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Total	—	—	—	—	—	—	—	—	—	—	—	34.9	46.2	81.1	3.59	0.09	—	196
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5

Total	—	—	—	—	—	—	—	—	—	—	—	5.78	7.64	13.4	0.59	0.01	—	32.5

4.5. Waste Emissions by Land Use

4.5.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1
Total	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1

4.5.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Total	—	—	—	—	—	—	—	—	—	—	—	39.9	0.00	39.9	3.99	0.00	—	140
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unrefrigerated Warehouse-No Rail	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1
Total	—	—	—	—	—	—	—	—	—	—	—	6.61	0.00	6.61	0.66	0.00	—	23.1

4.6. Refrigerant Emissions by Land Use

4.6.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.6.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7. Offroad Emissions By Equipment Type

4.7.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipm Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.7.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8. Stationary Emissions By Equipment Type

4.8.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.8.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9. User Defined Emissions By Equipment Type

4.9.1. Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.9.2. Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Equipment Type	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10. Soil Carbon Accumulation By Vegetation Type

4.10.1. Soil Carbon Accumulation By Vegetation Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.2. Above and Belowground Carbon Accumulation by Land Use Type - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.3. Avoided and Sequestered Emissions by Species - Unmitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.4. Soil Carbon Accumulation By Vegetation Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Vegetation	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.5. Above and Belowground Carbon Accumulation by Land Use Type - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Land Use	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4.10.6. Avoided and Sequestered Emissions by Species - Mitigated

Criteria Pollutants (lb/day for daily, ton/yr for annual) and GHGs (lb/day for daily, MT/yr for annual)

Species	TOG	ROG	NOx	CO	SO2	PM10E	PM10D	PM10T	PM2.5E	PM2.5D	PM2.5T	BCO2	NBCO2	CO2T	CH4	N2O	R	CO2e
Daily, Summer (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Daily, Winter (Max)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Annual	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Avoided	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sequestered	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Removed	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

5. Activity Data

5.1. Construction Schedule

Phase Name	Phase Type	Start Date	End Date	Days Per Week	Work Days per Phase	Phase Description
Site Preparation	Site Preparation	4/1/2025	4/2/2025	5.00	2.00	—
Grading	Grading	4/3/2025	4/4/2025	5.00	2.00	—
Building Construction	Building Construction	4/4/2025	9/4/2025	5.00	110	—
Paving	Paving	9/5/2025	9/18/2025	5.00	10.0	—
Architectural Coating	Architectural Coating	9/19/2025	9/30/2025	5.00	8.00	—

5.2. Off-Road Equipment

5.2.1. Unmitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41

Site Preparation	Rubber Tired Dozers	Diesel	Average	1.00	7.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Tractors/Loaders/Backhoes	Diesel	Average	2.00	7.00	84.0	0.37
Grading	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Cranes	Diesel	Average	1.00	6.00	367	0.29
Building Construction	Forklifts	Diesel	Average	1.00	6.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Building Construction	Welders	Diesel	Average	3.00	8.00	46.0	0.45
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Paving	Pavers	Diesel	Average	1.00	6.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	1.00	8.00	89.0	0.36
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38
Paving	Cement and Mortar Mixers	Diesel	Average	1.00	6.00	10.0	0.56
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.2.2. Mitigated

Phase Name	Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor
Site Preparation	Graders	Diesel	Average	1.00	8.00	148	0.41
Site Preparation	Rubber Tired Dozers	Diesel	Average	1.00	7.00	367	0.40
Site Preparation	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Grading	Graders	Diesel	Average	1.00	8.00	148	0.41
Grading	Tractors/Loaders/Backhoes	Diesel	Average	2.00	7.00	84.0	0.37

Grading	Rubber Tired Dozers	Diesel	Average	1.00	8.00	367	0.40
Building Construction	Cranes	Diesel	Average	1.00	6.00	367	0.29
Building Construction	Forklifts	Diesel	Average	1.00	6.00	82.0	0.20
Building Construction	Generator Sets	Diesel	Average	1.00	8.00	14.0	0.74
Building Construction	Tractors/Loaders/Backhoes	Diesel	Average	1.00	6.00	84.0	0.37
Building Construction	Welders	Diesel	Average	3.00	8.00	46.0	0.45
Paving	Tractors/Loaders/Backhoes	Diesel	Average	1.00	8.00	84.0	0.37
Paving	Pavers	Diesel	Average	1.00	6.00	81.0	0.42
Paving	Paving Equipment	Diesel	Average	1.00	8.00	89.0	0.36
Paving	Rollers	Diesel	Average	1.00	7.00	36.0	0.38
Paving	Cement and Mortar Mixers	Diesel	Average	1.00	6.00	10.0	0.56
Architectural Coating	Air Compressors	Diesel	Average	1.00	6.00	37.0	0.48

5.3. Construction Vehicles

5.3.1. Unmitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	7.50	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	10.0	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT

Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	8.40	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	3.28	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	12.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	1.68	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.3.2. Mitigated

Phase Name	Trip Type	One-Way Trips per Day	Miles per Trip	Vehicle Mix
Site Preparation	—	—	—	—
Site Preparation	Worker	7.50	11.7	LDA,LDT1,LDT2
Site Preparation	Vendor	—	8.40	HHDT,MHDT
Site Preparation	Hauling	0.00	20.0	HHDT
Site Preparation	Onsite truck	—	—	HHDT
Grading	—	—	—	—
Grading	Worker	10.0	11.7	LDA,LDT1,LDT2
Grading	Vendor	—	8.40	HHDT,MHDT
Grading	Hauling	0.00	20.0	HHDT

Grading	Onsite truck	—	—	HHDT
Building Construction	—	—	—	—
Building Construction	Worker	8.40	11.7	LDA,LDT1,LDT2
Building Construction	Vendor	3.28	8.40	HHDT,MHDT
Building Construction	Hauling	0.00	20.0	HHDT
Building Construction	Onsite truck	—	—	HHDT
Paving	—	—	—	—
Paving	Worker	12.5	11.7	LDA,LDT1,LDT2
Paving	Vendor	—	8.40	HHDT,MHDT
Paving	Hauling	0.00	20.0	HHDT
Paving	Onsite truck	—	—	HHDT
Architectural Coating	—	—	—	—
Architectural Coating	Worker	1.68	11.7	LDA,LDT1,LDT2
Architectural Coating	Vendor	—	8.40	HHDT,MHDT
Architectural Coating	Hauling	0.00	20.0	HHDT
Architectural Coating	Onsite truck	—	—	HHDT

5.4. Vehicles

5.4.1. Construction Vehicle Control Strategies

Non-applicable. No control strategies activated by user.

5.5. Architectural Coatings

Phase Name	Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
Architectural Coating	0.00	0.00	118,200	39,400	—

5.6. Dust Mitigation

5.6.1. Construction Earthmoving Activities

Phase Name	Material Imported (cy)	Material Exported (cy)	Acres Graded (acres)	Material Demolished (sq. ft.)	Acres Paved (acres)
Site Preparation	—	—	1.88	0.00	—
Grading	—	—	2.00	0.00	—
Paving	0.00	0.00	0.00	0.00	0.00

5.6.2. Construction Earthmoving Control Strategies

Non-applicable. No control strategies activated by user.

5.7. Construction Paving

Land Use	Area Paved (acres)	% Asphalt
Unrefrigerated Warehouse-No Rail	0.00	0%

5.8. Construction Electricity Consumption and Emissions Factors

kWh per Year and Emission Factor (lb/MWh)

Year	kWh per Year	CO2	CH4	N2O
2025	0.00	204	0.03	< 0.005

5.9. Operational Mobile Sources

5.9.1. Unmitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year
Unrefrigerated Warehouse-No Rail	137	137	137	50,046	1,453	1,453	1,453	530,167

5.9.2. Mitigated

Land Use Type	Trips/Weekday	Trips/Saturday	Trips/Sunday	Trips/Year	VMT/Weekday	VMT/Saturday	VMT/Sunday	VMT/Year

Unrefrigerated Warehouse-No Rail	137	137	137	50,046	1,453	1,453	1,453	530,167

5.10. Operational Area Sources

5.10.1. Hearths

5.10.1.1. Unmitigated

5.10.1.2. Mitigated

5.10.2. Architectural Coatings

Residential Interior Area Coated (sq ft)	Residential Exterior Area Coated (sq ft)	Non-Residential Interior Area Coated (sq ft)	Non-Residential Exterior Area Coated (sq ft)	Parking Area Coated (sq ft)
0	0.00	118,200	39,400	—

5.10.3. Landscape Equipment

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.10.4. Landscape Equipment - Mitigated

Season	Unit	Value
Snow Days	day/yr	0.00
Summer Days	day/yr	180

5.11. Operational Energy Consumption

5.11.1. Unmitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-No Rail	425,000	204	0.0330	0.0040	1,836,966

5.11.2. Mitigated

Electricity (kWh/yr) and CO2 and CH4 and N2O and Natural Gas (kBTU/yr)

Land Use	Electricity (kWh/yr)	CO2	CH4	N2O	Natural Gas (kBTU/yr)
Unrefrigerated Warehouse-No Rail	425,000	204	0.0330	0.0040	1,836,966

5.12. Operational Water and Wastewater Consumption

5.12.1. Unmitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-No Rail	18,222,500	501,088

5.12.2. Mitigated

Land Use	Indoor Water (gal/year)	Outdoor Water (gal/year)
Unrefrigerated Warehouse-No Rail	18,222,500	501,088

5.13. Operational Waste Generation

5.13.1. Unmitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-No Rail	74.1	—

5.13.2. Mitigated

Land Use	Waste (ton/year)	Cogeneration (kWh/year)
Unrefrigerated Warehouse-No Rail	74.1	—

5.14. Operational Refrigeration and Air Conditioning Equipment

5.14.1. Unmitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.14.2. Mitigated

Land Use Type	Equipment Type	Refrigerant	GWP	Quantity (kg)	Operations Leak Rate	Service Leak Rate	Times Serviced

5.15. Operational Off-Road Equipment

5.15.1. Unmitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.15.2. Mitigated

Equipment Type	Fuel Type	Engine Tier	Number per Day	Hours Per Day	Horsepower	Load Factor

5.16. Stationary Sources

5.16.1. Emergency Generators and Fire Pumps

Equipment Type	Fuel Type	Number per Day	Hours per Day	Hours per Year	Horsepower	Load Factor

5.16.2. Process Boilers

Equipment Type	Fuel Type	Number	Boiler Rating (MMBtu/hr)	Daily Heat Input (MMBtu/day)	Annual Heat Input (MMBtu/yr)

5.17. User Defined

Equipment Type	Fuel Type

5.18. Vegetation

5.18.1. Land Use Change

5.18.1.1. Unmitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Vegetation Land Use Type	Vegetation Soil Type	Initial Acres	Final Acres

5.18.1. Biomass Cover Type

5.18.1.1. Unmitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.1.2. Mitigated

Biomass Cover Type	Initial Acres	Final Acres

5.18.2. Sequestration

5.18.2.1. Unmitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

5.18.2.2. Mitigated

Tree Type	Number	Electricity Saved (kWh/year)	Natural Gas Saved (btu/year)

6. Climate Risk Detailed Report

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	10.7	annual days of extreme heat
Extreme Precipitation	25.0	annual days with precipitation above 20 mm
Sea Level Rise	—	meters of inundation depth
Wildfire	24.6	annual hectares burned

Temperature and Extreme Heat data are for grid cell in which your project are located. The projection is based on the 98th historical percentile of daily maximum/minimum temperatures from observed historical data (32 climate model ensemble from Cal-Adapt, 2040–2059 average under RCP 8.5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Extreme Precipitation data are for the grid cell in which your project are located. The threshold of 20 mm is equivalent to about ¾ an inch of rain, which would be light to moderate rainfall if received over a full day or heavy rain if received over a period of 2 to 4 hours. Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.
Sea Level Rise data are for the grid cell in which your project are located. The projections are from Radke et al. (2017), as reported in Cal-Adapt (Radke et al., 2017, CEC-500-2017-008), and consider inundation location and depth for the San Francisco Bay, the Sacramento-San Joaquin River Delta and California coast resulting different increments of sea level rise coupled with extreme storm events. Users may select from four scenarios to view the range in potential inundation depth for the grid cell. The four scenarios are: No rise, 0.5 meter, 1.0 meter, 1.41 meters
Wildfire data are for the grid cell in which your project are located. The projections are from UC Davis, as reported in Cal-Adapt (2040–2059 average under RCP 8.5), and consider historical data of climate, vegetation, population density, and large (> 400 ha) fire history. Users may select from four model simulations to view the range in potential wildfire probabilities for the grid cell. The four simulations make different assumptions about expected rainfall and temperature are: Warmer/drier (HadGEM2-ES), Cooler/wetter (CNRM-CM5), Average conditions (CanESM2), Range of different rainfall and temperature possibilities (MIROC5). Each grid cell is 6 kilometers (km) by 6 km, or 3.7 miles (mi) by 3.7 mi.

6.2. Initial Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A

Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores do not include implementation of climate risk reduction measures.

6.3. Adjusted Climate Risk Scores

Climate Hazard	Exposure Score	Sensitivity Score	Adaptive Capacity Score	Vulnerability Score
Temperature and Extreme Heat	N/A	N/A	N/A	N/A
Extreme Precipitation	N/A	N/A	N/A	N/A
Sea Level Rise	N/A	N/A	N/A	N/A
Wildfire	N/A	N/A	N/A	N/A
Flooding	N/A	N/A	N/A	N/A
Drought	N/A	N/A	N/A	N/A
Snowpack Reduction	N/A	N/A	N/A	N/A
Air Quality Degradation	N/A	N/A	N/A	N/A

The sensitivity score reflects the extent to which a project would be adversely affected by exposure to a climate hazard. Exposure is rated on a scale of 1 to 5, with a score of 5 representing the greatest exposure.
The adaptive capacity of a project refers to its ability to manage and reduce vulnerabilities from projected climate hazards. Adaptive capacity is rated on a scale of 1 to 5, with a score of 5 representing the greatest ability to adapt.
The overall vulnerability scores are calculated based on the potential impacts and adaptive capacity assessments for each hazard. Scores include implementation of climate risk reduction measures.

6.4. Climate Risk Reduction Measures

7. Health and Equity Details

7.1. CalEnviroScreen 4.0 Scores

The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Exposure Indicators	—
AQ-Ozone	11.7
AQ-PM	2.54
AQ-DPM	4.29
Drinking Water	47.7
Lead Risk Housing	30.6
Pesticides	70.0
Toxic Releases	0.70
Traffic	17.1
Effect Indicators	—
CleanUp Sites	0.00
Groundwater	70.3
Haz Waste Facilities/Generators	68.4
Impaired Water Bodies	72.2
Solid Waste	72.4
Sensitive Population	—
Asthma	25.0
Cardio-vascular	13.3
Low Birth Weights	19.0
Socioeconomic Factor Indicators	—
Education	44.3
Housing	27.2
Linguistic	55.6
Poverty	31.5
Unemployment	—

7.2. Healthy Places Index Scores

The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

Indicator	Result for Project Census Tract
Economic	—
Above Poverty	58.4370589
Employed	11.71564224
Median HI	59.00166816
Education	—
Bachelor's or higher	70.21686129
High school enrollment	100
Preschool enrollment	95.7141024
Transportation	—
Auto Access	66.18760426
Active commuting	69.03631464
Social	—
2-parent households	83.58783524
Voting	99.17875016
Neighborhood	—
Alcohol availability	83.69049147
Park access	8.302322597
Retail density	1.501347363
Supermarket access	30.39907609
Tree canopy	96.79199281
Housing	—
Homeownership	65.25086616
Housing habitability	80.17451559
Low-inc homeowner severe housing cost burden	47.26036186
Low-inc renter severe housing cost burden	96.95880919
Uncrowded housing	51.79006801
Health Outcomes	—

Insured adults	26.49813936
Arthritis	0.0
Asthma ER Admissions	75.0
High Blood Pressure	0.0
Cancer (excluding skin)	0.0
Asthma	0.0
Coronary Heart Disease	0.0
Chronic Obstructive Pulmonary Disease	0.0
Diagnosed Diabetes	0.0
Life Expectancy at Birth	43.8
Cognitively Disabled	22.1
Physically Disabled	33.4
Heart Attack ER Admissions	92.2
Mental Health Not Good	0.0
Chronic Kidney Disease	0.0
Obesity	0.0
Pedestrian Injuries	67.5
Physical Health Not Good	0.0
Stroke	0.0
Health Risk Behaviors	—
Binge Drinking	0.0
Current Smoker	0.0
No Leisure Time for Physical Activity	0.0
Climate Change Exposures	—
Wildfire Risk	6.1
SLR Inundation Area	0.0
Children	94.5
Elderly	3.2

English Speaking	45.4
Foreign-born	29.0
Outdoor Workers	11.9
Climate Change Adaptive Capacity	—
Impervious Surface Cover	98.8
Traffic Density	12.5
Traffic Access	23.0
Other Indices	—
Hardship	40.3
Other Decision Support	—
2016 Voting	98.6

7.3. Overall Health & Equity Scores

Metric	Result for Project Census Tract
CalEnviroScreen 4.0 Score for Project Location (a)	20.0
Healthy Places Index Score for Project Location (b)	70.0
Project Located in a Designated Disadvantaged Community (Senate Bill 535)	No
Project Located in a Low-Income Community (Assembly Bill 1550)	No
Project Located in a Community Air Protection Program Community (Assembly Bill 617)	No

a: The maximum CalEnviroScreen score is 100. A high score (i.e., greater than 50) reflects a higher pollution burden compared to other census tracts in the state.
b: The maximum Health Places Index score is 100. A high score (i.e., greater than 50) reflects healthier community conditions compared to other census tracts in the state.

7.4. Health & Equity Measures

No Health & Equity Measures selected.

7.5. Evaluation Scorecard

Health & Equity Evaluation Scorecard not completed.

7.6. Health & Equity Custom Measures

No Health & Equity Custom Measures created.

8. User Changes to Default Data

Screen	Justification
Construction: Construction Phases	Schedule to reflect 7 month construction period
Construction: Architectural Coatings	Adjusted to adhere to architectural rules
Operations: Architectural Coatings	Adjusted to adhere to architectural rules
Operations: Energy Use	Adjusted electricity use for outdoor cultivation
Land Use	Adjusted to reflect average square footage for outdoor

Appendix D

Noise Data

Attenuation Calculations for Stationary Noise Sources

KEY: Orange cells are for input.
Grey cells are intermediate calculations performed by the model.
Green cells are data to present in a written analysis (output).

STEP 1: Identify the noise source and enter the reference noise level (dBA and distance).

STEP 2: Select the ground type (hard or soft), and enter the source and receiver heights.

STEP 3: Select the distance to the receiver.

Noise Source/ID	Reference Noise Level noise level (dBA)	@	distance (ft)	Attenuation Characteristics Ground Type (soft/hard)	Source Height (ft)	Receiver Height (ft)	Ground Factor	Attenuated Noise Level at Receptor noise level (dBA)	@	distance (ft)
Mechanized Trimmer	61.0	@	3	hard	8	5	0.00	30.5	@	100
Mechanized Timmer - nighttime standard (45)	61.0	@	3	hard	8	5	0.00	44.5	@	20
HVAC Equipment - Daytime standard (50 dBA)	70.0	@	3	hard	8	5	0.00	50.0	@	30
HVAC Equipment - Nighttime standard (45 dBA)	70.0	@	3	hard	8	5	0.00	44.9	@	54

Notes:

Estimates of attenuated noise levels do not account for reductions from intervening barriers, including walls, trees, vegetation, or structures of any type.

Computation of the attenuated noise level is based on the equation presented on pg. 176 and 177 of FTA 2018.

Computation of the ground factor is based on the equation presentd in Table 4-26 on pg. 86 of FTA 2018, where the distance of the reference noise leve can be adjusted and the usage factor is not applied (i.e., the usage factor is equal to 1).

Sources:

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment. Washington, D.C. Available: <http://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf>Accessed: March 5, 2020.

Sonoma County Cannabis Construction Noise Modeling (Leq)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
FTA residential daytime construction noise standard	25	90.0
FTA residential nighttime construction noise threshold	77	80.0
FTA Commercial/ Industrial Construction Noise Threshold	8	100.0
Agricultural/RRD Property Line Setback	100	77.8
Agricultural/RRD Residential Zone Setback	600	62.2
Agricultural/RRD Sensitve Use Setback	1000	57.8
M1, M2, and M3 setback from residential zones	10	97.8
MP Residential Zone Setback	100	77.8

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Dozer	82	0.4
Grader	85	0.4
Excavator	81	0.4

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Dozer	78.0
Grader	81.0
Excavator	77.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
83.8

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

CPU = Cannabis Program Update

Sonoma County Cannabis Construction Noise Modeling (Lmax)

Location	Distance to Nearest Receptor in feet	Combined Predicted Noise Level (L_{eq} dBA)
Daytime FTA Residential Threshold	39	90.0
Agricultural/Commercial/ Industrial Threshold	12	100.0
Agricultural/RRD Property Line Setback	100	81.8
Agricultural/RRD Residential Zone Setback	600	66.2
Agricultural/RRD Sensitve Use Setback	1000	61.8
M1, M2, and M3 setback from residential zones	10	101.8
MP Residential Zone Setback	100	81.8

Equipment	Reference Emission Noise Levels (L_{max}) at 50 feet[1]	Usage Factor[1]
Dozer	82	1
Grader	85	1
Excavator	81	1

Ground Type	hard
Source Height	8
Receiver Height	5
Ground Factor[2]	0.00

Predicted Noise Level [3]	L_{eq} dBA at 50 feet[3]
Dozer	82.0
Grader	85.0
Excavator	81.0

Combined Predicted Noise Level (L_{eq} dBA at 50 feet)
87.8

Sources:

[1] Obtained from the FHWA Roadway Construction Noise Model, January 2006. Table 1.

[2] Based on Figure 6-5 from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 6-23).

[3] Based on the following from the Federal Transit Noise and Vibration Impact Assessment, 2006 (pg 12-3).

L_{eq}(equip) = E.L.+10*log (U.F.) - 20*log (D/50) - 10*G*log (D/50)

Where: E.L. = Emission Level;

U.F.= Usage Factor;

G = Constant that accounts for topography and ground effects (FTA 2006: pg 6-23); and

D = Distance from source to receiver.

Equipment Description	Acoustical Usage Factor (%)	Spec 721.560 Lmax @ 50ft (dBA slow)	Actual Measured Lmax @ 50ft (dBA slow)	No. of Actual Data Samples (count)	Spec 721.560 LmaxCalc	Spec 721.560 Leq	Distance	Actual Measured LmaxCalc	Actual Measured Leq
Auger Drill Rig	20	85	84	36	79.0	72.0	100	78.0	71.0
Backhoe	40	80	78	372	74.0	70.0	100	72.0	68.0
Bar Bender	20	80	na	0	74.0	67.0	100		
Blasting	na	94	na	0	88.0		100		
Boring Jack Power Unit	50	80	83	1	74.0	71.0	100	77.0	74.0
Chain Saw	20	85	84	46	79.0	72.0	100	78.0	71.0
Clam Shovel (dropping)	20	93	87	4	87.0	80.0	100	81.0	74.0
Compactor (ground)	20	80	83	57	74.0	67.0	100	77.0	70.0
Compressor (air)	40	80	78	18	74.0	70.0	100	72.0	68.0
Concrete Batch Plant	15	83	na	0	77.0	68.7	100		
Concrete Mixer Truck	40	85	79	40	79.0	75.0	100	73.0	69.0
Concrete Pump Truck	20	82	81	30	76.0	69.0	100	75.0	68.0
Concrete Saw	20	90	90	55	84.0	77.0	100	84.0	77.0
Crane	16	85	81	405	79.0	71.0	100	75.0	67.0
Dozer	40	85	82	55	79.0	75.0	100	76.0	72.0
Drill Rig Truck	20	84	79	22	78.0	71.0	100	73.0	66.0
Drum Mixer	50	80	80	1	74.0	71.0	100	74.0	71.0
Dump Truck	40	84	76	31	78.0	74.0	100	70.0	66.0
Excavator	40	85	81	170	79.0	75.0	100	75.0	71.0
Flat Bed Truck	40	84	74	4	78.0	74.0	100	68.0	64.0
Front End Loader	40	80	79	96	74.0	70.0	100	73.0	69.0
Generator	50	82	81	19	76.0	73.0	100	75.0	72.0
Generator (<25KVA, VMS signs)	50	70	73	74	64.0	61.0	100	67.0	64.0
Gradall	40	85	83	70	79.0	75.0	100	77.0	73.0
Grader	40	85	na	0	79.0	75.0	100		
Grapple (on Backhoe)	40	85	87	1	79.0	75.0	100	81.0	77.0
Horizontal Boring Hydr. Jack	25	80	82	6	74.0	68.0	100	76.0	70.0
Hydra Break Ram	10	90	na	0	84.0	74.0	100		
Impact Pile Driver	20	95	101	11	89.0	82.0	100	95.0	88.0
Jackhammer	20	85	89	133	79.0	72.0	100	83.0	76.0
Man Lift	20	85	75	23	79.0	72.0	100	69.0	62.0
Mounted Impact Hammer (hoe ram)	20	90	90	212	84.0	77.0	100	84.0	77.0
Pavement Scarafier	20	85	90	2	79.0	72.0	100	84.0	77.0
Paver	50	85	77	9	79.0	76.0	100	71.0	68.0
Pickup Truck	40	55	75	1	49.0	45.0	100	69.0	65.0
Pneumatic Tools	50	85	85	90	79.0	76.0	100	79.0	76.0
Pumps	50	77	81	17	71.0	68.0	100	75.0	72.0
Refrigerator Unit	100	82	73	3	76.0	76.0	100	67.0	67.0
Rivit Buster/chipping gun	20	85	79	19	79.0	72.0	100	73.0	66.0
Rock Drill	20	85	81	3	79.0	72.0	100	75.0	68.0
Roller	20	85	80	16	79.0	72.0	100	74.0	67.0
Sand Blasting (Single Nozzle)	20	85	96	9	79.0	72.0	100	90.0	83.0
Scraper	40	85	84	12	79.0	75.0	100	78.0	74.0
Shears (on backhoe)	40	85	96	5	79.0	75.0	100	90.0	86.0
Slurry Plant	100	78	78	1	72.0	72.0	100	72.0	72.0
Slurry Trenching Machine	50	82	80	75	76.0	73.0	100	74.0	71.0
Soil Mix Drill Rig	50	80	na	0	74.0	71.0	100		
Tractor	40	84	na	0	78.0	74.0	100		
Vacuum Excavator (Vac-truck)	40	85	85	149	79.0	75.0	100	79.0	75.0
Vacuum Street Sweeper	10	80	82	19	74.0	64.0	100	76.0	66.0
Ventilation Fan	100	85	79	13	79.0	79.0	100	73.0	73.0
Vibrating Hopper	50	85	87	1	79.0	76.0	100	81.0	78.0
Vibratory Concrete Mixer	20	80	80	1	74.0	67.0	100	74.0	67.0
Vibratory Pile Driver	20	95	101	44	89.0	82.0	100	95.0	88.0
Warning Horn	5	85	83	12	79.0	66.0	100	77.0	64.0
Welder / Torch	40	73	74	5	67.0	63.0	100	68.0	64.0
chipper		75							

Source:
FHWA Roadway Construction Noise Model, January 2006. Table 9.1
U.S. Department of Transportation
CA/T Construction Spec. 721.560

Distance Propagation Calculations for Stationary Sources of Ground Vibration

KEY: Orange cells are for input.
Grey cells are intermediate calculations performed by the model.
Green cells are data to present in a written analysis (output).

STEP 1: Determine units in which to perform calculation.
— If vibration decibels (VdB), then use Table A and proceed to Steps 2A and 3A.
— If peak particle velocity (PPV), then use Table B and proceed to Steps 2B and 3B.

STEP 2A: Identify the vibration source and enter the reference vibration level (VdB) and distance.

STEP 3A: Select the distance to the receiver.

Table A. Propagation of vibration decibels (VdB) with distance

Noise Source/ID	Reference Noise Level vibration level (VdB)	@	distance (ft)	Attenuated Noise Level at Receptor vibration level (VdB)	@	distance (ft)	
Large Bulldozer	87	@	25	79.9	@	43	80
Small Bulldozer	53	@	25	76.9	@	4	80

The Lv metric (VdB) is used to assess the likelihood for vibration to result in human annoyance.

STEP 2B: Identify the vibration source and enter the reference peak particle velocity (PPV) and distance.

STEP 3B: Select the distance to the receiver.

Table B. Propagation of peak particle velocity (PPV) with distance

Noise Source/ID	Reference Noise Level vibration level (PPV)	@	distance (ft)	Attenuated Noise Level at Receptor vibration level (PPV)	@	distance (ft)	
Large Bulldozer	0.089	@	25	0.191	@	15	0.2
Small Bulldozer	0.003	@	25	0.133	@	2	0.2

The PPV metric (in/sec) is used for assessing the likelihood for the potential of structural damage.

Notes:
Computation of propagated vibration levels is based on the equations presented on pg. 185 of FTA 2018. Estimates of attenuated vibration levels do not account for reductions from intervening underground barriers or other underground structures of any type, or changes in soil type.

Federal Transit Association (FTA). 2018 (September). Transit Noise and Vibration Impact Assessment Manual. FTA Report No. 0123. Washington, D.C. Accessed: December 20, 2020. Page Available: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/118131/transit-noise-and-vibration-impact-assessment-manual-fta-report-no-0123_0.pdf

Appendix E

Economics Study

MEMORANDUM

To: County of Sonoma Commercial Cannabis Program

From: David Zehnder, Tom Martens, and Emilio Balingit

Subject: Market Demand for Sonoma County Cannabis; EPS #222073

Date: April 11, 2025

The Economics of Land Use

Introduction and Executive Summary

This memorandum provides an overview of the cannabis industry in Sonoma County and the State of California, as well as a snapshot of the current state of the industry, based on the best available data. Data sources include Sonoma County and State of California (State) cannabis regulators, private cannabis industry publications, and publicly available reports and studies, supplemented by interviews with cannabis business operators in Sonoma County.

Based on the available data, Economic & Planning Systems, Inc. (EPS) developed potential cannabis cultivation demand scenarios, along with estimates for acreage required to meet that demand. Estimates of total cannabis demand potential are based on demand from the following sources:

1. Sonoma County residents.
2. Sonoma County cannabis product manufacturers.
3. The rest of the State.

Sonoma County's potential demand from each of the three sources noted above is derived by applying a range of reasonable "capture" rates for that demand by licensed Sonoma County cannabis producers. Demand for cannabis is then translated into potential acreage needed based on the allocation of production methods found throughout the North Coast (outdoor; mixed light; indoor) and estimated productivity (pounds per square foot) per production method.

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Sacramento, CA 95814
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Denver
Los Angeles

www.epsys.com

Table 1 provides a summary of the range of acreage needed to meet cannabis demand for each of the three sources noted above and in total. The base case under existing conditions essentially represents the current state of the industry, while the higher end reflects the potential cumulative effects of positive local branding and development of local cannabis market infrastructure. Additional demand because of a hypothetical 20 percent inducement from the unlicensed market to the licensed market because of changes at the State level is also presented. (Note: A hypothetical high-demand scenario to frame the upper limit of cannabis acreage for environmental impact purposes is included in the final section of this memorandum.)

Table 1. Sonoma County Potential Demand for Cannabis Cultivation Acreage

	Demand Source			
Scenario	Local Residents	Local Manufacturing	Statewide Demand	**Total Acres**
Under Existing Conditions				
Low	4 Ac	1 Ac	17 Ac	**22 Ac**
High	7 Ac	1 Ac	34 Ac	**42 Ac**
Assuming 20% Inducement from Unlicensed to Licensed Market [1]				
Low	5 Ac	1 Ac	21 Ac	**26 Ac**
High	8 Ac	2 Ac	41 Ac	**51 Ac**

Source: EPS.

[1] Due to increased enforcement, tax reduction or other changes.

The remainder of this memorandum is divided into several subsections, summarized below:

- **Cannabis Industry Overview** provides a brief overview of the licensed cannabis industry and market, with a focus on cultivation dynamics.
- **Commercial Cannabis in Sonoma County** summarizes commercial cannabis business activity in Sonoma County since legalization.
- **Demand for Sonoma County Cannabis** presents EPS's methodology and results for estimating demand for legal cannabis in Sonoma County and resulting acreage estimates.
- **Key Policy Considerations** discusses potential land use policy changes and their impact on Sonoma County's cannabis industry.

Cannabis Industry Overview

This section provides an overview of the cannabis industry in California, including the overall size of the industry, the roles and interaction between different industry function groups, and broad trends affecting the industry.

The legal, adult-use cannabis industry in California is 6 years old. Medical cannabis has been legal in the State since the passage of Proposition 215 in 1996. The combination of ongoing stigma about cannabis consumption that was prevalent until recently and the administrative barriers to medical cannabis likely stymied significant growth of the medicinal cannabis industry. Between 1996 and the legalization of adult-use (non-medicinal) cannabis in 2017, a doctor's prescription was required to legally purchase cannabis. In 2003, the State created the Medical Marijuana Identification Card (MMIC) program, which combined a County-issued identification card with a Web-based statewide registry to allow law enforcement and dispensaries to quickly verify a person's eligibility to purchase, use, grow, and transport medicinal cannabis. However, cannabis identification cards were not mandatory for purchase of medicinal cannabis; at their peak in 2009-10, fewer than 13,000 medical cannabis cards were issued statewide.[1]

Public perception of cannabis consumption changed significantly between the legalization of medical cannabis in 1996 and the start of the State's adult-use licensing program in 2018. Nationally, fewer than one-quarter of those surveyed supported cannabis legalization in 1988, compared with more than two-thirds in 2019.[2] Changes in perception of cannabis in this timeframe were accompanied by an increase in consumption—in 2002, fewer than 5 percent of California adults 26 or older reported cannabis use in the past month, compared with nearly 12 percent in 2019.[3] [4]

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[1] California Department of Public Health. 2023. Medical Marijuana Identification Card Data by County and Fiscal Year. https://www.cdph.ca.gov/Programs/CHSI/CDPH%20Document%20Library/MMPCounty_Card_Count_September_2023_ADA.xlsx

[2] Felson, J.; Adamczyk, A.; and Thomas, C. 2019. How and why have attitudes about cannabis legalization changed so much? Social Science Research Vol. 78, Pages 12-27.

[3] Alejandro Azofeifa, Margaret E. Mattson, and Rob Lyerla. Supplementary Material. State Level Data: Estimates of Marijuana Use and Related Indicators—National Survey on Drug Use and Health, California, 2002-2014. Center for Behavioral Health Statistics and Quality. (2016). Substance Abuse and Mental Health Services Administration, Rockville, MD.

[4] US Substance Abuse and Mental Health Administration. 2019. 2018-2019 National Survey On Drug Use And Health: Model-Based Prevalence Estimates (50 States And The District Of Columbia). https://www.samhsa.gov/data/report/2018-2019-nsduh-state-prevalence-estimates

Despite increasing public acceptance of cannabis consumption, and increasing consumption of cannabis itself, the licensed cannabis industry is still experiencing significant instability. A key reason for this uncertainty is the persistence and size of the unlicensed cannabis industry.

Precisely characterizing the size of the overall cannabis industry in California is infeasible because of its legal status—outlawed in California until 1996 and still prohibited under federal law. Because of the long-standing prohibition on cannabis production and consumption, the bulk of the industry developed in remote locales to evade law enforcement. The legacy of California's cannabis prohibition, combined with ongoing federal prohibition, means that the majority of cannabis production in the State is still in the illicit sector. As late as 2020, experts estimate that unlicensed growers produce at least 80 percent of the State's cannabis.[5] However, some share of the illicit sector is likely flowing out of the State.

Characterization of the licensed cannabis sector is also difficult, apart from broad metrics, because of the availability of data. California Department of Cannabis Control (DCC) data is largely confidential and not subject to California Public Records Act requests.[6] In addition, federal prohibition on cannabis activity extends to academic research on cannabis.[7] Similarly, traditional sources of industrial research, such as U.S. Securities and Exchange Commission filings, are unavailable for the sector.

Nonetheless, several researchers have strived to characterize the overall cannabis industry in California, using a variety of techniques, from survey data regarding cannabis use, surveys sent to cannabis producers, and even satellite data. The subsection below will provide a brief overview of each section of the cannabis industry, with a primary focus on cannabis cultivation, the main cannabis business activity in Sonoma County. Below is a brief description of the main sectors of the cannabis industry, separated by their function:

- **Cultivators** grow and harvest cannabis plants. This sector also includes nurseries, which provide seeds and immature plants to cannabis farmers.
- **Processors** dry, cure, trim, and package harvested cannabis plants. Cannabis flowers, which have the highest concentration of psychoactive compounds,

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[5] Sumner, D.; Goldstein, R.; Matthews, W.; and Sambucci, O. 2020. California Agriculture: Dimensions and Issues. Chapter 13: Cannabis in California.

[6] California Business and Professional Code Section 26067.

[7] University of California Research Policy Analysis & Coordination. 2018. Information for Researchers on Conducting Marijuana Research at the University of California. https://researchmemosapi.ucop.edu/index.php/site/document?memo=UlBBQy0xOC0wMQ==&doc=3743

are packaged for consumer sale, while leaves and other cannabis biomass are sent to manufacturers.

- **Manufacturers** use a variety of chemical processes to extract psychoactive chemicals from cannabis leaves to create cannabis oils, edibles, tinctures, drinks, and other products.
- **Distributors** are responsible for moving cannabis and manufactured cannabis products between cultivators, manufacturers, and retail sites.
- **Retailers** sell cannabis flower and manufactured cannabis products directly to consumers, either through a storefront or delivery service.
- **Testing** laboratories provide testing of cannabis and manufactured products for potency or contaminants.

Although the State requires separate licenses for each of these activities, many cannabis businesses perform multiple industry functions.[8] In addition, relationships and transactions between different industry functions can take multiple forms. For example, cultivators may pay a cash fee to processors for drying, trimming, and packaging their harvested cannabis, or processors may purchase unprocessed cannabis from cultivators for eventual resale after processing.[9] As seen in **Table 2**, cultivation businesses dominate the overall licensed industry in California, although there are nearly 3,000 fewer active cultivation licenses than there were at the peak in 2021.

Table 2. Active State Licenses by License Type and Year

	Year					
License Type	2018	2019	2020	2021	2022	2023
Cultivation	3	4,581	6,278	8,609	7,997	5,750
Distributor	1	1,272	1,281	1,359	1,440	1,301
Manufacturer	6	263	166	220	314	816
Microbusiness	-	281	299	336	383	404
Retailer	8	987	1,092	1,278	1,581	1,699
Testing	-	31	39	48	46	41
Total	**18**	**7,415**	**9,155**	**11,850**	**11,761**	**10,011**

Source: California Department of Cannabis Control Unified License Search; EPS.

[8] California DCC. License Types. https://cannabis.ca.gov/applicants/license-types/

[9] Interview with Sonoma County Cannabis Cultivator. July 26, 2023.

Cannabis Consumption in California

Cannabis consumed in California is procured through one of three markets: (1) licensed adult-use market, (2) licensed medical-use market, and (3) unlicensed market. Many producers in the licensed segments of the market are authorized to produce cannabis products for both the medical and adult-use market.[10] In addition, the unlicensed market includes both cannabis legally grown for personal use and cannabis illegally produced for the illicit market.

Total cannabis consumption in California has been estimated before using results from the National Survey on Drug Use and Health (NSDUH), administered by the U.S. Substance Abuse and Mental Health Services Administration (SAMHSA). In 2017, before the establishment of the licensed adult-use cannabis market, total consumption in California was estimated between 2.2 million pounds and 2.6 million pounds of dried flower.[11]

Using updated results from the NSDUH, EPS replicated that 2017 analysis, as shown in **Table 3**. Based on assumptions used in ERA Economics' 2017 analysis (in which regular users and casual users consumed 21 grams and 3.5 grams of cannabis per month, respectively), EPS estimated that total annual consumption in California is approximately 2.7 million pounds, or about 0.089 pounds per adult. Because the overall goal of this analysis is to estimate demand for *licensed* cannabis in Sonoma County, an adjustment was needed to net out the estimated share of demand satisfied by the illicit market.

Estimates for the share of demand that is supplied by the illicit market vary widely. UC Davis' Agricultural Issues Center estimates that in 2019, only 20 percent of the total cannabis by weight sold was sold through licensed retailers."[12] For purposes of generating an upper limit of the potential size of the cannabis market in Sonoma County, EPS applied an assumption that 50 percent of cannabis demand can eventually be satisfied by licensed sales, resulting in an estimate of 0.044 pounds per adult.

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[10] California DCC Unified License Search.

[11] ERA Economics, LLC. 2017. Economic Impact Analysis of CalCannabis Cultivation Licensing Program Regulations Standardized Regulatory Impact Assessment.

[12] Sumner, D.; Goldstein, R.; Matthews, W.; and Sambucci, O. 2020. California Agriculture: Dimensions and Issues. Chapter 13: Cannabis in California.

Table 3 Total Cannabis Consumption in California (Licensed & Unlicensed)

User Type	Number of Users	Consumption Per User [1]		Statewide Consumption per Year (Lbs, Rounded)
		Consumption per Month (grams)	Consumption per Year (Lbs)	
Regular Users	4,543,000	21.0	0.556	2,524,000
Casual Users	2,026,000	3.5	0.093	188,000
Total Users	**6,569,000**			**2,712,000**
Statewide Population				39,040,600
Annual Consumption per Capita (Lbs)				0.069
Estimated Annual Licensed Consumption per Capita (Lbs) @50%				**0.035**
Statewide Population 18+				30,530,000
Annual Consumption per Adult (Lbs)				0.089
Estimated Annual Licensed Consumption per Person 18+ (Lbs) @50%				**0.044**

Source: 2021 National Survey on Drug Use: ERA Economics, LLC; US Census.

[1] Regular users are those who responded they have consumed in the last month, while those who have consumed in the last year are casual users. Assumptions for grams per user per month are from ERA Economics, LLC.

As shown in **Table 4**, the average retail price of cannabis varies from approximately $25 to $60 per "eighth," the traditional unit of sale of dried cannabis that is equivalent to 3.5 grams, or approximately one-eighth of an ounce. Using the $42 per eighth average reported by Goldstein et. al. in 2020, the total retail value of cannabis consumed per year in California is approximately $14.6 billion. In 2023, licensed retailers sold approximately $4.4 billion of cannabis products, equal to about 30 percent of the total retail value of cannabis consumed throughout the State.

Table 4 Cannabis Retail Value

Price Band	Retail Price per "Eighth" [1]	Total Retail Value
Low	$25	$8,678,400,000
Medium [2]	$42	$14,579,712,000
High	$60	$20,828,160,000
Statewide Annual Cannabis Consumption (lbs)		*2,712,000*
Statewide Annual Retail Sales [3]		*$4,339,208,774*

Source: Low and High prices based on EPS review of Weedmaps.com data. See Footnote 2 for Source for medium price. Retail sales data from California Department of Tax and Fee Administration.

[1] One "eighth" is equiavlent to 3.5 grams of dried cannabis, or one-eighth of an ounce. This is the traditional unit of sale for dried cannabis flower.
[2] Figure from Goldstein, R; Saposhni, R; and Sumner, D. 2020. Prices of Cannabis in California from Licensed and Unlicensed Retailers.
[3] Based on first two quarters of 2023.

Cannabis Cultivation

To estimate the amount of land needed to satisfy demand for Sonoma County cannabis, EPS conducted research into cannabis cultivation practices to understand production practices and efficiencies. In this section, EPS focuses largely on outdoor cannabis production, the dominant mode of production in Sonoma County.

Because of its longstanding prohibition by both the federal and State governments through much of the 20th century, the cannabis cultivation industry developed in locations where detection by law enforcement was unlikely. Far northern California along the Pacific coast, including Mendocino, Humboldt, and Trinity Counties, provided both ample distance from populated areas and law enforcement and ideal climate for cannabis cultivation.[13]

[13] Sumner, D.; Goldstein, R.; Matthews, W.; and Sambucci, O. 2020. California Agriculture: Dimensions and Issues. Chapter 13: Cannabis in California.

In further attempts to save on costs and evade law enforcement, pre-legalization cannabis growers usually grew outdoors on small (smaller than 10,000-square-foot) plots, a legacy that continues through production practices today. Even with the advent of factory-scale indoor and mixed-light farming, nearly 50 percent of all active cultivation licenses in the State are issued for outdoor plots smaller than 1.0 acre in size.[14]

Outdoor-grown cannabis produces 1 crop per year, compared with up to 6 crops per year for indoor-grown cannabis.[15] Although certain strains of cannabis, known as autoflowers, allow multiple harvests per year because of quicker growth and flowering, these strains tend to produce less flower per plant and have lower THC[16] concentrations than non-autoflower strains.[17] In California, more than 90 percent of outdoor growers reported only 1 crop per year, indicating that autoflower cultivation is not common among commercial growers.[18]

Of the harvested cannabis material, between 60 percent and 70 percent by dry weight is sold to consumers as flower, which generates the majority of the revenue.[19] The remainder, which includes leaves and flower trimmings, is sold to manufacturers for the production of cannabis concentrates and edibles. While some growers may grow on a contract basis for manufacturers and deliver both flower and trimmings to these manufacturers, interviews with cultivators suggest this practice is less common than the arrangement described above.

Estimates of total production per acre differ significantly across data sources. However, in general, on a per-square-foot basis mixed-light productivity can be close to double that of outdoor cultivation, while indoor grows are several times more productive than outdoor cultivation. These differences in productivity are due to the multiple annual harvests that mixed-light and indoor operations can support, as well as higher yields per plant compared to outdoor grows.

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[14] California DCC Unified License Search.

[15] Wilson, H., et al. 2019. First known survey of cannabis production practices in California. California Agriculture, 73(3).

[16] THC is one of the main intoxicants in cannabis. Cannabis with higher concentrations of THC generally sells for higher prices.

[17] https://www.royalqueenseeds.com/us/blog-the-pros-and-cons-of-autoflowering-cannabis-strains-n557

[18] Wilson, H., et al. 2019. First known survey of cannabis production practices in California. California Agriculture, 73(3).

[19] Interview with Sonoma County Cannabis Cultivator. July 26, 2023.

The estimated licensed cannabis cultivation in California is approximately 1.2 million pounds, based on cultivation tax collected in Fiscal Year 2021-22.[20] While there are indications that production may have declined in 2022 because of a drop in prices, the total licensed cultivation figure is perhaps the best estimate of stabilized demand for licensed cannabis, in terms of projecting potential need for cannabis cultivation acreage in the State. After adult-use legalization in 2018, growers quickly acquired licenses, and 6 months after legalization, the State had enough licensed growers to produce more than 8 million pounds of cannabis annually, well above the State's total estimated demand of approximately 2.5 million pounds.[21] As a result of this oversupply, wholesale prices for licensed cannabis crops dropped steeply, leading many cultivators to reduce their production or exit the industry altogether. By 2022, the wholesale markets had stabilized after the initial "green rush," and thus the post-2022 cultivation market is the best available figure for stabilized demand for licensed cannabis in California.

Characterizing the market for licensed cannabis in California is difficult because of the large and persistent illicit market for cannabis. As noted above, consumption in California is approximately double the licensed cultivation, indicating that a significant portion of consumers are purchasing illicit cannabis. Further, a large portion of illicit cannabis cultivation is likely flowing to other states, where the adult-use cannabis market remains illegal. According to the Los Angeles Times, the unlicensed hoop houses in Siskiyou County's Mount Shasta Vista alone have the capacity to supply half of California's legal cannabis market.[22]

While increased enforcement in California and expanded legalization in other states may shift some demand from the unlicensed to the licensed sector, the introduction of highly capitalized entrants into the market could significantly reshape the industry. The indoor Glass House Brands operation in Ventura County, billed as the world's largest cannabis greenhouse at 5.5 million square feet (only a portion is allocated to cannabis production; the rest to other crops),

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[20] California Department of Tax and Fee Administration. Cannabis Tax Reported Cultivation and Excise Revenue by Fiscal Year.
https://www.cdtfa.ca.gov/dataportal/dataset.htm?url=CannabisTaxCultivationExciseRevenue
Accessed June 11, 2024.

[21] HdL Companies, 2023. Cannabis Supply and Demand in 2023.
https://www.hdlcompanies.com/news/cannabis-supply-and-demand-in-2023#:~:text=At%20the%20start%20of%202023,the%20commercial%20market%20in%202021.&text=That's%20just%2015%25%20of%20current%20production%20capacity
Accessed August 2024.

[22] Paige St. John, Los Angeles Times. August 15, 2022. The Reality of legal weed in California: Huge illegal grows, violence, worker exploitation and deaths.

has the capacity to supply close to half of the State's legal market.[23] In addition, these larger operators are able to sell cannabis at much lower wholesale prices, which could crowd out smaller growers unless a strong market for boutique cannabis is created. With federal legalization, similar operators may begin supplying other parts of the country. However, such facilities may become increasingly common in more cost-effective locations than California.

Commercial Cannabis in Sonoma County

Since adult-use cannabis was legalized in Sonoma County, the County has approved 281 permits for 49 different cannabis businesses.[24] As shown in **Table 5**, the distribution of cannabis business permits between different industry functions in Sonoma County mirrors the statewide trends described earlier. Outdoor cannabis cultivation businesses were issued the majority of permits for commercial cannabis businesses in Sonoma County. In addition, the temporal trends of the cannabis business permits in Sonoma County are similar to that of the State overall, with a rapid runup in the number of businesses from 2018 to 2021, followed by a decline in 2023. As shown in **Table A-1**, 114 permits for outdoor cultivation expired in 2022, while only 3 new permits were approved, causing a large decline in the number of business permits held in 2023.

[23] Cannabis Benchmarks. August 22, 2023. Does Anyone Know How Much Marijuana is Grown in California?

[24] Assumes that multiple permits held at the same address are held by a single business entity.

Table 5. Active Cannabis Business Permits by Year

Cannabis Permit Type	2017	2018	2019	2020	2021	2022	2023
Cultivation Only							
Outdoor	1	21	69	145	209	211	100
Indoor	-	1	4	8	12	12	13
Mixed-Light	-	1	4	8	12	12	13
Subtotal Cultivation Only	**1**	**23**	**77**	**161**	**233**	**235**	**126**
Non-Cultivation							
Retailer	1	3	4	5	6	8	9
Self-Transport	-	-	-	-	-	-	1
Distribution	1	1	5	7	8	8	8
Manufacturing	-	2	10	11	11	12	12
Testing Lab	-	-	1	1	1	1	1
Distributor-Transport Only	-	-	-	-	-	2	3
Processor	-	1	2	3	4	4	4
Non-Cultivation Subtotal	**2**	**7**	**22**	**27**	**30**	**35**	**38**
Cultivation as Secondary Use [1]							
Indoor	-	2	9	10	10	10	10
Outdoor	1	1	1	1	2	3	4
Mixed-Light	-	-	-	-	-	-	-
Nursery	-	-	1	1	1	1	1
Subtotal Cultivation as Secondary Use [1]	**1**	**3**	**11**	**12**	**13**	**14**	**15**
	-	-	-	-	-	-	-
Total Cannabis Licenses	**3**	**30**	**99**	**188**	**263**	**270**	**164**

Source: Sonoma County Cannabis Program. See Table A-1 for further detail.

[1] Cultivation as a secondary use is not counted in the total number of permits. Refers to permit holders primarily engaged in non-cultivation supply chain functions (distribution, manufacturing) whose permits also allow cultivation.

Because Sonoma County charges a cultivation tax to businesses each year based on the actual square footage of canopy harvested, Sonoma County requires each business to submit to a cannabis canopy field verification. Using data from this process, EPS estimated the total square footage of cannabis cultivated. As seen in **Table 6**, the trends for cultivation square footage match those of commercial cannabis permits approved. Although EPS tracks cultivation square footage by fiscal year and cannabis permits by calendar year, both show a significant increase between 2019 and 2022, followed by a marked decline in 2023.

As with cannabis permits, outdoor cultivation dominates the overall area of cannabis cultivated in Sonoma County. In addition, by comparing the amount of overall cannabis cultivation permitted by Sonoma County with the amount of canopy verified by Sonoma County staff, EPS calculated the approximate use of permitted cultivation area in **Table 6**. With the exception of 2018-19, the second year of the commercial cannabis business program in Sonoma County, cannabis growers never cultivated more than 59 percent of permitted square footage in Sonoma County. Verified canopy exceeded permitted square footage in the early years of the program, likely because of the cannabis Penalty Relief Program (PRP).

Table 6. Verified Canopy Square Footage by Year

Canopy Type	Fiscal Year 18-19	19-20	20-21	21-22	22-23
Verified Canopy Square Feet [1]					
Indoor	24,238	22,088	51,774	68,931	54,852
Mixed-Light	67,291	39,405	46,920	29,564	8,038
Outdoor	226,071	343,550	515,576	1,315,403	890,689
Total	**317,600**	**405,043**	**614,270**	**1,413,898**	**953,579**
Permitted Square Feet					
Indoor	15,278	76,351	94,351	102,300	102,300
Mixed-Light	22,180	53,439	68,439	83,289	93,289
Outdoor	264,622	781,151	1,584,435	2,363,224	1,407,933
Total	**302,080**	**910,941**	**1,747,225**	**2,548,813**	**1,603,522**
Percent of Permitted Square Feet [2]					
Indoor	159%	29%	55%	67%	54%
Mixed-Light	303%	74%	69%	35%	9%
Outdoor	85%	44%	33%	56%	63%
Total	**105%**	**44%**	**35%**	**55%**	**59%**

Source: Sonoma County Cannabis Program; EPS.

[1] Canopy square footage is slightly overestimated, as the County taxes a cannabis business permittee 100% of their permitted square footage if staff are unable to verify canopy square footage in the field.
[2] See Table A-2 for further detail on total square footage of approved cultivation by year.

Demand for Sonoma County Cannabis

Demand for Sonoma County cannabis has been estimated from three sources:

1. Sonoma County residents.
2. Sonoma County cannabis product manufacturers.
3. The rest of the State.

The cannabis demand from each source noted above is determined by estimating the total cannabis consumption for each category, and then applying a range of reasonable potential shares of cannabis that would be sourced from Sonoma County, referred to as the county’s potential “capture” rates.

The potential cannabis demand from each source, calculated in pounds, is translated into the required acreage needed to produce that amount of cannabis by applying the same breakdown of cultivation method found throughout the North Coast, shown in **Table 7**, and then applying productivity assumptions for each method, shown in **Table 8**.

Table 7. North Coast Cultivation/Lighting Methods

Cultivation/Lighting Type	Share of North Coast Cannabis Acreage	Adjusted Sonoma Acreage Share Assumptions [1]
Outdoor	51%	61%
Mixed Light	43%	33%
Indoor	6%	6%

Source: ERA Economics; EPS.

[1] Assumed share of acreage cultivated as mixed light adjusted downward to reflect Sonoma County conditions.

Table 8. Production Efficiency by Cultivation/Lighting Method

Cultivation/Lighting Type	Data Input / Source	Average Cannabis Production per Acre (rounded)
Outdoor	Estimate based on a variety of sources	1,000 Lbs/Ac
Mixed Light	0.04 lbs per sq ft	1,700 Lbs/Ac
Indoor	0.16 lbs per sq ft	7,000 Lbs/Ac

Source: UC Davis, ERA Economics, EPS.

The calculation of estimated demand from each source is detailed below.

Resident Demand

Total Sonoma County resident demand is based on the estimate of average licensed consumption of 0.044 pounds per adult, as calculated in **Table 3** earlier in this memorandum, multiplied by the population 18 years or older in Sonoma County. While most resident purchases of licensed cannabis will be captured locally at a cannabis retailer, the products sold in licensed cannabis retailers can be sourced from throughout the State.

A range of 30 percent to 50 percent of products sold in local licensed cannabis retailers was deemed a reasonable estimate for the share that would be sourced locally. The 50 percent upper limit reflects the broad array of products produced beyond Sonoma County, while the 30 percent lower limit reflects a stronger regional preference among locals and visitors.

Applying the estimated range of locally sourced products results in the local demand from Sonoma County residents calculated in **Table 9**.

Table 9. County Resident Demand

Sonoma County Population 18+	Annual Estimated Licensed Consumption per Pop. 18+ (Lbs) [1]	Annual Resident Demand for Licensed Cannabis (Lbs) [2]	Assumed Local Capture of Resident Market Demand		Local Resident Demand for Locally Produced Cannabis (Rounded)	
			Low	High	Low	High
392,805	0.044	17,400	30%	50%	**5,200 Lbs**	**8,700 Lbs**

Source: US Census; ERA Economics; EPS.

[1] See Table: Total Cannabis Consumption in California (Licensed and Unlicensed)
[2] Annual licensed demand under current conditions. Enhanced enforcement and/or other measures could increase licensed product share, resulting in greater licensed cannabis demand.

The demand generated from local residents for locally produced cannabis is translated into demand for cannabis-growing acreage by applying the typical North Coast breakdown of cultivation types and the average assumed productivity levels for each method to produce the required number of acres to meet the estimated demand, as shown in **Table 10**.

Table 10. Acreage for County Resident Demand

Estimate	Total Demand (Lbs)	Demand Breakdown by Cultivation/Lighting Type			Acreage Needed by Cultivation/Lighting Type			Acreage Needed for Resident Demand
		Outdoor	Mixed Light	Indoor	Outdoor	Mixed Light	Indoor	
Methodology:	*From Resident Demand Table*	*Per North Coast Cultivation/Lighting Table [1]*			*Per Production Efficiency Table*			*Sum of Acreage by Type*
Low	5,200 Lbs	3,172 Lbs	1,716 Lbs	312 Lbs	3.2 Ac	1.0 Ac	0.0 Ac	**4.2 Ac**
High	8,700 Lbs	5,307 Lbs	2,871 Lbs	522 Lbs	5.3 Ac	1.7 Ac	0.1 Ac	**7.1 Ac**

Source: EPS.

[1] Based on adjusted North Coast cultivation/lighting pattern and typical productivity by cultivation/lighting type.

Manufacturer Demand

Demand from local cannabis manufacturers is derived using multi-step analysis. Based on EPS's understanding of cannabis manufacturing dynamics, demand for Sonoma County cannabis from manufacturers located outside the county is likely negligible and thus is not included in this estimate. The first step is development of an estimate of cannabis input required for a given amount of cannabis manufactured product output. In **Table 11**, the total amount spent on manufactured products is divided by the remaining pounds of cannabis produced after netting out the estimated pounds sold as dried flower/pre-roll to estimate the weight of cannabis input for a given dollar value of manufactured product, resulting in an estimate of 375 pounds of (generally) lower grade cannabis used to generate $1 million in manufactured product.

Table 11. Allocation of Statewide Cannabis Sales

Item	Value	Corresponding Pounds of Cannabis	Notes
Total Statewide Licensed Sales	**$4,714,604,000**	**1,300,000 Lbs**	Production Estimate
Dried Flower & Pre-Roll Sales	**$2,350,604,000**	**412,400 Lbs**	@$5,700/lb
Manufactured Product Sales			
Concentrates	$319,000,000		
Captures/tinctures/sublinguals	$155,000,000		
Beverages	$70,000,000		
Edibles	$583,000,000		
Topicals	$37,000,000		
Vape Pens	$1,200,000,000		
Total Manufactured Product Sales	**$2,364,000,000**	**887,600 Lbs**	@$2,660/lb
Per $1M Manufactured Product Value:	**$1,000,000**	**375 Lbs**	

Source: MJBiz Factbook 2023; CDTFA; Cannabis Benchmarks; EPS.

The (rough order-of-magnitude) estimate of cannabis required per unit of manufacturing output identified can be applied to the total estimated manufactured cannabis product output in Sonoma County to estimate the required pounds of cannabis to meet the needs of local manufacturers.

Tax collected from cannabis manufacturers in the City of Santa Rosa and unincorporated Sonoma County were used to estimate the value of cannabis manufacturing in each location, with a slight upward adjustment of 10 percent for assumed delinquent tax payments. An additional 10 percent was added to account for other potential cannabis manufacturing within other jurisdictions in Sonoma County.

Downward demand adjustments were made to local manufacturer demand for estimated impacts from manufacturers using proprietary cannabis crops in their manufacturing products (-45 percent) and from the likely flow of illicit product into the manufacturing process (-25 percent). Although proprietary crops could be grown in Sonoma County, this analysis assumes that these crops come from outside the county, based on an interview with a Sonoma County Manufacturer. No systematic evidence is available to accurately characterize the geography of cannabis crop origin for manufactured products. Both of these adjustments, as well as the upward tax delinquency adjustments noted above and the capture adjustments described below, were based on EPS's best available knowledge of the cannabis industry from interviews with cannabis business operators in Sonoma County and other jurisdictions and may be subject to revision upon further input.

The various inputs noted above result in total annual demand of approximately 35,000 pounds of licensed cannabis by local manufacturers from across the State. With a relatively low weight per value, shipping distance/proximity has less importance to manufacturers than consistent, reliable inputs for the manufacturing process. In addition, manufacturers typically have strong interdependent relationships with distributors and growers, many of which cover the large portions of the State. Therefore, the assumed capture of local manufacturing demand by local growers is assumed to be moderate, ranging from 15 percent to 35 percent. The resulting estimated manufacturer demand for locally produced cannabis is estimated from about 5,000 to 12,000 pounds.

Table 12. County Manufacturer Demand

Estimated County Manufactured Cannabis Product Value		Avg. Lbs. of cannabis input per $1M manufactured product value	Annual Local Manufacturer Demand for Licensed Cannabis (Lbs)	Assumed Capture of Local Manufacturer Market Demand		Local Manufacturer Demand (Rounded)	
				Low	High	Low	High
City of Santa Rosa [1]	$37,380,750						
Unincorp. Sonoma County [2]	$1,360,700						
Rest of County @ 10%	$4,304,606						
Est Total Production	**$43,046,056**	375 Lbs	16,200 Lbs				
Less Proprietary Input @ 45%	-$18,758,410		-7,290 Lbs				
Less Unlicensed Input @ 25%	-$16,833,425		-4,050 Lbs				
County Manufacturer Cannabis Demand:			**4,860 Lbs**	15%	35%	**700 Lbs**	**1,700 Lbs**

Source: EPS.

[1] Based on City of Santa Rosa FY 2022/2023 cannabis manufacturer tax revenue of $339,825 divided by 1% tax rate, plus 10% adjustment for estimated tax delinquency.
[2] Based on Sonoma County FY 2022/2023 cannabis manufacturer tax revenue of $37,110 divided by 3% tax rate, plus 10% adjustment for estimated tax delinquency.

Sonoma County's potential capture of local cannabis manufacturer demand is translated into required cannabis acreage to meet demand by applying the typical North Coast breakdown of cultivation types and the average assumed productivity levels for each method to produce the required number of acres to meet the estimated demand, as shown in **Table 13.**[25]

Table 13. Acreage for County Manufacturer Demand

Estimate	Total Demand (Lbs)	Demand Breakdown by Cultivation/Lighting Type			Acreage Needed by Cultivation/Lighting Type			Acreage Needed for Manufacturing Demand
		Outdoor	Mixed Light	Indoor	Outdoor	Mixed Light	Indoor	
Methodology:	*From Resident Demand Table*	*Per North Coast Cultivation/Lighting Table*			*Per Production Efficiency Table*			*Sum of Acreage by Type*
Low	0,700 Lbs	0,427 Lbs	0,231 Lbs	42 Lbs	0.4 Ac	0.1 Ac	0.0 Ac	**0.6 Ac**
High	1,700 Lbs	1,037 Lbs	0,561 Lbs	102 Lbs	1.0 Ac	0.3 Ac	0.0 Ac	**1.4 Ac**

Source: EPS.

[1] Based on North Coast cultivation/lighting pattern and typical productivity by cultivation/lighting type.

25 The estimated area needed to meet demand from local manufacturers is additive to the area needed to meet demand from local consumers.

Statewide Demand

The local share of statewide demand was analyzed by identifying the larger North Coast region's share of statewide licensed demand and then estimating the share of North Coast demand that Sonoma County could reasonably expect to capture.

Cannabis currently grown in the "Emerald Triangle" counties of Humboldt, Trinity, and Mendocino, the heart of North Coast cannabis production, is assumed to be in greater demand than cannabis from Sonoma County. Humboldt County, in particular, has been the epicenter of cannabis cultivation and production in the United States since the 1960s. While growers originally established there in large part to evade law enforcement, they found the unique microclimates of the Emerald Triangle were ideally suited to growing cannabis.[26]

As a result of the early establishment of cannabis farms in the Emerald Triangle, a mature industrial ecosystem in the area has developed to support cannabis cultivation and processing. According to one grower, Humboldt County has "the best nurseries, the best pest control, [and] the best seed suppliers…" for farming cannabis.[27] Combined with the region's ideal climate and more than 50 years of experience cultivating commercial cannabis (licensed and otherwise), this industrial ecosystem has helped to establish the region's cannabis as the highest quality in the State.

Although the legalization of commercial cannabis cultivation means that licensed growers no longer need to locate in the remote areas of the Emerald Triangle to evade law enforcement, the legacy of prohibition and the factors mentioned above have helped the North Coast remain the dominant region for cannabis production. In speaking with cannabis business operators, EPS observed that relationships between growers and other sectors of the cannabis economy pre-date full legalization in 2018. As one manufacturer located in the City of Santa Rosa described, their company purchases nearly all their cannabis biomass from growers in Humboldt and Mendocino Counties.[28] In addition, production and labor costs are significantly higher in Sonoma County compared to the Emerald Triangle region—one business owner who manages cultivation and processing businesses in Sonoma County estimates these costs are 20 percent to 50 percent higher in Sonoma County than in Mendocino and Humboldt Counties. While wages specifically for cannabis industry employees are not available at the county level, EPS examined average wages for the agricultural sector as a whole and farmworkers and laborers specifically in both Sonoma County and Del Norte,

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[26] Witt, E. 2019. How Legalization Changed Humboldt County Marijuana. The New Yorker. May 20, 2019.

[27] Interview with Humboldt County Cannabis Grower. September 25, 2023.

[28] Interview with Sonoma County Manufacturer. 2023. August 4, 2023.

Lake, Humboldt, and Mendocino Counties. As shown in **Table 14**, wages in Sonoma County are between 10 percent and 20 percent higher than in the North Coast counties. Finally, despite Sonoma County's advantages in terms of proximity to major population areas and transportation routes, cannabis' high value with respect to its weight and volume compared to other agricultural commodities means that transportation costs are a minimal consideration when considering cultivation locations.

Table 14. Agricultural Wages by Occupation and Industry, 2023 Averages.

Geography	Farmworkers and Laborers, Crop, Nursery, and Greenhouse [1]			Crop Production [2]	
	Total Employment	Mean Hourly Wage	Median Hourly Wage	Total Employment	Average Annual Wages
Sonoma County	2,390	$21.11	$19.75	2,988	$51,518
North Coast Region [3]	960	$18.95	$18.20	1,493	$39,177

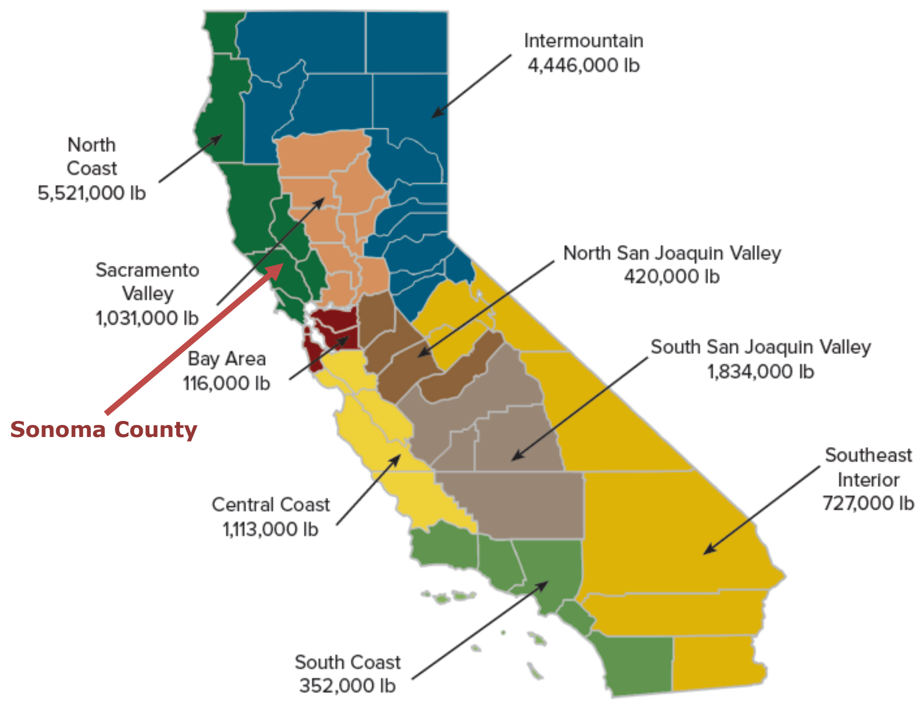
Sources: US Bureau of Labor Statistics, Quarterly Census of Employment and Wages and Occupational Employment and Wage Statisctics.

[1] SOC Code 45-2092
[2] NAICS Code 111
[3] Defined by Del Norte, Humboldt, Lake, and Mendocino Counties.

EPS considered Sonoma County's competitive position relative to the other North Coast counties, one of the regions identified in what is likely the most authoritative study on cannabis production in California. That study calculates production by region and production type, using groups of counties to create "cannabis production regions" that do not correspond to other existing administrative regions such as metropolitan statistical areas.[29] In that study, Sonoma County (indicated with a red arrow) is grouped with Humboldt, Mendocino, Del Norte, Marin, Napa, and Lake Counties into a single production region, as shown in **Map 1**.

[29] ERA Economics, LLC. 2017. Economic Impact Analysis of CalCannabis Cultivation Licensing Program Regulations Standardized Regulatory Impact Assessment.

Map 1 Cannabis Production Regions



Source: UC Davis, 2020. Adapted from ERA Economics, LLC, 2017.

The North Coast produces 35 percent of the licensed cannabis grown in the State. Applying the North Coast's share of production to the total estimated licensed cannabis produced in the State, after deducting the demand from Sonoma County residents and manufacturers identified above, results in total North Coast demand of almost 408,000 pounds per year, assuming that licensed production and licensed demand are in equilibrium.

Given the strong market position of the Emerald Triangle producers within the larger North Coast region, Sonoma County's potential capture of statewide demand being met by this region will be fairly moderate. As shown in **Table 15**, Sonoma County cultivators produced approximately 8 percent of the total licensed cannabis from this production region in 2023, as measured by the number of plants tracked by the State's DCC. Based on this figure, EPS applied an assumed capture rate range of 5 percent to 10 percent of this demand, resulting in estimated statewide demand potential in Sonoma County of about 20,000 to 41,000 pounds, as shown in **Table 16**.

Table 15. Sonoma County and North Coast Cannabis Cultivation, 2023.

County	Total Plant Count	Share of Total
Sonoma	**26,058**	**8%**
Humboldt	192,529	60%
Mendocino	60,090	19%
Lake	43,261	13%
Marin	-	0%
Napa	-	0%
Total	**321,939**	**100%**

Source: California Department of Cannabis Control.

Table 16. County Capture of Statewide Demand

Net Statewide Annual Demand for Licensed Cannabis (Lbs) [1]	North Coast Share of Statewide Production	Annual North Coast Demand for Licensed Cannabis (Lbs)	Assumed County Capture of North Coast Share of Market Demand		Captured Statewide Demand (Rounded)	
			Low	High	Low	High
1,164,700 Lbs	35%	407,645 Lbs	5%	10%	**20,400 Lbs**	**40,800 Lbs**

[1] Licensed demand estimate of 1.3 million lbs. based on State cultivation tax collection in 2021, less Sonoma County resident and manufacturer demand, accounted for separately.

The County's potential capture of statewide cannabis demand is translated into required cannabis acreage to meet demand by applying the typical North Coast breakdown of cultivation types and the average assumed productivity levels for each method to produce the required number of acres to meet the estimated demand, as shown in **Table 17**.

Table 17. Acreage for County Capture of Statewide Demand

Estimate	Total Demand (Lbs)	Demand Breakdown by Cultivation/Lighting Type			Acreage Needed by Cultivation/Lighting Type			Acreage Needed for Statewide Demand
		Outdoor	Mixed Light	Indoor	Outdoor	Mixed Light	Indoor	
Methodology:	*From Resident Demand Table*	*Per North Coast Cultivation/Lighting Table*			*Per Production Efficiency Table*			*Sum of Acreage by Type*
Low	20,400 Lbs	10,404 Lbs	8,772 Lbs	1224 Lbs	10.4 Ac	5.2 Ac	0.2 Ac	**15.7 Ac**
High	40,800 Lbs	20,808 Lbs	17,544 Lbs	2448 Lbs	20.8 Ac	10.3 Ac	0.3 Ac	**31.5 Ac**

Source: EPS.

[1] Based on North Coast cultivation/lighting pattern and typical productivity by cultivation/lighting type.

Key Policy Considerations

Sonoma County Cannabis Acreage to Meet Demand

The combined demand for cannabis cultivation acreage from local resident, local manufacturer, and other statewide demand is summarized in **Table 18**.

Table 18. Sonoma County Potential Demand for Cannabis Cultivation Acreage/Square Feet

	Demand Source			
Scenario	Local Residents	Local Manufacturing	Statewide Demand	**Total Acres**
Under Existing Conditions				
Low	4 Ac *0.2M sq ft*	1 Ac *0.0M sq ft*	17 Ac *0.7M sq ft*	**22 Ac** ***0.9M sq ft***
High	7 Ac *0.3M sq ft*	1 Ac *0.1M sq ft*	34 Ac *1.5M sq ft*	**42 Ac** ***1.8M sq ft***
Assuming 20% Inducement from Unlicensed to Licensed Market [1]				
Low	5 Ac *0.2M sq ft*	1 Ac *0.0M sq ft*	21 Ac *0.9M sq ft*	**26 Ac** ***1.1M sq ft***
High	8 Ac *0.4M sq ft*	2 Ac *0.1M sq ft*	41 Ac *1.8M sq ft*	**51 Ac** ***2.2M sq ft***

Source: EPS.

[1] Due to increased enforcement, tax reduction or other changes.

Policy Considerations

Although the licensed commercial cannabis market has been somewhat unstable since it was established by the State in 2018, trends over the past 10 years indicate that demand for cannabis will continue to grow in the short to medium term. Both public acceptance of cannabis and rates of consumption have grown steadily since full prohibition ended in the State in 1996, and a potential federal cannabis market remains a political possibility, given public opinion changes over the past 30 years. Although the Emerald Triangle's dominance of the pre-Prohibition market has allowed it to dominate the post-Prohibition market, Sonoma County's strong agricultural brand, as evidenced by beer and wine production and proximity to the San Francisco Bay Area, present a significant opportunity for growth, should broader conditions around cannabis tourism and federal legalization change.

Cannabis Tourism

One potential policy change Sonoma County can consider is the legalization of onsite consumption and cannabis tourism. Sonoma County's wine and beer industries drive significant economic activity, in terms of both direct sales and tourism—one in five visitors to Sonoma County visit a winery or brewery during their trips.[30] If Sonoma County were to legalize onsite consumption, the existing knowledge base of winery and brewery operators could contribute to a vibrant visitor-serving cannabis sector that combine tours, education, and consumption in a similar manner to current winery and brewery businesses. However, with few existing examples of cannabis tourism, the effect on cultivation demand is uncertain.

National Legalization

A potential policy change beyond Sonoma County's control that could have wide-ranging impacts is federal legalization. This would allow Sonoma County growers to access to the entire country's consumer base, greatly expanding the potential demand for Sonoma County-grown cannabis. Although cannabis originating from Humboldt and Mendocino Counties would still likely be highly desirable in such a scenario, it is reasonable to assume that Sonoma County growers could still benefit from such a change. However, the potential market growth from national legalization would also likely bring about a significant increase in large indoor production facilities in other parts of the country, potentially affecting the economics of cannabis cultivation.

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[30] Sonoma County Economic Development Board. 2022. Sonoma County Annual Tourism Report 2022.

In the near term, the federal government is likely to reschedule cannabis under the Controlled Substance Act from a Schedule I substance to a Schedule III substance. Generally, Schedule I substances are drugs that have little to no medical use and a high probability of abuse compared to lower scheduled drugs—as such, Schedule I substances are subject to much stricter regulations and higher criminal penalties for the possession, manufacture, or distribution of the substance.[31] Although the rescheduling of cannabis at the federal level would not permit adult-use cannabis nationwide, it could have significant impacts on the national cannabis industry. Specifically, it would allow cannabis businesses registered with the US Drug Enforcement Agency to deduct business costs when filing income taxes and would loosen regulations on banks serving cannabis businesses, easing access to capital and credit for cannabis businesses. [32] However, under this proposed rescheduling, any cannabis product sold on the national market would require approval from the US Food and Drug Administration, which could restrict potential growth opportunities for Sonoma County cultivators currently focused on the adult-use market.

Other Operational Considerations

Based on conversations with cannabis business operators in Sonoma County and elsewhere, EPS offered a few policy considerations that could benefit Sonoma County's cannabis industry and ensure that future growth in Sonoma is possible, should larger trends allow it.

The first recommendation would be to facilitate mixed-light cultivation in Sonoma County through a few key policy changes. Mixed-light cultivation, which involves the use of greenhouses or hoophouses or artificial lighting, allows cannabis farms to be significantly more productive than relying on sunlight alone. Greenhouse cultivation allows several harvests per year, with one-third of greenhouse cultivators reporting two harvests per year, and one-fifth of cultivators reporting three or more harvests per year.[33]

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31 US Department of Justice, 2024. Questions Related to the Potential Rescheduling of Marijuana. https://www.justice.gov/olc/media/1352141/dl?inline Accessed August 2024.

32 Ravitz, J., et. al., 2024. DOJ Proposes to Reschedule Marijuana (Cannabis) to Schedule III. https://www.mwe.com/insights/doj-proposes-to-reschedule-marijuana-cannabis-to-schedule-iii Accessed August 2024.

33 Wilson, H., et al. 2019. First known survey of cannabis production practices in California. California Agriculture, 73(3).

Currently, Sonoma County requires a Use Permit for more than 2,500 square feet of mixed-light cultivation in agricultural zones, where the majority of cultivation occurs. This approval process, which typically takes longer and costs more money than the standard zoning clearance for outdoor cultivation in agricultural zones, discourages potential business operators from pursuing mixed-light cultivation. The State's current regulations classify light deprivation without the addition of artificial lighting as "outdoor" cultivation. If Sonoma County alters its policies to align with the State's classification of light-deprivation cultivation, this would simplify Sonoma County's permitting process for growers and align with the State's licensing categories as well, reducing the administrative burdens on new businesses.

In addition, Sonoma County could further publicize the clarifying guidance on the process of permitting cannabis-related structures on agricultural land.[34] Based on interview with cultivators throughout the county, cannabis growers believe that all structures associated with cannabis growing on agricultural lands require a building permit. Sonoma County should ensure that cannabis business owners understand the types of structures that are eligible for agricultural structure exemptions.

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[34] Sonoma County, 2020. B-48 2020-Current: Vineyard, Cannabis, and Agricultural Structures.

APPENDIX A:

Hypothetical High-Demand Scenario

Appendix A

Hypothetical High-Demand Scenario

For purposes of enhancing the usable timeframe of the Environmental Impact Report, a hypothetical high-demand scenario was developed to frame the upper limit of potential demand for cannabis cultivated in Sonoma County and the resulting acreage that would be needed to meet that level of demand. The capture rates included in the market demand analysis detailed earlier in this memorandum can be characterized as the best reasonable estimates of demand, based on numerous industry interviews, both locally and statewide, and a variety of other factors. This hypothetical level of demand is not likely to be realized over the next several decades. However, it provides a maximum potential impact scenario for environmental assessment purposes.

The market demand analysis detailed earlier in this memorandum assumes cannabis cultivated in Sonoma County would capture 30 percent to 50 percent of demand from local residents. This high-demand scenario assumes that Sonoma County-grown cannabis would capture 50 percent to 70 percent of county resident demand.

Table A-1 Sonoma County Resident Demand—High Demand Scenario

Sonoma County Population 18+	Annual Estimated Licensed Consumption per Pop. 18+ (Lbs) [1]	Annual Resident Demand for Licensed Cannabis (Lbs) [2]	Assumed Local Capture of Resident Market Demand		Local Resident Demand for Locally Produced Cannabis (Rounded)	
			Low	High	Low	High
392,805	0.044	17,400	**50%**	**70%**	**8,700 Lbs**	**12,200 Lbs**

Source: US Census; ERA Economics; EPS.

[1] See Table 2.
[2] Annual licensed demand under current conditions. Enhanced enforcement and/or other measures could increase licensed product share, resulting in greater licensed cannabis demand.

The market demand analysis detailed earlier in this memorandum assumes the cannabis cultivated in Sonoma County would capture 15 percent to 35 percent of demand from local manufacturers. This high-demand scenario assumes that Sonoma County-grown cannabis would capture 30 percent to 50 percent of county manufacturer demand.

Table A-2 Sonoma County Manufacturer Demand—High Demand Scenario

Estimated County Manufactured Cannabis Product Value		Avg. Lbs. of cannabis input per $1M manufactured product value	Annual Local Manufacturer Demand for Licensed Cannabis (Lbs)	Assumed Capture of Local Manufacturer Market Demand		Local Manufacturer Demand (Rounded)	
				Low	High	Low	High
City of Santa Rosa [1]	$37,380,750						
Unincorp. Sonoma County [2]	$1,360,700						
Rest of County @ 10%	$4,304,606						
Est Total Production	**$43,046,056**	375 Lbs	16,200 Lbs				
Less Proprietary Input @ 45%	-$18,758,410		-7,290 Lbs				
Less Unlicensed Input @ 25%	-$16,833,425		-4,050 Lbs				
County Manufacturer Cannabis Demand:			**4,860 Lbs**	**30%**	**50%**	**1,500 Lbs**	**2,400 Lbs**

Source: EPS.

[1] Based on City of Santa Rosa FY 2022/2023 cannabis manufacturer tax revenue of $339,825 divided by 1% tax rate, plus 10% adjustment for estimated tax delinquency.
[2] Based on Sonoma County FY 2022/2023 cannabis manufacturer tax revenue of $37,110 divided by 3% tax rate, plus 10% adjustment for estimated tax delinquency.

The market demand analysis detailed earlier in this memorandum assumes the cannabis cultivated in Sonoma County would capture 5 percent to 10 percent of North Coast demand from throughout the State. This high-demand scenario assumes that Sonoma County-grown cannabis would capture 10 percent to 20 percent of statewide North Coast demand.

Table A-3 Sonoma County Statewide Demand—High Demand Scenario

Net Statewide Annual Demand for Licensed Cannabis (Lbs) [1]	North Coast Share of Statewide Production	Annual North Coast Demand for Licensed Cannabis (Lbs)	Assumed County Capture of North Coast Share of Market Demand		Captured Statewide Demand (Rounded)	
			Low	High	Low	High
1,266,400 Lbs	35%	443,240 Lbs	**10%**	**20%**	**44,300 Lbs**	**88,600 Lbs**

[1] Licensed demand estimate of 1.3 million lbs. based on State cultivation tax collection in 2021, less Sonoma County resident and manufacturer demand, accounted for separately.

Table A-4 translates the high-demand scenario for Sonoma County capture of statewide demand into acreage needed for production to meet that demand.

Table A-4 Acreage Needed for Statewide Demand—High Demand Scenario

Estimate	Total Demand (Lbs)	Demand Breakdown by Cultivation/Lighting Type			Acreage Needed by Cultivation/Lighting Type			Acreage Needed for Statewide Demand
		Outdoor	Mixed Light	Indoor	Outdoor	Mixed Light	Indoor	
Methodology:	*From Resident Demand Table*	*Per North Coast Cultivation/Lighting Table*			*Per Production Efficiency Table*			*Sum of Acreage by Type*
Low	22,200 Lbs	11,322 Lbs	9,546 Lbs	1332 Lbs	11.3 Ac	5.6 Ac	0.2 Ac	**17.1 Ac**
High	44,300 Lbs	22,593 Lbs	19,049 Lbs	2658 Lbs	22.6 Ac	11.2 Ac	0.4 Ac	**34.2 Ac**

Source: EPS.

[1] Based on North Coast cultivation/lighting pattern and typical productivity by cultivation/lighting type.

Combining the high scenario demand from the 3 sources discussed above results in the range of demand shown in **Table A-5**, under existing conditions. Assuming a further 30 percent[35] increase in overall demand because of a shift from the illicit market to the licensed market results in an upper limit range of 55 acres to 104 acres needed to meet potential demand for Sonoma County-cultivated cannabis.

Table A-5 Hypothetical High Demand Scenario for Cannabis Cultivation Acres

	Demand Source			
Scenario	Local Residents	Local Manufacturing	Statewide Demand	**Total Acres**
Under Existing Conditions				
Low	7 Ac *0.3M sq ft*	1 Ac *0.1M sq ft*	34 Ac *1.5M sq ft*	**42 Ac** ***1.8M sq ft***
High	9 Ac *0.4M sq ft*	2 Ac *0.1M sq ft*	68 Ac *3.0M sq ft*	**80 Ac** ***3.5M sq ft***
*Assuming **30%** Inducement from Unlicensed to Licensed Market [1]*				
Low	9 Ac *0.4M sq ft*	2 Ac *0.1M sq ft*	44 Ac *1.9M sq ft*	**55 Ac** ***2.4M sq ft***
High	12 Ac *0.5M sq ft*	2 Ac *0.1M sq ft*	89 Ac *3.9M sq ft*	**104 Ac** ***4.5M sq ft***

Source: EPS.

[1] Due to increased enforcement, tax reduction or other changes.

[35] The market demand discussed previously in this memorandum includes a potential 20 percent inducement from the illicit market to the licensed market. The potential induced demand was increased to 30 percent for this hypothetical high-demand scenario.