STAGECOACH NORTH VINEYARD CONVERSION EROSION CONTROL PLAN APPLICATION #P18-00446-ECPA

Draft Environmental Impact Report Appendices
State Clearinghouse #2019100250

Prepared for
Napa County

February 2021



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Prepared for
Napa County
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February 2021

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STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN
PACKAGE 1 OF 2

REVISED JULY 2019

PPI
ENGINEERING

Electronic version published in one package

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STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN



REVISED JULY 2019
ORIGINAL SUBMITTAL DECEMBER 2018

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STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN

NARRATIVE

1. The nature and purpose of the land disturbing activity and the amount of grading involved.

a) This ECP addresses the development of approximately 91.3 net acres (116.2 gross acres) of proposed vineyard on the property located on Soda Canyon Road in Napa. The project is located on APN 032-010-086 which consists of approximately 169.61 acres per the Napa County Assessor's Office. There is currently a lot-line adjustment being pursued for the parcel, the project assumes the lot-line adjustment was recorded. The adjusted parcel acreage will be approximately 170.2 acres.

b) Activities to be accomplished include removal of brush and trees within the proposed clearing limits, ripping, rock removal, blasting, cultivating the soil to prepare for planting, seeding cover crop, mulching, trenching for storm drain and irrigation pipelines, installation of trellis system and deer fence, laying out the vine rows, installing erosion control measures, and planting grapevines.

c) Ripping will not occur outside of the clearing limits. The average depth of ripping will be 42" with maximum ripping depths up to 60" depending on site conditions.

2. General description of existing site conditions, including topography, vegetation, and soils.

a) The site is located in the Rector Reservoir Watershed.

b) The elevations in the vineyard area range from approximately 1660 to 2140 feet above mean sea level per topographic mapping. Ground slopes within the project boundary range between 7 and 25 percent. There are small pockets of areas with slope over 30% in several vineyard blocks which total approximately 2.1 acres, please see Sheets 2 through 4 for the locations.

c) Topographic mapping was provided by American Aerial Mapping, Inc., flown on June 4, 2014.

d) Existing vegetation consists of brush, grass, and trees. Please see the biological report prepared by LSA Associates dated November, 2018.

e) Please see Appendix C for Vegetation Retention Calculations based on the existing vegetation and parcel configuration in 1993. This project proposes to retain 99% of the tree canopy and 50% of the brush and open (grass) cover that existed on the parcel as it

was configured in 1993. A subsequent lot line adjustment resulted in the parcel configuration shown throughout the ECP.

f) There are no structures on the property. Please see the cultural resources survey prepared by Flaherty's Cultural Resources Services dated July 24, 2018.

g) A portion of the property is currently deer fenced. Please see Figure 4 in Appendix E for the Proposed Deer Fence map.

h) Numerous site visits of the property were performed by Jim Bushey and other PPI Engineering staff during 2014 and 2015 and again in 2018. Photographic documentation of pre-project conditions can be found in Appendix A.

3. Natural and man-made features onsite including streams, lakes, reservoirs, roads, drainage, and other areas that may be affected by the proposed activity.

a) The Waters of the U.S. are shown on Sheets 1 through 4 and were mapped by LSA Associates.

b) The tributaries on the property that meet the Napa County definition of a stream have the appropriate setbacks, determined by slope as outlined in Napa County Conservation Regulations Section 18.108.025, shown on Sheets 2 through 4. Prior to construction the Engineer shall stake the appropriate stream setbacks adjacent to vineyard blocks based on in-field determination of the top of bank and slope. All Waters of the U.S. not requiring a Napa County stream setback have been avoided with a minimum 50' buffer, which includes a 24' turnaround avenue and a 26' undisturbed filter strip.

c) Primary access to the parcel is from Stagecoach Vineyard, which is under the same ownership. The existing ranch road network is sufficient for access to proposed vineyard blocks, however in select locations the existing road will be re-aligned to an improved location. The improved locations will reduce erosion and sedimentation as well as improving the safety of the roads. Please see Appendix F for the Road Plan.

4. Location and source of water for irrigation or other uses.

a) The proposed water source is existing wells. Please see Sheet 2 for the locations. Please see the Draft Groundwater Study dated December 2018 prepared by Richard C. Slade and Associates.

5. Soil types/soil series identified in the Soil Conservation Service (SCS) Napa County Soil Survey.

a) The USDA – NRCS Web Soil Survey maps the soils within the project boundary as Guenoc-Rock Outcrop Complex with 30 to 75 percent slopes, Hambright Rock-Outcrop Complex with 30 to 75 percent slopes, Rock Outcrop-Hambright Complex with 50 to 75 percent slopes, and Sobrante Loam with 5 to 30 percent slopes.

b) Rock is expected to be generated as a result of this project. Some of the rock generated will be used to construct erosion control features such as rock energy dissipaters and rock level spreaders. In many locations rock will be used for rock-filled avenues that will help retain sediment as well as disperse runoff from vineyard blocks. Rock-filled avenues shall be located as shown on Sheets 2 through 4 and at the downslope edge of vineyard blocks as determined by the Engineer in the field at the time of construction. The toe of the rock avenue fill slope shall not extend past the proposed clearing limits. Because of the nature of the rock-filled avenues, the proposed block boundary location is conceptual and not exact, however, adjustments will only be to move the boundary further inside the clearing limits to allow for stable slope construction. No grading activities, ground disturbance, or rock storage will occur outside of the proposed clearing limits

Rock not used immediately will be temporarily stockpiled for future use inside the proposed clearing limits. Stockpiles will be temporary and are expected to be less than 30 feet in height. Rock will also be crushed and used on the existing roads where needed. Rock staging areas shall also be located inside of proposed clearing limits.

6. Critical areas, if any, within the development site that have serious erosion potential or problems.

a) Any areas with serious erosion potential or problems have been addressed with erosion control measures shown on Sheets 2 through 4.

7. Erosion calculations

a) Universal Soil Loss Equation (USLE) spreadsheets for this project are in Appendix B of this report.

b) Please see pre-project versus post-project soil loss analysis prepared by PPI Engineering dated December 2018.

8. Proposed erosion control methods including:

a) All drainage systems and facilities, walls, cribbing, or other erosion protection devices to be constructed with, or as a part of the proposed work.

1. A variety of drainage systems will be utilized for erosion control in this project. In some locations diversion ditches or diversion avenues will direct runoff to drop inlets, and drainage pipelines will be used to direct runoff to desired locations. Rock level spreaders and rock energy dissipaters will be used at pipe outlets to disperse water and prevent concentrated flow from forming and developing gullies. Detention structures will be used at pipe and diversion ditch outlets to collect concentrated flow and release it at a controlled rate. Rolling dips will be installed in some locations. Several different types of drop inlets will be used throughout the project as shown on the Plans and Detail sheets. The Project Engineer may substitute one type for another type during construction based on field conditions providing both types have the same capacity.

   Please see Sheets 2 through 4 for locations of the above erosion control items. Please see the Detail Sheets 5-7 and the Special Provisions for details on the erosion control items.

2. The final pass with disking equipment shall be performed across slopes to prevent channeling water downhill the first winter after development.

3. Straw wattles shall be installed the year of construction in the location shown on the Site Plan. Additional temporary erosion control measures shall be installed as needed.

b) Proposed vegetative erosion control measures including location, type and quantity of seed, mulch, fertilizer and irrigation, timing and methods of planting, mulching and maintenance of plant material and slopes until a specified percentage of plant coverage is uniformly established.

1. Disturbed areas shall be seeded as described below. Straw mulch shall be applied to all disturbed areas at a rate of 3,000 lbs/acre prior to September 15 of the year of construction.

2. A permanent cover crop strategy will be utilized. The permanent cover crop will be generated the first year by seeding with the following mix: Blando Brome at 20 pounds per acre, Zorro fescue at 12 pounds per acre, Subterranean clover blend at 4 pounds per acre, and Hykon Rose clover at 4 pounds per acre. A pre-approved alternative seed mix may be allowed.

   The permanent cover crop will be managed each year such that any areas which have less than the percent vegetative cover specified below will be reseeded and mulched until adequate coverage is achieved. The permanent cover crop shall be mowed only and not disked.

Blocks with 75% vegetative cover: V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20

Blocks with 80% vegetative cover: V1, Y15, Y16, & Z19

Block with 85% vegetative cover: W7

3. The permanent cover must be established the first year. Disking for the first three years to aid with vineyard establishment is not permitted.

4. No pre-emergent herbicides will be strip sprayed in the vinerows for weed management. Contact or systemic herbicides may be applied in spring (no earlier than February 15th to ensure adequate vegetative cover in the spray strips for the remainder of the rainy season). In Blocks V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20 the width of the spray strip shall be no wider than 1.5' in order to achieve 75% vegetative cover (based on a 6 foot vine row). In Blocks V1, Y15, Y16, & Z19 the width of the spray strip shall be no wider than 1 foot in order to achieve 80% vegetative cover (based on a 6 foot vine row). In Block W7 no strip spraying shall be performed. In Block W7 spot spraying of contact or systemic herbicides in spring (no earlier than February 15) will be allowed provided the 85% vegetative cover is achieved in the block. If the owner chooses to farm without herbicide, an alternative will be to hand-hoe around the base of the vine only, or other methods that do not result in a continuous bare strip.

5. The vineyard avenues shall be mowed only and shall not be disked. Unless otherwise noted, all avenues shall conform to the natural grade. Vineyard avenues shall be seeded and mulched prior to September 15 of the year of construction and in subsequent years in bare or disturbed areas. The cover crop will be managed each year such that any avenues that have less than the percent vegetative cover specified below will be reseeded and mulched until adequate coverage is achieved. Seeding and mulching is not required on avenues and roads properly surfaced with gravel.

   Blocks with 75% vegetative cover: V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20

   Blocks with 80% vegetative cover: V1, Y15, Y16, & Z19

   Block with 85% vegetative cover: W7

6. Fertilizer shall be applied as necessary by vineyard management personnel for both the vineyard and to ensure specified percent vegetative cover crop is achieved. Site-specific soil analysis should be performed.

7. The proposed vine by row spacing is expected to be 6 feet by 4 feet, however in areas where cross-slope exceeds 15% the owner shall increase the row spacing as needed to ensure there is adequate room for equipment. Width of tillage equipment shall be no more than 75% of row width to allow for bench formation and to minimize erosion.

8. The owner has the freedom to further subdivide vineyard blocks within the footprint of the proposed vineyard for irrigation and viticulture purposes. The proposed vinerow directions shall not be altered without an approved modification from Napa County.

9. Irrigation pipelines shall be located within existing roadways, vineyards and vineyard avenues, and/or within proposed clearing limits. Regardless of pipeline location, pipeline trenches located on ground slopes greater than 15% shall be backfilled using imported or select native granular material to a depth of 6 inches above the pipelines such that voids do not form below haunches of pipe. Backfill shall be wheel rolled or otherwise compacted to reduce settlement. Final grading over trenches shall be mounded and water-barred such that water is directed away from trenches.

10. As stated in the Napa County Protocol for Re-Planting/Renewal of Approved Non-Tilled Vineyard Cover Crops dated March 23, 2004, when it becomes necessary, either by routine or emergency, to re-establish or renew vineyard cover crop the following measures should be followed:
    - Seek professional consultation, including soil nutrient analysis, to determine the reasons for the original cover crop's failure. Adjust soil fertility, irrigation and seed selection accordingly.
    - When tillage is necessary, alternate rows should be tilled, seeded, and straw-mulched to effectively accomplish the re-establishment/renewal process over a two-year period.
    - Tillage and re-seeding should be conducted in the following manner:
        - In year 1, till to prepare seed bed and sow desired cover crop in every other row ("the evens"), leaving the alternate rows ("the odds") untilled and mowed only.
        - Mulch all tilled rows having an up and down hill (perpendicular to contour) row direction with 3,000 lbs./acre of loose straw, or approved equivalent, after seeding.
        - Tilled rows with cross-slope (parallel to contour) row direction and slope gradients less than 15% may not require straw mulch.
        - In year 2, till to prepare seed bed and sow desired cover crop in "odd" rows.
        - In year 2, leave "even" rows untilled and mowed only.
        - Mulch rows tilled in year 2 as specified above.
        - Put all re-establishment measures in place by September 1
        - In year 3, return all rows to non-tilled culture.

9. Stormwater stabilization measures, if the development of the site will result in increased peak rates of runoff that may cause flooding or channel degradation downstream.

a) Please see the hydrology report prepared by PPI Engineering dated December 2018.

10. An implementation schedule showing the following:

a) The proposed clearing, grading, and/or construction schedule.

DATE	DESCRIPTION
April 1:	Commence clearing and tillage operations.
September 1:	All tillage and erosion control completed. This shall include complete construction of all structural measures required which could include diversion ditches, drop inlets, surface drainage pipelines, rock energy dissipaters, detention basins, etc.
September 15:	All winterization complete, including seeding, straw mulching, and straw wattle installation.

b) The proposed schedule for winterizing the site (generally by October 15 of each year the permit is in effect.)

The site shall be winterized and all necessary erosion control measures described in the Erosion Control Plan shall be installed by September 15.

c) The proposed schedule of installation of all interim erosion and sediment control measures, including the stage of completion of such devices at the end of the grading season (generally October 15) of each year the permit will be in effect.

See Item 10a).

d) The schedule for installation of permanent erosion and sediment control devices where required.

See Item 10a).

11. The estimated cost of implementation of the erosion and sediment control measures.

Typical costs for installing erosion control measures as described in this plan range from $2,000 to $20,000 per acre.

STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN

S T A N D A R D P R O V I S I O N S

SECTION 1 - SCOPE OF WORK

These specifications cover the construction of the erosion control measures for approximately 91.3 acres of vineyard to be developed by Gallo Vineyards Inc.

The drawings numbered 11713301B and 11713301X, and these Specifications describe in detail the construction of the complete erosion control system. Requests for further information or clarification of the work to be done can be made to Jim Bushey or Matt Bueno at the Napa office of PPI Engineering, phone (707) 253-1806.

All costs for the complete construction of the erosion control system must be included in the bid items, since no other payment will be made outside of the bid items. This includes all costs for moving onto and off of the job site, all equipment, tools, materials, labor, fuel, taxes, and incidentals for furnishing and installing the erosion control system.

Surveying adequate for construction will be provided by the Owner, at the Owner's expense. The Contractor (or Owner if the owner is acting as his own Contractor) will be responsible for preserving construction survey stakes and markers for the duration of their intended use. Any restaking costs or additional survey work requested by the Contractor shall be deducted from the final payment to the Contractor. The Owner does not guarantee that the project being bid will be awarded. The Owner also reserves the right to change the quantities of actual work performed as needed with payment made according to the new quantities at the unit price bid.

SECTION 2 - AUTHORITY OF OWNER AND ENGINEER

The property is owned by Gallo Vineyards Inc. Gallo Vineyards Inc. or its appointed representative shall have the final say in the event of a dispute with the Contractor.

The Owner shall appoint PPI Engineering (PPI) as the Engineer to perform periodic review of the work. PPI Engineering shall report any unsatisfactory work to the Owner. The Contractor shall be responsible for any engineering fees or repair costs associated with bringing the unsatisfactory work into compliance with the Plans and Specifications.

SECTION 3 - CHANGES IN WORK

Materials and the manner of performance of the work performed in this contract shall be according to the Plans and Specifications. Modifications to the Plans or Specifications shall be agreed upon in writing by the Contractor, Owner, and Engineer before the work in question is performed. Materials and construction methods shall be as specified on the Plans and Specifications. The burden of proof that a given material or method constitutes an equivalent to the one specified will rest with the Contractor (or Owner if the owner is acting as his own Contractor).

SECTION 4 - UTILITIES

At least two working days prior to beginning any excavation on the project, the Contractor (or Owner if the owner is acting as his own Contractor) shall contact Underground Service Alert (USA) at 1-800-642-2444 and request field location of all existing utilities.

Certain facilities at the site are existing. The Contractor or Owner shall be careful to avoid damaging existing facilities and shall notify the Owner immediately if any damage does occur. The cost of repairing any damage shall be the sole responsibility of the Contractor or Owner.

SECTION 5 - PROSECUTION OF THE WORK

Unless otherwise provided, the contract time shall commence upon issuance of a Notice to Proceed by the Owner. The work shall start within ten days thereafter and be diligently prosecuted to completion within the time specified in the Contractor's bid. If weather conditions prevent completion of the project within the specified amount of time, the Owner may extend the completion date of the project.

SECTION 6 - RESPONSIBILITIES OF THE CONTRACTOR

The Contractor (or Owner if the owner is acting as his own contractor) agrees that in accordance with generally accepted construction practices, Contractor or Owner will be required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including the safety of all persons and property. This requirement shall be made to apply continuously and not be limited to normal working hours. Contractor or Owner further agrees to defend, indemnify and hold design professional harmless from any and all liability, real or alleged, in connection with the performance of the work on this project, excepting liability arising from the sole negligence of design professional.

The Contractor or Owner shall be responsible for controlling dust and mud generated from construction activities. The Contractor shall not allow dust or mud to obstruct vehicular traffic on County roads or State Highways. The Contractor or Owner shall be responsible for cleaning all vehicles prior to leaving the site as required by the California Highway Patrol. The Contractor or Owner, at their own expense, shall provide adequate dust control and prevention of mud tracking on roads, and take other preventative measures as directed by the Owner.

The Contractor or Owner shall be responsible for following all safety laws that may be applicable. Of particular concern are the trench safety regulations issued by CAL-OSHA. The Contractor or Owner alone shall be responsible for the safety of their equipment and methods and for any damage or injury which may result from their failure, improper construction, maintenance, or operation.

The Contractor or Owner shall be responsible for installing necessary sediment retention measures to keep sediment from leaving the site if construction activities continue beyond October 1.

The Contractor or Owner shall keep the work site clean and free of rubbish and debris throughout the project. Materials and equipment shall be removed from the site as soon as they are no longer necessary or the project is completed.

The Contractor or Owner shall also be responsible for ensuring that all permits which are necessary for construction have been obtained and that copies of these permits are maintained onsite at all times.

The Contractor or Owner shall, at their own expense, furnish all necessary light, power, pumps, and water necessary for the work.

SECTION 7 - MEASUREMENT AND PAYMENT

Payment shall be made at the unit prices bid according to the actual quantities installed. Measurement of the final quantities shall be the responsibility of the Owner's Engineer.

The Engineer shall periodically observe the project during construction and upon completion of the project any unfinished or unacceptable work observed will be brought to the Contractor's (or Owner's if the owner is acting as his own contractor) attention verbally and in writing. Final payment will be made upon satisfactory completion of all work items required by these Plans and Specifications.

SECTION 8 - GUARANTEE

In addition to the guarantees from suppliers, the Contractor shall guarantee the work he performs for a period of two years. Any repairs needed to the system within two years of completion due to faulty workmanship or materials shall be promptly repaired at no expense to the Owner. Any costs incurred by the Owner and/or Engineer within two years of completion due to rubbish or debris placed in a trench or other excavation shall be paid by the Contractor.

Unless otherwise provided in writing, payment by the Owner to the Contractor for installation of this system shall constitute acceptance of all provisions in this document by the Contractor.

STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN

S P E C I A L P R O V I S I O N S

SECTION 1 - SURFACE DRAINAGE PIPELINES

1.1 GENERAL:

Surface drainage pipelines shall be installed to collect surface runoff at low points throughout the project area and transport it to protected outlets, as shown on Detail 3, Sheet 6.

1.2 MATERIALS:

Surface drainage pipelines shall be constructed of solid corrugated polyethylene pipe (CPP), either single-wall or dual-wall as shown on the Plans. Corrugated plastic pipe for use as surface drainage pipelines shall meet the standards of ASTM F667 and AASHTO M294, as applicable. Bent or damaged pipe shall not be used in the drainage system and shall be removed from the job site. Pipelines shall be corrugated steel pipe, 14-gauge minimum, where pipes outlet to energy dissipaters or level spreaders if cover is less than 2 feet unless otherwise approved by the engineer.

Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections shall be securely fastened and the resulting connection shall not have gaps greater than 1/8 inch wide.

1.3 GRAVEL ENVELOPE:

Gravel envelope bedding material may be crushed rock generated onsite. Crushed rock shall be 3-inch minus. No more than 10% shall be larger than 2-inch diameter and no more than 50% shall be larger than 1-inch diameter. It shall be free of organic matter, clay, or other material which could prevent it from flowing uniformly around the pipe.

Alternative bedding material may be approved by the Engineer. A sample and sieve analysis of the proposed material must be submitted to the Engineer at least 2 days prior to delivering material to the job site.

1.4 INSTALLATION:

The Contractor (or Owner if the owner is acting as his own contractor) may use a trencher, or drainage plow with vertical soil displacement or backhoe/excavator for the excavation and placement of the surface drainage pipe as dictated by soil conditions. The operator shall be skillful in laying the tubing. Grade control may be established by visual control with grade stakes set no more than 100 feet apart or by laser control with grade stakes set no more than 200 feet apart.

Construction staking shall be provided by the Owner's Engineer. The slope, alignment, and depth of placement of the tubing shall be as shown on the Plans and as staked in the field. A minimum cover of 4.0 feet must be provided within vineyard areas, unless otherwise staked in the field by the Engineer.

A gradual variation of no more than 0.10 foot from grade will be allowed where slopes are 2% or less. Where slopes are greater than 2%, a gradual variation of no more than 0.20 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed.

Stretching of the tubing should be avoided during installation. No more than 10% stretch will be allowed.

Cobbles and rocks may be present on the project site. The Contractor or Owner shall take necessary actions to work around the cobbles and rocks at his own expense.

1.5 BEDDING AND BACKFILL:

Surface drainage piping shall be backfilled with approved gravel envelope material. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 2 inch. Bedding shall be provided around the pipe and to a depth of 12 inches above the pipe.
Rocks or clods shall not be allowed to fall upon or otherwise strike the pipe during any phase of construction. No rocks larger than 6" may be placed within 12" of the pipe. Final backfill shall be placed and spread in approximately uniform layers to fill the trench completely. Rolling equipment or heavy tampers shall not be used to consolidate backfill.

SECTION 2 - CUTOFF COLLARS

2.1 GENERAL:

Cutoff collars shall be installed on all solid pipelines with slopes greater than 5%, in the locations shown on the plans and as shown in Detail 5, Sheet 6. Spacing between collars shall be as specified in the table below or as staked in the field by the Engineer.

Ground Slope (%)	Spacing (Feet)
0-5	None Required
6-15	200
16 and greater	100

2.2 MATERIALS:

Cutoff collars shall be constructed of Portland Cement Concrete, 3000-psi minimum compressive strength.

The envelope material shall be the same as that specified in Section 1, subsection 1.3, gravel envelope.

2.3 INSTALLATION:

Cutoff collars shall extend a minimum of 1.0 foot into native, undisturbed material on the sides and bottom of the trench and extend 1.5 feet above the top of the pipe. Cutoff collars shall be a minimum of 8 inches thick. A watertight seal shall be formed between the cutoff wall and the pipeline. The wall of the collar shall be poured against undisturbed soil. Backfill shall be placed around wall and hand compacted to ensure no voids are present.

The Contractor or Owner shall perforate the pipe with ±30 3/8-inch diameter holes along the bottom half of the pipe a minimum of 3 feet upstream of the cutoff collar to allow water to infiltrate back into the pipe. This perforated section shall be backfilled with approved envelope material. Gravel envelope shall be a minimum of 3 inches thick on all sides of the pipe.

The Contractor or Owner shall take precautions to ensure that concrete does not flow through perforations in amounts that would cause any reduction in flow capacity of pipe.

SECTION 3 – STANDARD DROP INLETS

3.1 GENERAL:

Drop inlets shall be furnished and installed by the Contractor or Owner in the locations shown on the plans and as staked in the field by the Engineer, according to Detail 6, Sheet 5. The dimensions of the riser and connector pipeline shall be as shown on the plans. A grate shall be installed over the top of each drop inlet.

3.2 MATERIALS:

Drop inlet risers shall be dual walled corrugated polyethylene pipe of the diameter shown on the Plans. Pipe shall meet the same standards as listed in Section 1- Surface Drainage Pipelines, Subsection 1.2 – Materials (as applicable).

Grates shall be Agri Drain Bar Guard or equal.

Concrete for the bottom of the inlet shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

3.3 INSTALLATION:

Standard Drop inlets shall be constructed as shown on the detail sheet and as staked in the field by the Engineer. Connector pipes shall be mortared in place to form a watertight seal. Grates shall be bolted or locked to drop inlet riser. Backfill around the inlet shall be compacted sufficiently by hand or water-jetted such that excessive settlement does not occur**.**

SECTION 4 – CONCRETE DROP INLETS

4.1 GENERAL:

Concrete drop inlets may be substituted for Standard Drop Inlets in high-traffic areas at the Owners discretion. In that case the inlet shall be installed at the location staked in the field by the Engineer. Concrete drop inlets shall be constructed as shown on Detail 5, Sheet 5.

4.2 MATERIALS:

Concrete drop inlets shall be Jensen Precast product or equivalent. Inlets shall be constructed of a precast, reinforced concrete box with drive grate. Box and grate shall be H-20 traffic rated.

Drop inlets shall be placed on an aggregate base pad consisting of Cal Trans Class II Aggregate Base or equivalent with approval of the Engineer. Connector pipes shall be single- or dual-wall solid corrugated polyethylene pipe as shown on the plans and conforming to Section 1 of these specifications of the size specified by the Engineer when the substitution is approved.

Wire mesh for the debris shield shall be ¼" x ¼" galvanized hardware cloth or an engineer approved alternative.

4.3 INSTALLATION:

Upon completion of the excavation for the drop inlet, a 2-inch thick pad of Class II Aggregate Base shall be placed on the bottom of the excavation. Aggregate base shall be compacted to 90% relative compaction. If approved by the Engineer, native material may be scarified, moisture conditioned as necessary, and compacted to 90% relative compaction.

The drop inlet shall be placed plumb and level and square with any adjacent fence or avenue. The lip of the inlet shall conform to the natural grade elevation or as directed in the field by the Engineer. Pipe connections and all other openings shall be grouted to form a watertight seal. Backfill around the inlet shall be water jetted or otherwise placed and compacted to prevent excess settlement of backfill. Earth berms around the drop inlets shall be moisture conditioned as necessary and compacted to 85% relative compaction.

A debris shield shall be constructed to help prevent loose debris and sediment from clogging the drop inlet grate. The shield shall be constructed as shown in the Detail. The shield shall be installed between the inlet grate and the concrete drop inlet frame. The wire mesh shall extend approximately 2 inches above the top of the inlet grate. This shield will not function after being driven over and is not intended for inlets in locations which receive traffic during the rainy season. It also should not be relied upon exclusively. Concrete drop inlets can be more susceptible to plugging than other types of inlets, especially with straw, and therefore require diligent maintenance.

SECTION 5 - DIVERSION DITCH

5.1 GENERAL:

Diversion ditches shall be constructed along the uphill side of vineyard avenues in certain blocks at the locations shown on the plans and as staked in the field. Diversion ditches shall be constructed according to Detail 2, Sheet 5 of the plans. The primary function of the ditches will be to collect upslope runoff and direct it to a stable outlet or drop inlet.

5.2 MATERIALS:

Diversion ditches will be cut into native material. Rock for lining ditches (if necessary) will be native rock generated onsite, 4-inch to 8-inch diameter.

5.3 INSTALLATION:

Diversion ditches shall be cut into native material to the extent possible. Fill material, if necessary, shall be moisture conditioned and compacted to 90% relative compaction per ASTM D1557. Flowline slope shall follow the natural grade in the locations constructed. Side slopes of the ditches shall be 2:1 (Horizontal:Vertical) as shown on Detail 2, Sheet 5. The ditch shall be a minimum of 12 inches deep when complete and shall be lined with 4 to 8 inch diameter angular rock if the flowline slope exceeds 5%. The rocks shall be keyed into the sides of the ditch such that they do not obstruct or reduce the cross section of the channel.

SECTION 6 – DIVERSION AVENUE

6.1 GENERAL:

Diversion avenues shall be constructed in the locations shown on the plans and as staked in the field by the Engineer. Diversion Avenues will reduce slope run length and intercept runoff throughout the vineyard while directing it to a stable outlet.

6.2 MATERIALS:

Diversion avenues will be cut into native material. Rock for lining diversion avenues will be native rock generated onsite, 3-inch to 6-inch diameter.

6.3 INSTALLATION:

Diversion avenues shall be constructed as shown on Detail 3, Sheet 5. Flowline slope shall be 4% minimum, and side slopes of the avenues shall be 8:1 (Horizontal:Vertical). No reverse grade will be allowed. The rocks shall be keyed into the sides of the avenue such that they do not obstruct or reduce the cross section of the channel. The avenues shall be a minimum of 18 inches deep when complete. The diversion avenues will direct water to a stable outlet.

SECTION 7 – ROCK LEVEL SPREADERS

7.1 GENERAL:

Rock level spreaders will be constructed as shown in Detail 1, Sheet 6 and Detail 4, Sheet 7 in the locations shown on the plans and as staked in the field by the Engineer.

7.2 MATERIALS:

Rock used for construction shall be field rock generated onsite and shall be well-graded to prevent large voids within the structure. Smaller (3-inch minus) field rock and ¾-inch minus gravel will be used to line the trough of the spreader. Gravel may be crushed rock generated onsite but should contain sufficient fines to reduce the overall permeability of the spreader and cause water to flow laterally along the length of the structure (generally equivalent to Cal –Trans Class II Aggregate Base).

7.3 INSTALLATION:

A bench shall be cut along the outboard toe for placement of rock. Straw wattles shall be installed along the outboard edge of the bench **prior** to placing rock. Care shall be taken to remove as much of the fine material (clay and silt size) as possible prior to placing the rock. The rock level spreader shall be parallel to the contour to ensure the water is evenly distributed, and the ends shall be turned uphill at least 2 feet in elevation to prevent water from running around the end. The spreader shall be constructed of large, well-graded rock to a finished cross-section with a trough depth of at least 3 feet. A layer of 3-inch minus field rock shall be spread 6-inches thick within the trough and a 6-inch layer of gravel applied over the smaller rock. Finished depth of the trough shall be at least 2 feet.

Where a ditch outlets to the rock level spreader, the ditch shall be constructed so that the flow line gradually transitions to become parallel with the level spreader. Curve the berm of the spreader upstream to ensure water changes direction without overtopping.

Where a pipe discharges into the middle of the rock level spreader, a tee shall be used to re-direct flows parallel with the berm. The pipe shall be attached to the tee with two rows of sheet metal screws spaced approximately 6” apart along the circumference of the pipe – one row in the pipe and one row in the tee. At least one large rock, minimum 3-foot–diameter, shall be placed against the fitting.

Where a pipe discharges at the end of the rock level spreader, a 90° fitting shall be used to re-direct flows parallel with the berm. The pipe shall be attached to the elbow with two rows of sheet metal screws spaced approximately 6” apart along the circumference of the pipe – one row in the pipe and one row in the elbow. At least one large rock, minimum 3-foot–diameter, shall be placed against the fitting.

SECTION 8 – ROCK-FILLED AVENUE

8.1 GENERAL:

Rock-filled avenues will be constructed as shown in Detail 2, Sheet 7 in the locations shown on the plans and as staked in the field by the Engineer to dispose of rock generated on the site and provide for safer turning of equipment while helping to disperse and filter runoff.

8.2 MATERIALS:

Rock used for construction shall be field rock generated onsite and shall be well-graded to prevent large voids within the structure.

8.3 INSTALLATION:

A bench shall be cut along the outboard toe for placement of rock. Straw wattles shall be installed along the outboard edge of the bench **prior** to placing rock. Care shall be taken to remove as much of the fine material (clay and silt size) as possible prior to placing the rock. The rock-filled avenue shall be parallel to the contour to the extent possible to ensure the water does not concentrate in certain areas.

SECTION 9 – ROCK ENERGY DISSIPATER

9.1 GENERAL:

Rock energy dissipaters shall be installed in the locations shown on the plans and as staked in the field to help disperse concentrated flow.

9.2 MATERIALS:

Rock used in the construction of the rock energy dissipaters shall be field rock generated onsite, 4-inch to 12-inch diameter. Care shall be taken to remove as much of the fine material (clay and silt size) as possible prior to placing the rock.

9.3 INSTALLATION:

The energy dissipater shall be constructed as shown on Detail 2, Sheet 6. A keyway shall be excavated to a depth of 1 foot prior to placing any rock. All rock shall be placed within the excavated keyway on a non-woven geotextile such as Mirafi 140-N or equivalent. The apron shall extend approximately 10 feet from the outlet of the ditch or pipe. The upstream end of the apron shall be approximately 6 feet wide. The downstream end shall be a minimum of 10 feet wide. Actual dimensions shall be as directed in the field by the Engineer to fit the site.

SECTION 10 – ROLLING DIPS

10.1 GENERAL:

Rolling dips shall be constructed as shown on Detail 1, Sheet 7 in locations specified by the Engineer.

10.2 INSTALLATION:

The existing roadway within the location of the rolling dip shall be scarified and any vegetation shall be removed and thoroughly incorporated. Excavation into the existing road bed shall begin approximately 20 to 25 feet uphill from the rolling dip location, progressively steepening the grade until the axis is reached. The axis of the rolling dip shall be angled approximately 30 degrees to the road alignment. Fill shall be used to achieve approximately 12" minimum of elevation between the axis of the trough and the top of the reverse grade. Fill shall be moisture conditioned as necessary and compacted to 90% compaction per ASTM D1557. Construction shall be such that vehicles can easily drive over the rolling dips yet allows the trough to effectively convey surface flow, when present, off the road. Existing dense vegetation shall help diffuse the surface flow on the downstream side of the trough. In the event that existing grade is too rocky for uniform excavation, the Engineer may approve the use of Caltrans Class 2 Aggregate Base (or equivalent) to construct the rolling dip to the dimensions shown in Detail 1, Sheet 7.

SECTION 11- CULVERTS

11.1 GENERAL:

Culverts shall be installed in the locations shown on the plans and according to Detail 4, Sheet 5.

11.2 MATERIALS:

The culvert shall be Aluminized Steel Type 2 Corrugated Steel Pipe (CSP), 12 gauge minimum, conforming to ASTM A929 and AASHTO M294. Backfill for culverts shall be select native granular material approved in the field by the Engineer. Clean 8-inch median field rock generated on site will be used for energy dissipation and channel protection. Mirafi 1100N filter fabric or equivalent (if needed).

11.3 INSTALLATION:

A trench will be excavated such that the invert of the pipe is at the same elevation of the upstream and downstream flow line in the stream channel. The culvert shall be installed to follow the natural grade and alignment of the existing channel. Backfill around the culvert shall be placed in no greater than 1.0' lifts and compacted to 90% relative compaction per ASTM D1557. A minimum 1.0' of cover shall be maintained along the entire length of pipe unless approved otherwise by the Engineer.

When installing the culvert in the stream channel, place rock at the outlet of the culvert if needed to prevent erosion. If the channel is not bedrock, place filter fabric prior to the placement of rock. Care should be taken to not disturb channel, bank, and surrounding area any more than is necessary for culvert installation. All disturbed areas shall be seeded and mulched. Permits from appropriate regulatory agencies shall be obtained prior to construction.

SECTION 12 – ROCKED WATER CROSSINGS

12.1 GENERAL:

Rocked water crossings shall be constructed as shown on Detail 1, Sheet 5 in locations shown on the plans and as staked in the field by the engineer.

12.2 MATERIALS & INSTALLATION:

Excavate channel bed to a depth of 6" - 8". If the bed of channel is not bedrock, place filter fabric (Mirafi 1100N or equal) under rock. Place clean 6-8" field rock in excavated channel bed, on grade with natural channel.

All segments of road that contribute runoff directly to the stream crossing (hydrologically connected) shall be surfaced with 3 inch minus crushed field rock.

Care should be taken to not disturb channel, bank and surrounding area any more than is necessary for rocked water crossing and road construction. All disturbed areas shall be seeded and mulched. Permits from appropriate regulatory agencies shall be obtained prior to construction.

SECTION 13 – DETENTION BASIN #1

13.1 GENERAL:

A detention basin shall be constructed in the northwest corner of Block Y16 to attenuate small increases in runoff associated with the proposed development. The basin shall be excavated into natural earth and have a compacted earth embankment. The basin shall be constructed as shown on Sheets 1 and 2 of Drawing 11713301X in ECP Package 2, as described in these Specifications, and as staked in the field by the Engineer.

13.2 MATERIALS:

Compacted embankment shall be constructed of native soil.

Outlet risers shall consist of a 12" and an 18" diameter galvanized, 14-gauge corrugated metal pipe (CMP). Six- to eight-inch (6"-8") diameter field rock shall be used to encase the outlet risers and to help keep sediment and debris from clogging the slots in the risers.

Outlet piping from the 12" riser shall be 4" diameter dual wall corrugated polyethylene pipe (DW). Outlet piping from the 18" riser shall be 8" diameter DW. Outlet piping shall conform to AASHTO M252 specifications. Bent or damaged pipe shall not be used and shall be removed from the job site. Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections shall be securely fastened, and the resulting connection shall not have gaps greater than 1/8 inch wide.

Concrete for the bottom of the risers and the cutoff collars shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

Trash racks shall be Agri Drain Bar Guard or equal.

13.3 CONSTRUCTION:

Prior to construction, all vegetation and organic matter shall be stripped from the site and spread in the adjacent vineyard area.

A keyway shall be excavated as shown on Sheet 2 of Drawing 11713301X. The keyway shall be excavated a minimum of 2 feet into firm native material. The base of the keyway shall be 5 feet wide minimum. The bottom of the keyway shall be inspected and approved the by Project Engineering Geologist or Geotechnical Engineer prior to placement of any fill material. The keyway shall backfilled in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. The contractor shall construct a compacted earth embankment from material excavated from the detention basin site. The fill material shall be free of large rocks and organic material. The embankment shall be constructed as shown on Sheets 1 and 2 of Drawing 11713301X. Material below the embankment shall be over-excavated as necessary (minimum 8 inches) to expose firm native soils and recompacted to 90% relative compaction per ASTM D1557. Embankment fill shall be placed in uniform, 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Field density testing shall be conducted as directed by the Project Engineering Geologist or Geotechnical Engineer on fill material to confirm the required relative compaction. Field density tests shall conform to ASTM D1557 standards.

The embankment shall extend around the perimeter of the detention basin to the catch point with existing grade as shown in the Plan View and as staked in the field by the Engineer. The embankment fill slopes shall be 2:1 (H:V) to top of embankment at elevation 1984.50'. The top of the embankment shall be a minimum of 6' wide and constructed level.

The bottom of the proposed detention basin shall be constructed at elevation 1980'. The uphill side of the detention basin shall be graded at 5:1 (H:V) slope from the bottom of the detention basin to the existing grade in proposed Block Y16.

The compacted embankment shall be completed prior to installing the outlet risers. Two risers shall be installed as shown on Sheets 1 and 2 of Drawing 11713301X. The risers shall be installed at the depths and locations shown and as staked in the field by the Engineer. The risers shall be set level and have concrete poured into the bottom of each riser to the thickness specified on the detail. They shall be notched with 6" high x 2" wide slots. Four (4) equally spaced slots

shall be cut along the circumference of the riser at each elevation shown in the Sections on Sheet 2 of Drawing 11713301X. The tops of the individual risers shall be cut at the elevations shown, and trash racks shall be installed over the top of each. The risers shall be encased with 6"-8" field rock as shown in the Sections.

Outlet pipes shall connect to the individual risers as shown on Sheets 1 and 2 of Drawing 11713301X at the respective elevations shown. The trench for the outlet pipe shall be excavated into the compacted embankment fill and shall be made sufficiently wide to accommodate the proposed pipe and compaction equipment. The slope, alignment, and depth of placement of the piping shall be as shown in the Plan View and Sections and as staked in the field by the Engineer. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 1 inch. A gradual variation of no more than 0.1 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed. The pipe connections to the risers shall be mortared to form a watertight seal. Concrete cutoff collars shall be installed on the outlet pipes as shown in Detail 3, Sheet 11 of Drawing 11713301X. Concrete cutoff collars shall be constructed as described in Section 2 of these Special Provisions, except that no perforations of the pipe upstream nor gravel backfill shall be required. Backfill around the pipes shall be placed in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Backfill material within 6 inches of the pipe shall be free of rocks and dirt clods larger than 1 inch in size and shall be hand-tamped as necessary to ensure no voids are present.

A rock level spreader shall be installed at the proposed pipe outlets. The rock level spreader shall be constructed according to Detail 2, Sheet 11 of Drawing 11713301X. A 4" DW tee shall be installed at the outlet of the 4" pipe, and an 8" DW tee shall be installed at the outlet of the 8" pipe. The tees shall be secured with two (2) rows of ¾" metal screws.

SECTION 14 – DETENTION BASIN #2

14.1 GENERAL:

A detention basin shall be constructed in the southwest corner of Block Y16 to attenuate small increases in runoff associated with the proposed development. The basin shall be excavated into natural earth and have a compacted earth embankment. The basin shall be constructed as shown on Sheets 3 and 4 of Drawing 11713301X in ECP Package 2, as described in these Specifications, and as staked in the field by the Engineer.

14.2 MATERIALS:

Compacted embankment shall be constructed of native soil.

Outlet risers shall be an 18" and a 36" diameter galvanized, 14-gauge corrugated metal pipe (CMP). Six- to eight-inch (6"-8") diameter field rock shall be used to encase the outlet risers and to help keep sediment and debris from clogging the slots in the risers.

Outlet piping from the 18" riser shall be 6" diameter dual wall corrugated polyethylene pipe (DW). Outlet piping from the 36" riser shall be 15" diameter DW. Outlet piping shall conform to AASHTO M252, AASHTO M294, and SCS 606 specifications as applicable. Bent or damaged pipe shall not be used and shall be removed from the job site. Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections shall be securely fastened, and the resulting connection shall not have gaps greater than 1/8 inch wide.

Concrete for the bottom of the risers and the cutoff collars shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

Trash racks shall be Agri Drain Bar Guard or equal.

14.3 CONSTRUCTION:

Prior to construction, all vegetation and organic matter shall be stripped from the site and spread in the adjacent vineyard area.

A keyway shall be excavated as shown on Sheet 4 of Drawing 11713301X. The keyway shall be excavated a minimum of 2' into native material. The base of the keyway shall be 5' wide minimum. The bottom of the keyway shall be inspected and approved by the Project Engineering Geologist or Geotechnical Engineer prior to placement of any fill material. The keyway shall be backfilled in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. The contractor shall construct a compacted earth embankment from material excavated from the detention basin site. The fill material shall be free of large rocks and organic material. The embankment shall be constructed as shown on Sheets 3 and 4 of Drawing 11713301X. Material below the embankment shall be over-excavated as necessary (minimum 8 inches) to expose firm native soils and recompacted to 90% relative compaction per ASTM D1557. Embankment fill shall be placed in uniform, 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Field density testing shall be conducted as directed by the Project Engineering Geologist or Geotechnical Engineer on fill material to confirm the required relative compaction. Field density tests shall conform to ASTM D1557 standards.

The embankment shall extend around the perimeter of the detention basin to the catch point with existing grade as shown in the Plan View and as staked in the field by the Engineer. The embankment fill slopes shall be 2:1 (H:V) to top of embankment at elevation 1947.50'. The top of the embankment shall be a minimum of 6' wide and constructed level.

The bottom of the proposed detention basin shall be constructed at elevation 1944'. The uphill side of the detention basin shall be graded at 1.5:1 (H:V) slope from the bottom of the detention basin to the existing grade in proposed Block Y16. The Project Engineering Geologist shall inspect the final grading of the 1.5:1 cut slope to confirm that the cut slope is stable.

The compacted embankment shall be completed prior to installing the outlet risers. Two risers shall be installed as shown on Sheets 3 and 4 of Drawing 11713301X. The risers shall be

installed at the depths and locations shown and as staked in the field by the Engineer. The risers shall be set level with a 1' thick concrete bottom. They shall be notched with 12" high x 2" wide slots. Five (5) equally spaced slots shall be cut along the circumference of the riser at each elevation shown in the Sections. The tops of the individual risers shall be cut at the elevations shown, and trash racks shall be installed over the top of each. The risers shall be encased with 6"-8" field rock as shown in the Sections.

Outlet pipes shall connect to the individual risers as shown on Sheets 3 and 4 of Drawing 11713301X at the respective elevations shown. The trench for the outlet pipe shall be excavated into the compacted embankment fill and shall be made sufficiently wide to accommodate the proposed pipe and compaction equipment. The slope, alignment, and depth of placement of the piping shall be as shown in the Plan View and Sections and as staked in the field by the Engineer. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 1 inch. A gradual variation of no more than 0.1 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed. The pipe connections to the risers shall be mortared to form a watertight seal. Concrete cutoff collars shall be installed on the outlet pipes as shown in Detail 3, Sheet 11 of Drawing 11713301X. Concrete cutoff collars shall be constructed as described in Section 2 of these Special Provisions except that no perforations of the pipe upstream nor gravel backfill shall be required. Backfill around the pipes shall be placed in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Backfill material within 6 inches of the pipe shall be free of rocks and dirt clods larger than 1 inch in size and shall be hand-tamped as necessary to ensure no voids are present.

A rock level spreader shall be installed at the proposed pipe outlets. The rock level spreader shall be constructed according to Detail 2, Sheet 11 of Drawing 11713301X. A 6" DW tee shall be installed at the outlet of the 6" pipe, and a 15" DW tee shall be installed at the outlet of the 15" pipe. The tees shall be secured with two (2) rows of ¾" metal screws.

SECTION 15 – DETENTION BASIN #3

15.1 GENERAL:

A detention basin shall be constructed on the south side of Block Y16 to attenuate small increases in runoff associated with the proposed development. The basin shall be excavated into natural earth and have a compacted earth embankment. The basin shall be constructed as shown on Sheets 5 and 6 of Drawing 11713301X in ECP Package 2, as described in these Specifications, and as staked in the field by the Engineer.

15.2 MATERIALS:

Compacted embankment shall be constructed of native soil.

Outlet risers shall consist of a 15", 18", and a 24" diameter galvanized, 14-gauge corrugated metal pipe (CMP). Six- to eight-inch (6"-8") diameter field rock shall be used to encase the outlet risers and to help keep sediment and debris from clogging the slots in the risers.

Outlet piping from the 15" riser shall be 6" diameter dual wall corrugated polyethylene pipe (DW). Outlet piping from the 18" riser shall be 8" diameter DW. Outlet piping from the 24" riser shall be 12" diameter DW. Outlet piping shall conform to AASHTO M252, AASHTO M294, and SCS 606 specifications as applicable. Bent or damaged pipe shall not be used and shall be removed from the job site. Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections shall be securely fastened, and the resulting connection shall not have gaps greater than 1/8 inch wide.

Concrete for the bottom of the risers and the cutoff collars shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

Trash racks shall be Agri Drain Bar Guard or equal.

15.3 CONSTRUCTION:

Prior to construction, all vegetation and organic matter shall be stripped from the site and spread in the adjacent vineyard area.

A keyway shall be excavated as shown on Sheet 6 of Drawing 11713301X. The keyway shall be excavated a minimum of 2' into native material. The base of the keyway shall be 5' wide minimum. The bottom of the keyway shall be inspected and approved by the Project Engineering Geologist or Geotechnical Engineer prior to placement of any fill material. The keyway shall be backfilled in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. The contractor shall construct a compacted earth embankment from material excavated from the detention basin site. The fill material shall be free of large rocks and organic material. The embankment shall be constructed as shown on Sheets 5 and 6 of Drawing 11713301X. Material below the embankment shall be over-excavated as necessary to expose firm native soils (minimum 8 inches) and recompacted to 90% relative compaction per ASTM D1557. Embankment fill shall be placed in uniform, 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Field density testing shall be conducted as directed by the Project Engineering Geologist or Geotechnical Engineer on fill material to confirm the required relative compaction. Field density tests shall conform to ASTM D1557 standards.

The embankment shall extend around the perimeter of the detention basin to the catch point with existing grade as shown in the Plan View and as staked in the field by the Engineer. The embankment fill slopes shall be 2:1 (H:V) to top of embankment at elevation 1989.50'. The top of the embankment shall be a minimum of 6' wide and constructed level.

The bottom of the proposed detention basin shall be constructed at elevation 1984'. The uphill side of the detention basin shall be graded at 1.5:1 (H:V) slope from the bottom of the detention basin to the existing grade in proposed Block Y16. The Project Engineering Geologist shall inspect the final grading of the 1.5:1 cut slope to confirm that the cut slope is stable.

The compacted embankment shall be completed prior to installing the outlet risers. Three risers shall be installed as shown on Sheets 5 and 6 of Drawing 11713301X. The risers shall be

installed at the depths and locations shown and as staked in the field by the Engineer. The risers shall be set level with a 1' thick concrete bottom. Respective risers shall be notched with 6" high x 2" wide slots. Four (4) equally spaced slots shall be cut along the circumference of the riser at each elevation shown in the Sections. The tops of the individual risers shall be cut at the elevations shown, and trash racks shall be installed over the top of each. The risers shall be encased with 6"-8" field rock as shown in the Sections.

Outlet pipes shall connect to the individual risers as shown on Sheets 5 and 6 of Drawing 11713301X at the respective elevations shown. The trench for the outlet pipe shall be excavated into the compacted embankment fill and shall be made sufficiently wide to accommodate the proposed pipe and compaction equipment. The slope, alignment, and depth of placement of the piping shall be as shown in the Plan View and Sections and as staked in the field by the Engineer. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 1 inch. A gradual variation of no more than 0.1 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed. The pipe connections to the risers shall be mortared to form a watertight seal. Concrete cutoff collars shall be installed on the outlet pipes as shown in Detail 3, Sheet 11 of Drawing 11713301X. Concrete cutoff collars shall be constructed as described in Section 2 of these Special Provisions except that no perforations of the pipe upstream nor gravel backfill shall be required. Backfill around the pipes shall be placed in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Backfill material within 6 inches of the pipe shall be free of rocks and dirt clods larger than 1 inch in size and shall be hand-tamped as necessary to ensure no voids are present.

A rock energy dissipater shall be installed at the proposed pipe outlets. The rock energy dissipater shall be constructed according to Detail 5, Sheet 11 of Drawing 11713301X.

SECTION 16 – DETENTION BASIN #4

16.1 GENERAL:

A detention basin shall be constructed on the south side of Block Y16 to attenuate small increases in runoff associated with the proposed development. The basin shall be excavated into natural earth and have a compacted earth embankment. The basin shall be constructed as shown on Sheets 7 and 8 of Drawing 11713301X in ECP Package 2, as described in these Specifications, and as staked in the field by the Engineer.

16.2 MATERIALS:

Compacted embankment shall be constructed of native soil.

Outlet risers shall consist of a 12", 18", and a 24" diameter galvanized, 14-gauge corrugated metal pipe (CMP). Six- to eight-inch (6"-8") diameter field rock shall be used to encase the outlet risers and to help keep sediment and debris from clogging the slots in the risers.

Outlet piping from the 12" riser shall be 4" diameter dual wall corrugated polyethylene pipe (DW). Outlet piping from the 18" riser shall be 8" diameter DW. Outlet piping from the 24" riser shall be 10" diameter DW. Outlet piping shall conform to AASHTO M252 and SCS 606 specifications as applicable. Bent or damaged pipe shall not be used and shall be removed from the job site. Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections shall be securely fastened, and the resulting connection shall not have gaps greater than 1/8 inch wide.

Concrete for the bottom of the risers and the cutoff collars shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

Trash racks shall be Agri Drain Bar Guard or equal.

16.3 CONSTRUCTION:

Prior to construction, all vegetation and organic matter shall be stripped from the site and spread in the adjacent vineyard area. A keyway shall be excavated as shown on Sheet 8 of Drawing 11713301X. The keyway shall be excavated a minimum of 2' into native material. The base of the keyway shall be 5' wide minimum. The bottom of the keyway shall be inspected and approved by the Project Engineering Geologist or Geotechnical Engineer prior to placement of any fill material. The keyway shall be backfilled in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. The contractor shall construct a compacted earth embankment from material excavated from the detention basin site. The fill material shall be free of large rocks and organic material. The embankment shall be constructed as shown on Sheets 7 and 8 of Drawing 11713301X. Material below the embankment shall be over-excavated as necessary (minimum 8 inches) to expose firm native soils and recompacted to 90% relative compaction per ASTM D1557. Embankment fill shall be placed in uniform, 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Field density testing shall be conducted as directed by the Project Engineering Geologist or Geotechnical Engineer on fill material to confirm the required relative compaction. Field density tests shall conform to ASTM D1557 standards.

The embankment shall extend around the perimeter of the detention basin to the catch point with existing grade as shown in the Plan View and as staked in the field by the Engineer. The embankment fill slopes shall be 2:1 (H:V) to top of embankment at elevation 1956.5'. The top of the embankment shall be a minimum of 6' wide and constructed level.

The bottom of the proposed detention basin shall be constructed at elevation 1951'. The uphill side of the detention basin shall be graded at 4:1 (H:V) slope from the bottom of the detention basin to the existing grade in proposed Block Y16.

The compacted embankment shall be completed prior to installing the outlet risers. Three risers shall be installed as shown on Sheets 7 and 8 of Drawing 11713301X. The risers shall be installed at the depths and locations shown and as staked in the field by the Engineer. The risers shall be set level with a 1' thick concrete bottom. They shall be notched with 6" high x 2" wide slots. Four (4) equally spaced slots shall be cut along the circumference of the riser at each elevation shown in the Sections. The tops of the individual risers shall be cut at the elevations

shown, and trash racks shall be installed over the top of each. The risers shall be encased with 6"-8" field rock as shown in the Sections.

Outlet pipes shall connect to the individual risers as shown on Sheets 7 and 8 of Drawing 11713301X at the respective elevations shown. The trench for the outlet pipe shall be excavated into the compacted embankment fill and shall be made sufficiently wide to accommodate the proposed pipe and compaction equipment. The slope, alignment, and depth of placement of the piping shall be as shown in the Plan View and Sections and as staked in the field by the Engineer. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 1 inch. A gradual variation of no more than 0.1 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed. The pipe connections to the risers shall be mortared to form a watertight seal. Concrete cutoff collars shall be installed on the outlet pipes as shown in Detail 3, Sheet 11 of Drawing 11713301X. Concrete cutoff collars shall be constructed as described in Section 2 of these Special Provisions except that no perforations of the pipe upstream nor gravel backfill shall be required. Backfill around the pipes shall be placed in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Backfill material within 6 inches of the pipe shall be free of rocks and dirt clods larger than 1 inch in size and shall be hand-tamped as necessary to ensure no voids are present.

A rock energy dissipater shall be installed at the proposed pipe outlets. The rock energy dissipater shall be constructed according to Detail 5, Sheet 11 of Drawing 11713301X.

SECTION 17 – DETENTION BASIN #5

17.1 GENERAL:

A detention basin shall be constructed north of Blocks V3 and V4 to attenuate small increases in runoff associated with the proposed development. The basin shall be excavated into natural earth and have a compacted earth embankment. The basin shall be constructed as shown on Sheets 9 and 10 of Drawing 11713301X in ECP Package 2, as described in these Specifications, and as staked in the field by the Engineer.

17.2 MATERIALS:

Compacted embankment shall be constructed of native soil.

Outlet risers shall consist of an 18" and two (2) 36" diameter galvanized, 14-gauge corrugated metal pipes (CMP). Six- to eight-inch (6"-8") diameter field rock shall be used to encase the outlet risers and to help keep sediment and debris from clogging the slots in the risers.

Outlet piping from the 18" riser shall be 8" diameter dual wall corrugated polyethylene pipe (DW). Outlet piping from both 36" risers shall be 15" diameter DW. Outlet piping shall conform to AASHTO M252, AASHTO M294, and SCS 606 specifications as applicable. Bent or damaged pipe shall not be used and shall be removed from the job site. Pipe connections shall be made with fittings manufactured by the same manufacturer who made the pipe. All connections

shall be securely fastened, and the resulting connection shall not have gaps greater than 1/8 inch wide.

Concrete for the bottom of the risers and the cutoff collars shall be Portland Cement concrete, 3,000 psi minimum compressive strength.

Trash racks shall be Agri Drain Bar Guard or equal.

17.3 CONSTRUCTION:

Prior to construction, all vegetation and organic matter shall be stripped from the site and spread in the adjacent vineyard area.

A keyway shall be excavated as shown on Sheet 10 of Drawing 11713301X. The keyway shall be excavated a minimum of 2' into native material. The base of the keyway shall be 5' wide minimum. The bottom of the keyway shall be inspected and approved by the Project Engineering Geologist or Geotechnical Engineer prior to placement of any fill material. The keyway shall be backfilled in 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. The contractor shall construct a compacted earth embankment from material excavated from the detention basin site. The fill material shall be free of large rocks and organic material. The embankment shall be constructed as shown on Sheets 9 and 10 of Drawing 11713301X. Material below the embankment shall be over-excavated as necessary (minimum 8 inches) to expose firm native soils and recompacted to 90% relative compaction per ASTM D1557. Embankment fill shall be placed in uniform, 8"-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Field density testing shall be conducted as directed by the Project Engineering Geologist or Geotechnical Engineer on fill material to confirm the required relative compaction. Field density tests shall conform to ASTM D1557 standards.

The embankment shall extend around the perimeter of the detention basin to the catch point with existing grade as shown in the Plan View and as staked in the field by the Engineer. The embankment fill slopes shall be 2:1 (H:V) to top of embankment at elevation 1858.5'. The top of the embankment shall be a minimum of 6' wide and constructed level.

The bottom of the proposed detention basin shall be constructed at elevation 1853'. The uphill side of the detention basin shall be graded at 1.5:1 (H:V) slope from the bottom of the detention basin to the existing grade above Blocks V3 and V4. The Project Engineering Geologist shall inspect the final grading of the 1.5:1 cut slope to confirm that the cut slope is stable

The compacted embankment shall be completed prior to installing the outlet risers. Three risers shall be installed as shown on Sheets 9 and 10 of Drawing 11713301X. The risers shall be installed at the depths and locations shown and as staked in the field by the Engineer. The risers shall be set level with a 1' thick concrete bottom. They shall be notched with 6" high x 2" wide slots. Ten (10) equally spaced slots shall be cut along the circumference of the 18" riser. Two (2) rows of five (5) equally spaced slots shall be cut along the circumference of the 36" risers at each elevation shown in the Sections. The slots shall be spaced 0.5' apart vertically. The tops of

the individual risers shall be cut at the elevations shown, and trash racks shall be installed over the top of each. The risers shall be encased with 6”-8” field rock as shown in the Sections.

Outlet pipes shall connect to the individual risers as shown on Sheets 9 and 10 of Drawing 11713301X at the respective elevations shown. The trench for the outlet pipe shall be excavated into the compacted embankment fill and shall be made sufficiently wide to accommodate the proposed pipe and compaction equipment. The slope, alignment, and depth of placement of the piping shall be as shown in the Plan View and Sections and as staked in the field by the Engineer. The trench bottom shall be continuous, firm, relatively smooth, and free of rocks or other objects larger than 1 inch. A gradual variation of no more than 0.1 foot from grade will be allowed. No reverse grade will be allowed. A gradual variation of no more than 1 foot from design alignment is allowed. The pipe connections to the risers shall be mortared to form a watertight seal. Concrete cutoff collars shall be installed on the outlet pipes as shown in Detail 3, Sheet 11 of Drawing 11713301X. Concrete cutoff collars shall be constructed as described in Section 2 of these Special Provisions except that no perforations of the pipe upstream nor gravel backfill shall be required. Backfill around the pipes shall be placed in 8”-thick maximum horizontal layers, moisture conditioned as necessary, and compacted to 90% relative compaction per ASTM D1557. Backfill material within 6 inches of the pipe shall be free of rocks and dirt clods larger than 1 inch in size and shall be hand-tamped as necessary to ensure no voids are present.

The individual outlet pipes shall join together through a series of wye connections downstream of the basin as shown on Sheet 9 of Drawing 11713301X. The outlet pipes shall be connected at the elevation shown on Sheet 10 and as directed by the Engineer in the field.

SECTION 18 – OUTSLOPED INFIELD LEVEL SPREADER

18.1 GENERAL:

Outsloped infield level spreaders shall be constructed in Blocks X12 and Y14 and as shown in Detail 3, Sheet 7. The level spreaders will be constructed on the contour to prevent surface flows through the vineyard areas from becoming concentrated.

18.2 CONSTRUCTION:

The outsloped infield level spreaders shall be constructed using a bulldozer. The level spreaders will be constructed on the contour following ripping, rock removal, and smoothing of the field. The level spreaders shall be constructed as shown in Detail 3, Sheet 7. Soil for fill material shall be moisture conditioned as necessary and compacted as directed by the Engineer using only the bulldozer tracks to prevent over-compaction. Cut and fill slopes shall be seeded in the same manner as the vineyard.

SECTION 19 - TEMPORARY MEASURES

19.1 GENERAL:

Temporary erosion control measures shall be constructed by the Owner. These measures can include water bars, straw wattles, straw mulching, straw bale dikes, and other practices as needed. The measures shall be constructed in conformance with the detail drawings and maintained in a functional condition throughout the rainy season.

SECTION 20 - MAINTENANCE

20.1 GENERAL:

The erosion control measures described in these Specifications and shown on the Plans and Details require regular maintenance in order to function as intended. Vineyard management personnel shall assure that the erosion control measures are monitored throughout the rainy season each year and necessary repairs and/or maintenance are performed immediately. Maintenance operations shall include, but not be limited to the following activities.

20.2 DIVERSION DITCHES & AVENUES:

Ditches and diversion avenues shall be monitored for over-topping and repaired as needed. Debris that could reduce the capacity of the ditch shall be removed during/after each storm event.

20.3 ROLLING DIPS:

The rolling dips shall be monitored and repaired as needed to ensure water is directed off of the roadway. Any accumulated sediment shall be cleaned out by hand. In the event that a rolling dip requires removal of sediment on a regular basis another rolling dip should be constructed uphill as this indicates that spacing is too wide between rolling dips.

20.4 STRAW WATTLES:

Straw wattles shall be monitored and repaired as needed to ensure water does not run under the wattle or between adjacent wattles. Should excessive erosion cause the wattle to fill with sediment, this material shall be removed to a protected location and the source of the sediment located and protected as needed.

20.5 ROCK ENERGY DISSIPATERS:

These structure shall be monitored during/after every runoff event the first year and periodically in subsequent years. Adjustments shall be made as necessary to ensure flow is dissipated in a non-erosive manner.

20.6 DROP INLETS:

Drop inlets are designed with trash racks at the ground surface. Debris shall be removed from trash racks after each storm event or as necessary to assure a clear flow path for water entering the drop inlet. Damaged trash racks shall be repaired immediately in order to assure that unacceptable quantities of debris do not enter the storm drainage piping system.

20.7 LEVEL SPREADERS:

Level spreaders shall be inspected after each storm event the first year and at least annually thereafter to ensure proper functioning.

20.8 DETENTION BASINS:

Detention basins shall be inspected after each rain the first year and at least annually thereafter. Accumulated sediment shall be removed and spread in a safe location and protected as necessary against erosion. Debris shall be removed from the field rock that encases the risers as well as the trash racks after each storm event or as necessary to ensure a clear flow path for water entering the riser. Damaged trash racks shall be repaired immediately in order to ensure that unacceptable quantities of debris do not enter the storm drainage piping system. The risers shall also be inspected annually for any sediment that may have accumulated within the riser itself. Sediment shall be removed and spread in a safe location and protected as necessary.

APPENDIX A

PHOTOGRAPHIC DOCUMENTATION



Photo 1

11/2/2018



Photo 2

11/2/2018



Photo 3

11/2/2018

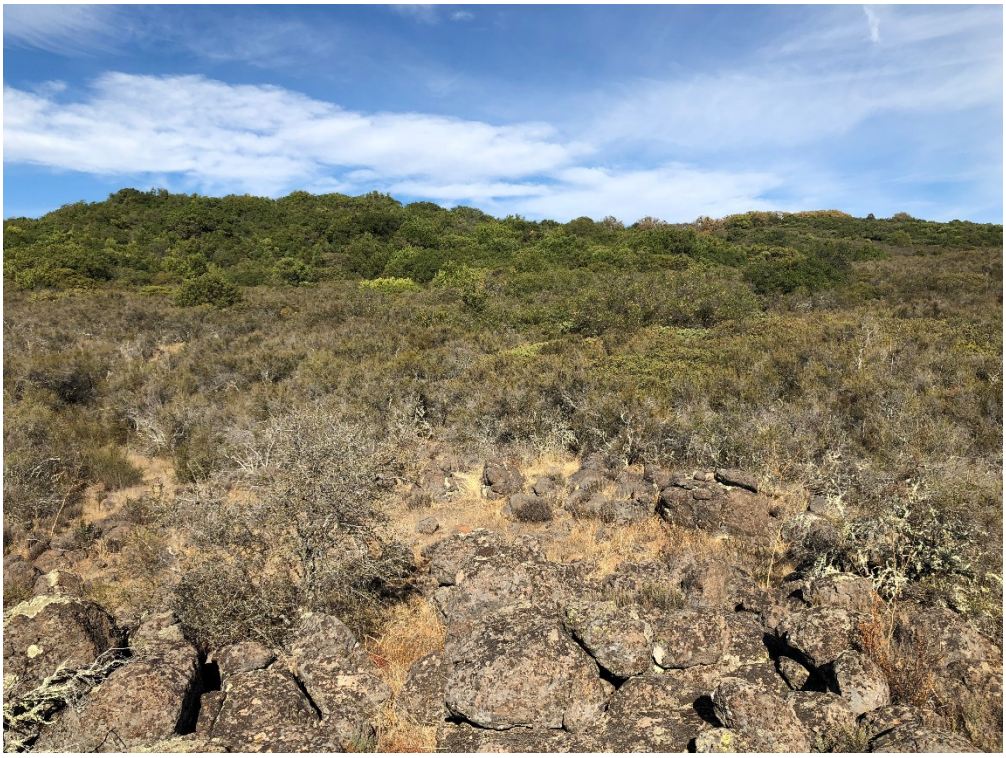


Photo 4

11/2/2018



Photo 5

11/2/2018



Photo 6

11/2/2018

APPENDIX B

USLE CALCULATIONS

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 4 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 144 -K= 0.37
Soil Name Guenoc-Rock Outcrop -R= 75
-T= 2

Percent Cover		65% Up & Down Hill	70% Up & Down Hill	75% Up & Down Hill	80% Up & Down Hill	85% Up & Down Hill	90% Up & Down Hill
		C= 0.058 P= 1.0	C= 0.046 P= 1.0	C= 0.034 P= 1.0	C= 0.022 P= 1.0	C= 0.015 P= 1.0	C= 0.010 P= 1.0
	2	439,218	951,146	2,605,213	11,118,089	39,853,609	153,970,645
	4	9,641	17,211	36,645	108,807	283,455	781,110
	6	1,369	2,177	3,985	9,518	20,474	46,068
	8	631	1,003	1,835	4,383	9,428	21,214
	10	336	535	979	2,338	5,030	11,317
	12	204	324	592	1,415	3,044	6,849
P	14	134	212	389	928	1,996	4,492
E	16	93	148	270	646	1,389	3,125
R	18	68	108	197	470	1,011	2,276
C	20	51	81	149	355	764	1,718
E	22	40	63	116	276	594	1,336
N	24	32	50	92	220	473	1,065
T	26	26	41	75	179	385	866
	28	21	34	62	148	319	717
S	30	18	29	52	125	268	604
L	32	15	24	45	106	229	515
O	34	13	21	38	92	197	444
P	36	12	18	34	80	172	388
E	38	10	16	30	71	152	342
	40	9	14	26	63	135	304
	42	8	13	24	56	121	272
	44	7	12	21	51	109	245
	46	7	11	19	46	99	223
	48	6	10	18	42	91	204
	50	6	9	16	39	83	187

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 4 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 144 -K= 0.37
Soil Name Guenoc-Rock Outcrop -R= 75
-T= 2

Percent Cover		65% Cross-Slope	70% Cross-Slope	75% Cross-Slope	80% Cross-Slope	85% Cross-Slope	90% Cross-Slope
		C= 0.058 P= 0.6	C= 0.046 P= 0.6	C= 0.034 P= 0.6	C= 0.022 P= 0.6	C= 0.015 P= 0.6	C= 0.010 P= 0.6
	2	2,410,880	5,220,865	14,300,078	61,027,451	218,757,397	845,148,495
	4	34,575	61,722	131,413	390,191	1,016,497	2,801,137
	6	3,804	6,048	11,070	26,439	56,874	127,966
	8	1,752	2,785	5,097	12,175	26,190	58,927
	10	935	1,486	2,719	6,495	13,972	31,437
	12	566	899	1,646	3,931	8,456	19,025
P	14	371	590	1,079	2,578	5,545	12,476
E	16	258	410	751	1,794	3,858	8,681
R	18	188	299	547	1,306	2,809	6,321
C	20	142	226	413	986	2,121	4,772
E	22	110	175	321	767	1,649	3,711
N	24	88	140	256	611	1,314	2,957
T	26	72	114	208	497	1,069	2,406
	28	59	94	172	412	886	1,993
S	30	50	79	145	346	745	1,677
L	32	43	68	124	295	635	1,430
O	34	37	58	107	255	548	1,234
P	36	32	51	93	222	479	1,077
E	38	28	45	82	196	422	949
	40	25	40	73	174	375	843
	42	22	36	65	156	336	755
	44	20	32	59	141	303	682
	46	18	29	54	128	275	619
	48	17	27	49	117	252	566
	50	15	25	45	107	231	520

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 3 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 152 -K= 0.10
Soil Name Hambright-Rock Outcrop -R= 75
-T= 1

Percent Cover		65% Up & Down Hill	70% Up & Down Hill	75% Up & Down Hill	80% Up & Down Hill	85% Up & Down Hill	90% Up & Down Hill
		C= 0.058 P= 1.0	C= 0.046 P= 1.0	C= 0.034 P= 1.0	C= 0.022 P= 1.0	C= 0.015 P= 1.0	C= 0.010 P= 1.0
PERCENT SLOPE	2	13,189,317	28,562,037	78,232,125	333,865,812	1,196,766,620	4,623,594,560
	4	123,680	220,788	470,081	1,395,768	3,636,149	10,020,050
	6	10,545	16,765	30,688	73,295	157,666	354,749
	8	4,856	7,720	14,131	33,752	72,603	163,358
	10	2,591	4,119	7,539	18,006	38,734	87,151
	12	1,568	2,493	4,562	10,897	23,441	52,741
	14	1,028	1,635	2,992	7,146	15,372	34,588
	16	715	1,137	2,082	4,972	10,696	24,065
	18	521	828	1,516	3,620	7,788	17,523
	20	393	625	1,144	2,733	5,880	13,229
	22	306	486	890	2,125	4,572	10,287
	24	244	387	709	1,694	3,643	8,197
	26	198	315	577	1,378	2,964	6,670
	28	164	261	478	1,141	2,455	5,525
	30	138	220	402	960	2,066	4,648
	32	118	187	343	819	1,762	3,964
	34	102	162	296	707	1,521	3,421
	36	89	141	258	617	1,327	2,985
	38	78	124	228	543	1,169	2,630
	40	69	110	202	483	1,039	2,338
	42	62	99	181	433	931	2,094
	44	56	89	163	390	840	1,890
	46	51	81	149	355	763	1,717
	48	47	74	136	324	697	1,569
	50	43	68	125	298	641	1,442

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 3 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 152 -K= 0.10
Soil Name Hambright-Rock Outcrop -R= 75
-T= 1

Percent Cover		65% Cross-Slope	70% Cross-Slope	75% Cross-Slope	80% Cross-Slope	85% Cross-Slope	90% Cross-Slope
		C= 0.058 P= 0.6	C= 0.046 P= 0.6	C= 0.034 P= 0.6	C= 0.022 P= 0.6	C= 0.015 P= 0.6	C= 0.010 P= 0.6
PERCENT SLOPE	2	72,396,472	156,777,694	429,417,973	1,832,597,298	6,569,080,139	25,379,019,335
	4	443,529	791,767	1,685,755	5,005,357	13,039,580	35,932,857
	6	29,293	46,570	85,244	203,598	437,962	985,415
	8	13,489	21,445	39,254	93,754	201,676	453,771
	10	7,196	11,441	20,942	50,018	107,594	242,086
	12	4,355	6,924	12,673	30,269	65,113	146,504
	14	2,856	4,540	8,311	19,851	42,701	96,077
	16	1,987	3,159	5,783	13,811	29,710	66,847
	18	1,447	2,300	4,211	10,057	21,633	48,675
	20	1,092	1,737	3,179	7,593	16,333	36,748
	22	849	1,350	2,472	5,904	12,700	28,574
	24	677	1,076	1,970	4,705	10,120	22,771
	26	551	876	1,603	3,828	8,234	18,527
	28	456	725	1,328	3,171	6,820	15,346
	30	384	610	1,117	2,667	5,738	12,910
	32	327	520	952	2,275	4,893	11,010
	34	283	449	822	1,964	4,224	9,504
	36	246	392	717	1,713	3,685	8,292
	38	217	345	632	1,509	3,247	7,306
	40	193	307	562	1,342	2,886	6,493
	42	173	275	503	1,202	2,585	5,817
	44	156	248	454	1,085	2,333	5,250
	46	142	225	413	985	2,120	4,769
	48	130	206	377	901	1,937	4,359
	50	119	189	347	828	1,781	4,007

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 3 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 176 -K= 0.10
Soil Name Rock Outcrop-Hambright -R= 75
-T= 1

Percent Cover		65% Up & Down Hill	70% Up & Down Hill	75% Up & Down Hill	80% Up & Down Hill	85% Up & Down Hill	90% Up & Down Hill
		C= 0.058 P= 1.0	C= 0.046 P= 1.0	C= 0.034 P= 1.0	C= 0.022 P= 1.0	C= 0.015 P= 1.0	C= 0.010 P= 1.0
PERCENT SLOPE	2	13,189,317	28,562,037	78,232,125	333,865,812	1,196,766,620	4,623,594,560
	4	123,680	220,788	470,081	1,395,768	3,636,149	10,020,050
	6	10,545	16,765	30,688	73,295	157,666	354,749
	8	4,856	7,720	14,131	33,752	72,603	163,358
	10	2,591	4,119	7,539	18,006	38,734	87,151
	12	1,568	2,493	4,562	10,897	23,441	52,741
	14	1,028	1,635	2,992	7,146	15,372	34,588
	16	715	1,137	2,082	4,972	10,696	24,065
	18	521	828	1,516	3,620	7,788	17,523
	20	393	625	1,144	2,733	5,880	13,229
	22	306	486	890	2,125	4,572	10,287
	24	244	387	709	1,694	3,643	8,197
	26	198	315	577	1,378	2,964	6,670
	28	164	261	478	1,141	2,455	5,525
	30	138	220	402	960	2,066	4,648
	32	118	187	343	819	1,762	3,964
	34	102	162	296	707	1,521	3,421
	36	89	141	258	617	1,327	2,985
	38	78	124	228	543	1,169	2,630
	40	69	110	202	483	1,039	2,338
	42	62	99	181	433	931	2,094
	44	56	89	163	390	840	1,890
	46	51	81	149	355	763	1,717
	48	47	74	136	324	697	1,569
	50	43	68	125	298	641	1,442

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 3 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 176 -K= 0.10
Soil Name Rock Outcrop-Hambright -R= 75
-T= 1

Percent Cover		65% Cross-Slope	70% Cross-Slope	75% Cross-Slope	80% Cross-Slope	85% Cross-Slope	90% Cross-Slope
		C= 0.058 P= 0.6	C= 0.046 P= 0.6	C= 0.034 P= 0.6	C= 0.022 P= 0.6	C= 0.015 P= 0.6	C= 0.010 P= 0.6
PERCENT SLOPE	2	72,396,472	156,777,694	429,417,973	1,832,597,298	6,569,080,139	25,379,019,335
	4	443,529	791,767	1,685,755	5,005,357	13,039,580	35,932,857
	6	29,293	46,570	85,244	203,598	437,962	985,415
	8	13,489	21,445	39,254	93,754	201,676	453,771
	10	7,196	11,441	20,942	50,018	107,594	242,086
	12	4,355	6,924	12,673	30,269	65,113	146,504
	14	2,856	4,540	8,311	19,851	42,701	96,077
	16	1,987	3,159	5,783	13,811	29,710	66,847
	18	1,447	2,300	4,211	10,057	21,633	48,675
	20	1,092	1,737	3,179	7,593	16,333	36,748
	22	849	1,350	2,472	5,904	12,700	28,574
	24	677	1,076	1,970	4,705	10,120	22,771
	26	551	876	1,603	3,828	8,234	18,527
	28	456	725	1,328	3,171	6,820	15,346
	30	384	610	1,117	2,667	5,738	12,910
	32	327	520	952	2,275	4,893	11,010
	34	283	449	822	1,964	4,224	9,504
	36	246	392	717	1,713	3,685	8,292
	38	217	345	632	1,509	3,247	7,306
	40	193	307	562	1,342	2,886	6,493
	42	173	275	503	1,202	2,585	5,817
	44	156	248	454	1,085	2,333	5,250
	46	142	225	413	985	2,120	4,769
	48	130	206	377	901	1,937	4,359
	50	119	189	347	828	1,781	4,007

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

Napa County
Maximum Length of Slope
for a soil loss of 4 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 178 -K= 0.32
Soil Name Sobrante -R= 75
-T= 2

Percent Cover		65% Up & Down Hill	70% Up & Down Hill	75% Up & Down Hill	80% Up & Down Hill	85% Up & Down Hill	90% Up & Down Hill
		C= 0.058 P= 1.0	C= 0.046 P= 1.0	C= 0.034 P= 1.0	C= 0.022 P= 1.0	C= 0.015 P= 1.0	C= 0.010 P= 1.0
	2	712,611	1,543,191	4,226,838	18,038,583	64,660,630	249,810,222
	4	13,860	24,743	52,680	156,417	407,487	1,122,902
	6	1,831	2,911	5,328	12,725	27,373	61,588
	8	843	1,340	2,453	5,860	12,605	28,361
	10	450	715	1,309	3,126	6,725	15,130
	12	272	433	792	1,892	4,070	9,156
P	14	179	284	519	1,241	2,669	6,005
E	16	124	197	361	863	1,857	4,178
R	18	90	144	263	629	1,352	3,042
C	20	68	109	199	475	1,021	2,297
E	22	53	84	154	369	794	1,786
N	24	42	67	123	294	633	1,423
T	26	34	55	100	239	515	1,158
	28	29	45	83	198	426	959
S	30	24	38	70	167	359	807
L	32	20	33	60	142	306	688
O	34	18	28	51	123	264	594
P	36	15	24	45	107	230	518
E	38	14	22	39	94	203	457
	40	12	19	35	84	180	406
	42	11	17	31	75	162	364
	44	10	16	28	68	146	328
	46	9	14	26	62	132	298
	48	8	13	24	56	121	272
	50	7	12	22	52	111	250

NOTES:
C=Cover and Management Factor
P=Practice Factor

PPI Engineering

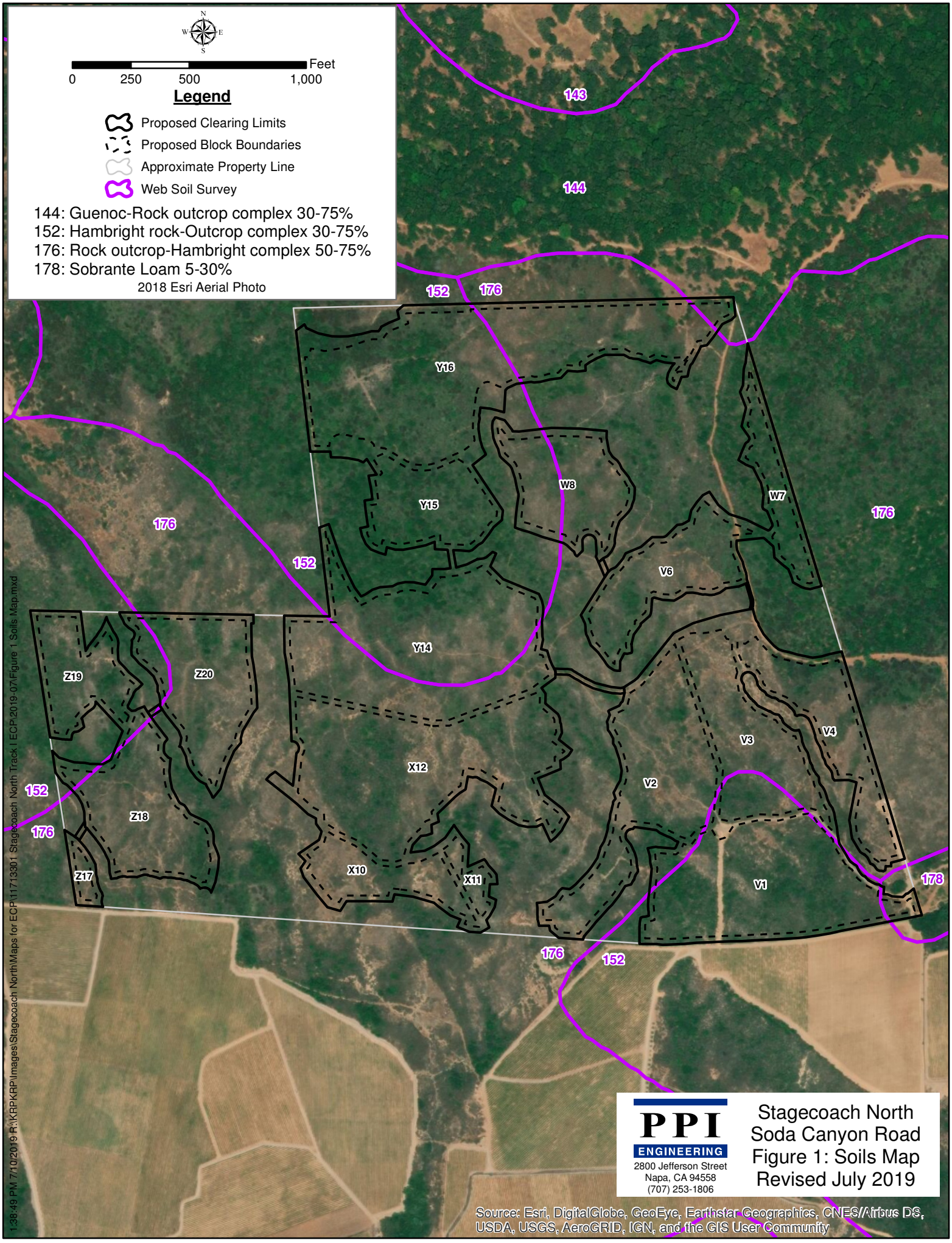
Napa County
Maximum Length of Slope
for a soil loss of 4 tons per acre

NAME: Stagecoach North DATE: 1/31/18

Cover Type: Permanent Cover Crop
Soil Unit No. (100-182)--- 178 -K= 0.32
Soil Name Sobrante -R= 75
-T= 2

Percent Cover		65% Cross-Slope	70% Cross-Slope	75% Cross-Slope	80% Cross-Slope	85% Cross-Slope	90% Cross-Slope
		C= 0.058 P= 0.6	C= 0.046 P= 0.6	C= 0.034 P= 0.6	C= 0.022 P= 0.6	C= 0.015 P= 0.6	C= 0.010 P= 0.6
PERCENT SLOPE	2	3,911,541	8,470,611	23,201,212	99,014,205	354,923,718	1,371,214,188
	4	49,704	88,730	188,915	560,928	1,461,287	4,026,833
	6	5,086	8,085	14,799	35,347	76,035	171,079
	8	2,342	3,723	6,815	16,277	35,013	78,780
	10	1,249	1,986	3,636	8,684	18,679	42,029
	12	756	1,202	2,200	5,255	11,304	25,435
	14	496	788	1,443	3,446	7,413	16,680
	16	345	548	1,004	2,398	5,158	11,605
	18	251	399	731	1,746	3,756	8,451
	20	190	302	552	1,318	2,836	6,380
	22	147	234	429	1,025	2,205	4,961
	24	118	187	342	817	1,757	3,953
	26	96	152	278	665	1,430	3,217
	28	79	126	230	550	1,184	2,664
	30	67	106	194	463	996	2,241
	32	57	90	165	395	850	1,911
	34	49	78	143	341	733	1,650
	36	43	68	125	297	640	1,440
	38	38	60	110	262	564	1,268
	40	34	53	98	233	501	1,127
	42	30	48	87	209	449	1,010
	44	27	43	79	188	405	911
	46	25	39	72	171	368	828
	48	22	36	65	156	336	757
	50	21	33	60	144	309	696

NOTES:
C=Cover and Management Factor
P=Practice Factor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Proposed Block Boundaries
Approximate Property Line
Web Soil Survey
144: Guenoc-Rock outcrop complex 30-75%
152: Hambright rock-Outcrop complex 30-75%
176: Rock outcrop-Hambright complex 50-75%
178: Sobrante Loam 5-30%
2018 Esri Aerial Photo
143
144
152
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Y16
Y15
W8
W7
V6
Y14
Z19
Z20
Z18
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1:38:49 PM 7/10/2019 R:\KRP\KRP\Images\Stagecoach North\Maps for ECP\11713301 Stagecoach North Track I ECP\2019-07\Figure 1 Soils Map.mxd
PPI
ENGINEERING
2800 Jefferson Street
Napa, CA 94558
(707) 253-1806
Stagecoach North
Soda Canyon Road
Figure 1: Soils Map
Revised July 2019
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX C

VEGETATION RETENTION CALCULATIONS

STAGECOACH NORTH
SODA CANYON ROAD
VEGETATION RETENTION CALCULATIONS
BASED ON 1993 PARCELS AND VEGETATION

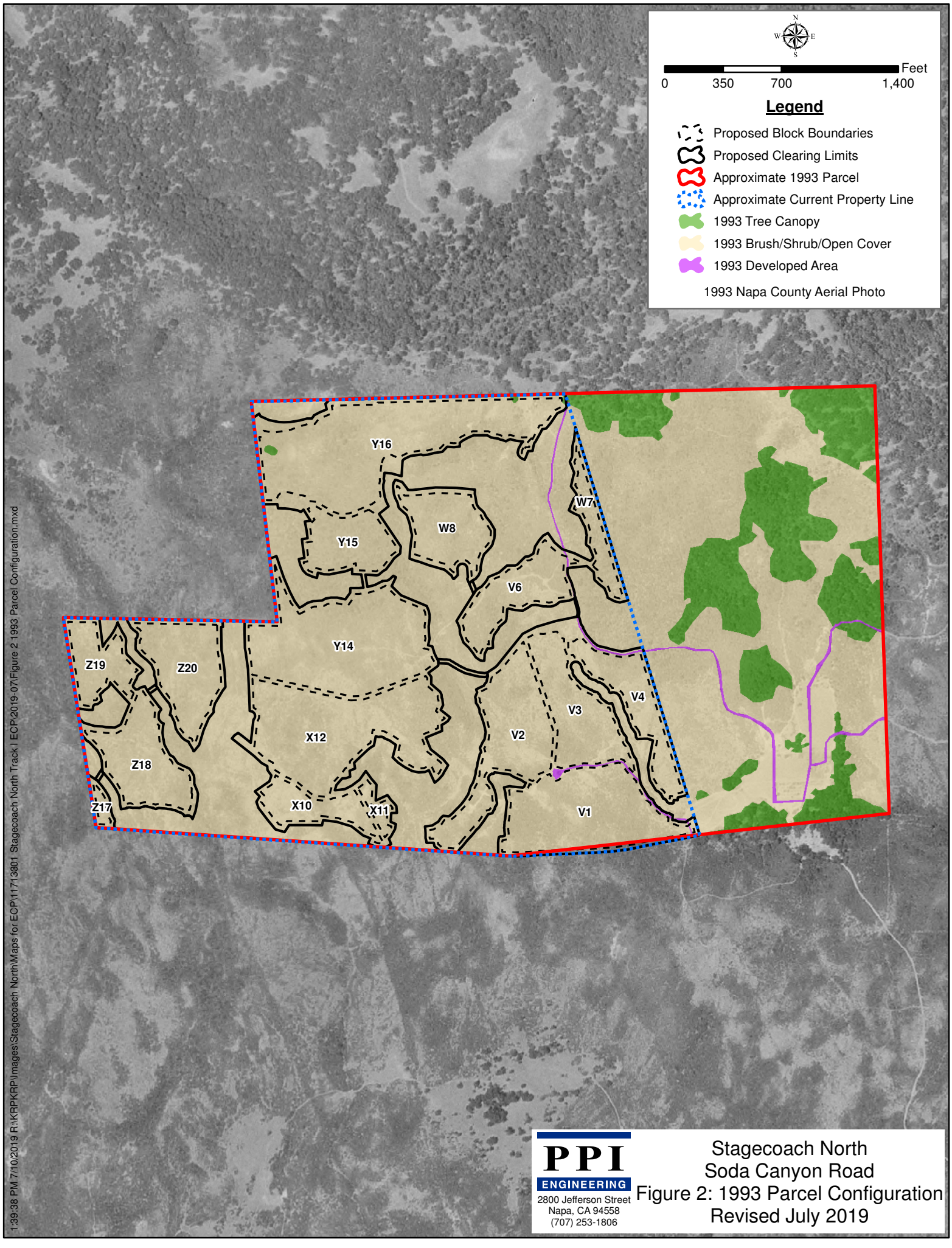
Parcel	Acres
032-010-086 in 1993	259.7
1993 Developed Area	2.0
Proposed Vineyard Area	116.2

	Tree Canopy Cover	Brush/Shrub/Open Cover
Existing in 1993 (acres)	27.9	229.9
Total Allowed to be Removed (acres)	11.1	137.9
Proposed to be Removed (acres)	0.2	114.9
Proposed to be Retained (percent)	99%	50%

Notes:

Some rounding may occur.

Calculations are based on the parcel as it was configured in 1993 per County Code. A subsequent lot line adjustment resulted in the configuration shown throughout the ECP.



1:39:38 PM 7/10/2019 R:\KRPKRP\Images\Stagecoach North\Maps for ECP\11713301 Stagecoach North Track I ECP\2019-07\Figure 2 1993 Parcel Configuration.mxd

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Stagecoach North
Soda Canyon Road
Figure 2: 1993 Parcel Configuration
Revised July 2019

APPENDIX D

SLOPE CALCULATIONS

Stagecoach North
Soda Canyon Road

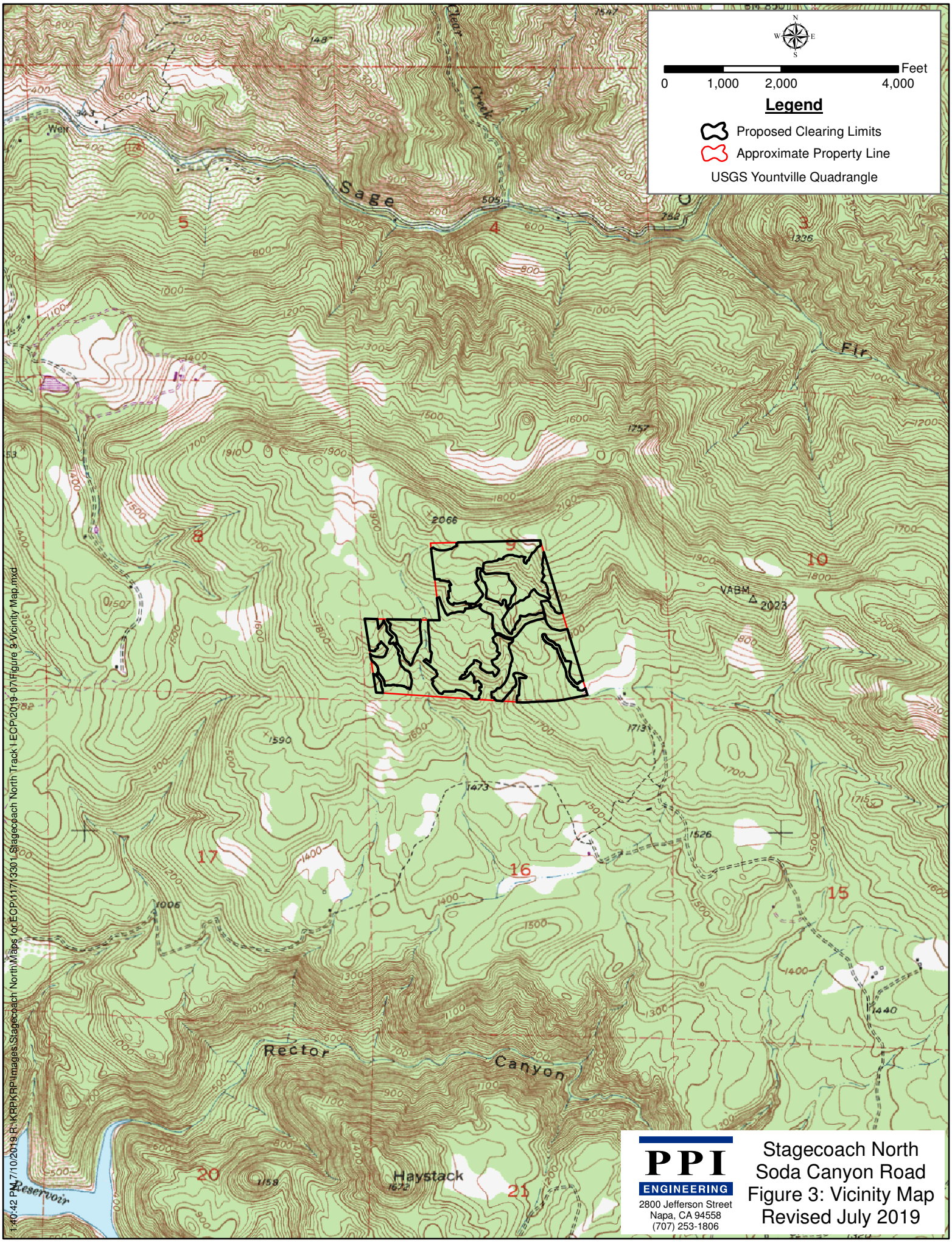
Average Slope Of Proposed Vineyard Blocks

Block	Gross Acres	Net Acres	Slope #1	Slope #2	Average slope
V1	10.5	9.0	14%	19%	17%
V2	8.8	7.0	22%	23%	23%
V3	6.4	5.3	15%	24%	20%
V4	5.7	3.8	13%	17%	15%
V6	5.4	4.0	22%	24%	23%
W7	2.8	1.6	23%	24%	24%
W8	5.3	4.0	7%	20%	14%
X10	3.6	2.5	21%	25%	23%
X11	1.1	0.5	10%	16%	13%
X12	13.3	11.2	16%	20%	18%
Y14	13.7	11.8	12%	18%	15%
Y15	4.6	3.6	17%	18%	18%
Y16	17.6	14.1	20%	21%	21%
Z17	0.7	0.3	10%	11%	11%
Z18	6.3	4.9	15%	18%	17%
Z19	3.8	2.7	13%	19%	16%
Z20	6.3	5.0	23%	24%	24%
Avenues & rock disposal areas	0.3	N/A			
Total	**116.2**	**91.3**			**18%**

Note: Some rounding may occur.

APPENDIX E

SUPPORTING FIGURES



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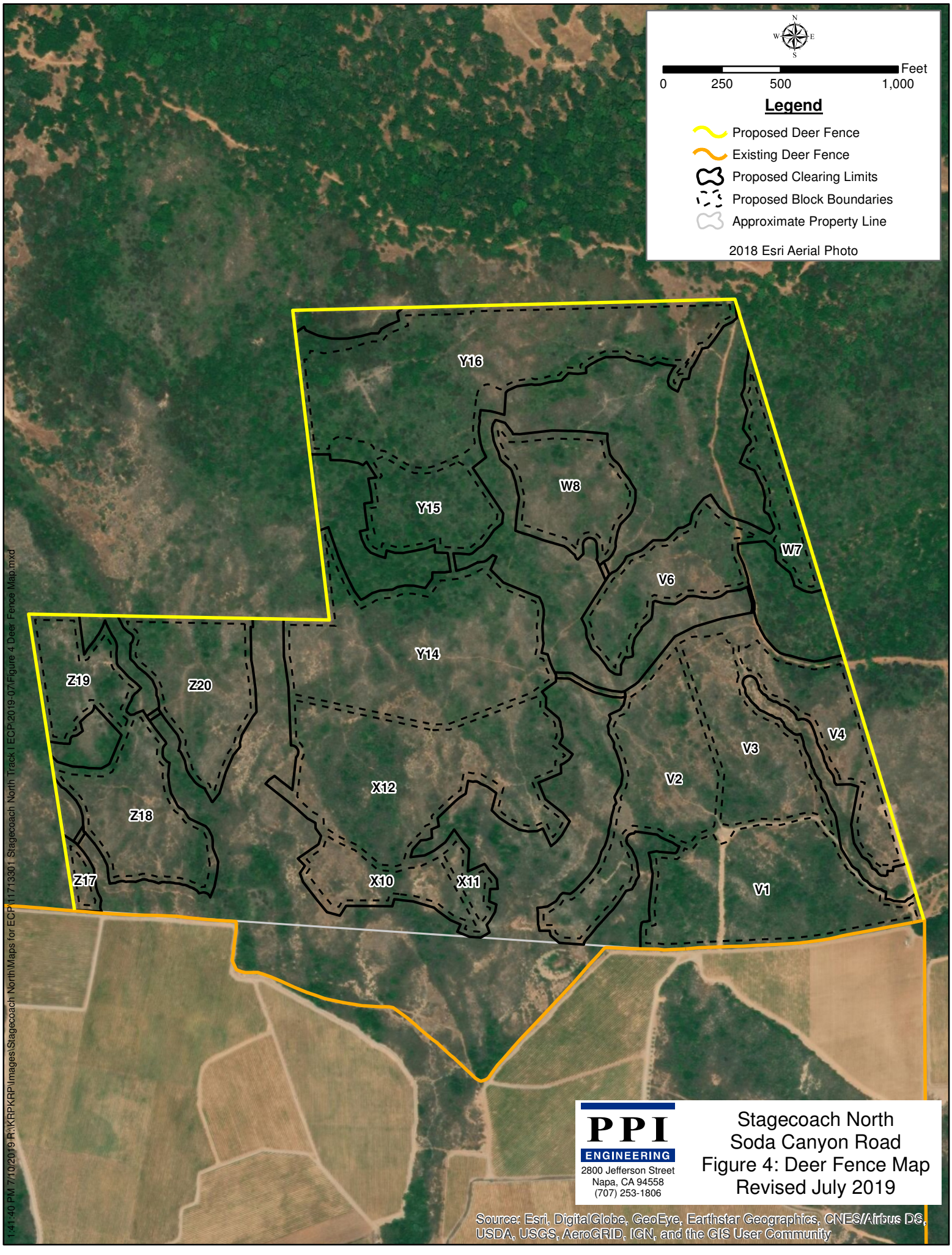
Stagecoach North
Soda Canyon Road
Figure 3: Vicinity Map
Revised July 2019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Proposed Block Boundaries
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1:41:40 PM 7/10/2019 R:\KRP\KRP\Images\Stagecoach North\Maps for ECP\11713301 Stagecoach North Track I ECP\2019-07\Figure 4 Deer Fence Map.mxd
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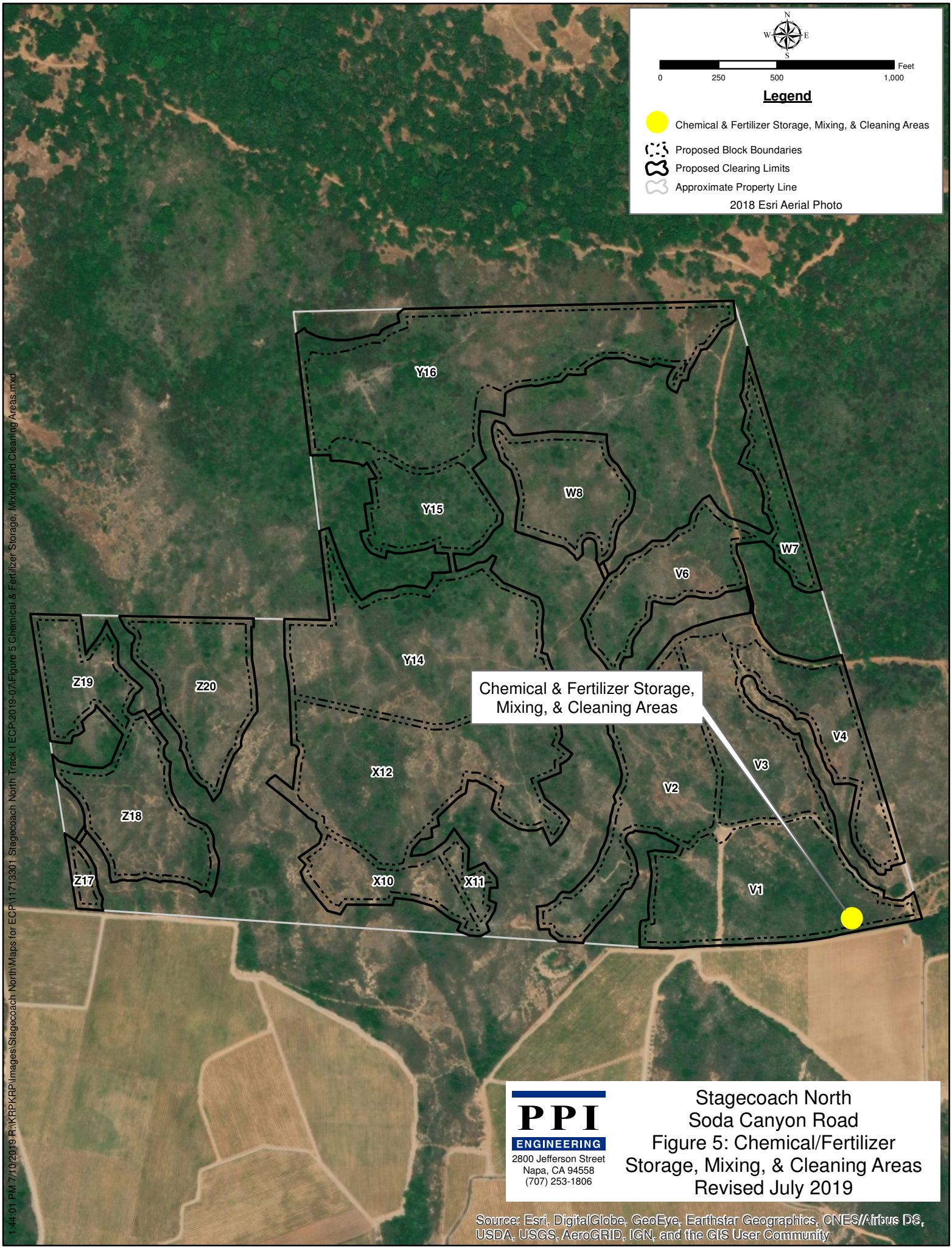
ENGINEERING
2800 Jefferson Street
Napa, CA 94558
(707) 253-1806
Stagecoach North
Soda Canyon Road
Figure 4: Deer Fence Map
Revised July 2019
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community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Chemical & Fertilizer Storage, Mixing, & Cleaning Areas
Proposed Block Boundaries
Proposed Clearing Limits
Approximate Property Line
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Chemical & Fertilizer Storage, Mixing, & Cleaning Areas
1:44:01 PM 7/10/2019 R:\KRP\KRP\Images\Stagecoach North\Maps for ECP\11713301 Stagecoach North Track I ECP\2019-07\Figure 5 Chemical & Fertilizer Storage, Mixing and Cleaning Areas.mxd
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ENGINEERING
2800 Jefferson Street
Napa, CA 94558
(707) 253-1806
Stagecoach North
Soda Canyon Road
Figure 5: Chemical/Fertilizer Storage, Mixing, & Cleaning Areas
Revised July 2019
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

APPENDIX F

ROAD PLAN

STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN

R O A D P L A N

SECTION 1 - INTRODUCTION

Road systems can be a significant but easily controlled source of sediment production and delivery to stream channels (Napolitano et. al. 2009). The recommendations contained within this Road Plan are consistent with recent road management plans prepared by the Napa County Resource Conservation District (RCD) and with guidance presented within the Mendocino County RCD's *Forest and Ranch Roads Handbook* (Weaver, W.E., and Hagans, D.K. 2014).

Stagecoach North is largely undeveloped, but does contain an existing road network of dirt roads and hand-cut trails throughout the property at Assessor's Parcel Number (APN) 032-010-086. This plan addresses road improvements associated with the proposed new vineyard blocks requested in this Track I Erosion Control Plan (ECP).

Access to the Stagecoach North property is derived from a private road from Soda Canyon Road to the main Stagecoach Vineyard property. The extensive road network on the Stagecoach Vineyard property is in excellent condition and will continue to be maintained in its current state, which includes gravel, rolling dips, and waterbars as needed. No changes or improvements are required as a result of this project, but they are mentioned here as they provide primary access to the proposed vineyard blocks on the Stagecoach North property. These roads are shown in Figure 6 as "Existing Roads, Not Part of this Project."

There are 0.9 miles of existing dirt roads on the Stagecoach North property, shown on Figure 6 as "Existing Road, Level 2". There are 0.6 miles of these existing roads shown as "Existing Roads, to be Upgraded to Level 1" where they provide primary access to groups of vineyard blocks. Finally, there are 0.2 miles of existing dirt road that will be decommissioned as part of this project. There are no new roads proposed.

Section 2 below discusses proposed improvements and recommendations to ensure that the increased usage of these existing dirt roads does not increase erosion or sedimentation to local waterways. No new roads are required for access to any of the proposed vineyard blocks.

SECTION 2 - PROPOSED IMPROVEMENTS

2.1 LEVEL 1 ROADS

Roads that provide primary access to the proposed vineyard blocks shown on Figure 6 will be surfaced with crushed rock as directed in the field by the Engineer. Approximately 0.6 miles of existing dirt roads will be upgraded to Level 1 roads as part of the project. A 3-inch minus

aggregate base material would be applied to the existing road width at a 3-6 inch depth to the road surface to ensure vehicle traffic would not degrade the road surface during wet periods of the year. This material would be applied concurrently with vineyard development. Applying crushed rock to a road surface is an effective means of reducing erosion caused by vehicle traffic and the subsequent potential for delivery of sediment to the stream system. Roads would be improved to reproduce natural drainage patterns and promote sheet flow through the use of Best Management Practices (BMPs), such as outsloping, berm removal, and frequent (approximately 150-foot spacing) rolling dip or waterbar construction as designated in the field by the Engineer.

Rolling dips are proposed in certain locations as shown on Figure 6 of the ECP where the existing road runs uphill and there is the potential for runoff to run down the road surface and cause erosion or gullying, or in locations as needed to ensure roads are hydrologically disconnected from receiving waters. The rolling dip serves to direct water off of the road surface and back onto native ground surface where vegetation will slow the water and allow it to infiltrate. In addition to those locations designated in the ECP, rolling dips may be recommended by the Engineer in the field at the time of construction

2.2 LEVEL 2 ROADS

Level 2 roads are typically dirt roads that will be used seasonally during dry periods of the year to provide secondary access to some vineyard blocks. There are 0.1 miles of existing dirt roads on the property that will remain as Level 2 roads under this project. This stretch of road would receive the same BMPs and road shaping as the Level 1 roads, except that the road surface would not be surfaced with crushed rock. This Level 2 road will be a vineyard avenue after implementation of the project and will receive the same vegetative cover crop requirements as the adjacent vineyard block pursuant to the ECP.

2.3 DECOMMISSIONED ROADS

Portions of existing roads will be decommissioned by incorporating them into vineyard blocks. In those locations, the access roads will be realigned to the outer vineyard avenue. All roads proposed for decommissioning would be decompacted by the use of a bulldozer ripping to at least a 6-inch depth. When the decommissioned road becomes part of the vineyard block it will be required to maintain the same percentage of vegetative cover as the surrounding vineyard. Approximately 0.2 miles of existing dirt road will be decommissioned as part of the project.

2.4 VEGETATED AVENUES

In addition to the graveled and dirt primary roads on the property, there will also be a network of vegetated vineyard avenues that surround vineyard blocks and provide access for farming equipment and workers. These avenues are reseeded as needed to ensure appropriate levels of vegetative cover are maintained as required in the engineered Erosion Control Plans that cover these avenues. Per the *Forest and Ranch Roads Handbook*, "[v]egetation protects erodible soil from raindrop impact and soil particle detachment, increases surface roughness and reduces surface runoff velocity." Section 8b of the ECP Narrative discusses the percent vegetative cover that is required for each vineyard avenue associated with the proposed vineyard blocks within this ECP.

2.5 ROCKED WATER CROSSINGS

There are three rocked water crossings proposed as part of the vineyard development. The Forest and Ranch Roads Handbook recommends the use of rocked water crossings for "ephemeral and intermittent streams when the majority of traffic will be crossing during low flow or dry conditions." Utilizing rocked water crossings instead of low-water crossings will ensure the continued stability of these drainages and minimize sedimentation caused by vineyard traffic. The rocked water crossing is shown on Detail 1 on Sheet 5 of this ECP, and the specifications are discussed in Section 12 of the Special Provisions.

2.6 UPGRADE EXISTING CULVERT

There is an existing undersized culvert located on the property that will be upgraded to a larger 48" diameter culvert as part of the vineyard development. The Forest and Ranch Roads Handbook states that "flow capacity is one of the most important factors in stream crossing design, especially when using culverts." Upgrading the existing culvert to an appropriately sized culvert will minimize the potential for plugging and other issues that can be caused by an undersized culvert. In addition, the road will be regraded and hydrologically disconnected from the stream channel via a proposed ditch upslope of this crossing that will end above the crossing in a protected outlet (rock energy dissipater). The proposed culvert replacement is shown on Detail 4 on Sheet 5 of this ECP, and the specifications are discussed in Section 11 of the Special Provisions.

SECTION 3 - SEDIMENT SAVINGS

The San Francisco Bay Regional Water Quality Control Board (RWQCB), Napa County RCD, and Pacific Watershed Associates (PWA) are considered to be regional experts on the construction and evaluation of roads in this area. These experts estimate that 50 percent of the total road length on the landscape is hydrologically connected to stream systems and assume a 25-foot wide road prism with 0.4-foot road/cutbank surface lowering over two decades on all unpaved roads (PWA, 2003 and Napolitano et al., 2009). By this estimation, 0.45 miles (2,376 feet) of the existing dirt roads on the property are hydrologically connected to onsite drainages and would contribute 880 cubic yards of sediment to the stream system over two decades under the current, pre-project conditions.

$$\text{Existing erosion from onsite dirt roads} = \frac{2{,}376' * 25' * 0.4'}{27'} = 880 \text{ cubic yards}$$

Upgrading 0.6 miles (3,168 feet) of existing dirt roads to graveled Level 1 roads and decommissioning 0.2 miles (1,056 feet) of dirt roads will result in a sediment savings of approximately 782.2 cubic yards.

$$\text{Sediment savings} = \frac{2{,}112' * 25' * 0.4'}{27'} = 782.2 \text{ cubic yards}$$

The assumption that 50 percent of the ranch roads are hydrologically connected is for a typical property, but likely overstates the hydrologic connectivity of the roads on the Stagecoach North property. This property does not have many stream crossings, care has been taken to place rolling dips at critical locations to disconnect the roadways from receiving waters, and there are usually vegetated buffers between the existing dirt roads and drainages, all factors that affect the deposition of sediment from a road surface into a waterway. Using a value of 50 percent of the road length as being hydrologically connected likely overstates the amount of road erosion, and therefore presents a conservative assessment of the existing conditions.

SECTION 4 - CONCLUSIONS

Road-related sediment can be prevented from entering the stream system through a variety of best management practices and erosion prevention treatments that generally involve dispersing road runoff and disconnecting road surface and ditch drainage. The recommendations in this Road Plan are consistent with guidance from the Napa County RCD and the Handbook for Forest and Ranch Roads and will ensure that the existing road network will be upgraded as necessary to minimize potential for erosion and sediment delivery to local drainages. It is estimated that the upgrading of 0.6 miles of existing roads on the property and decommissioning of 0.2 mile of existing road will decrease road-related sediment delivery from 880 cubic yards to 97.8 cubic yards, a decrease of approximately 89 percent.

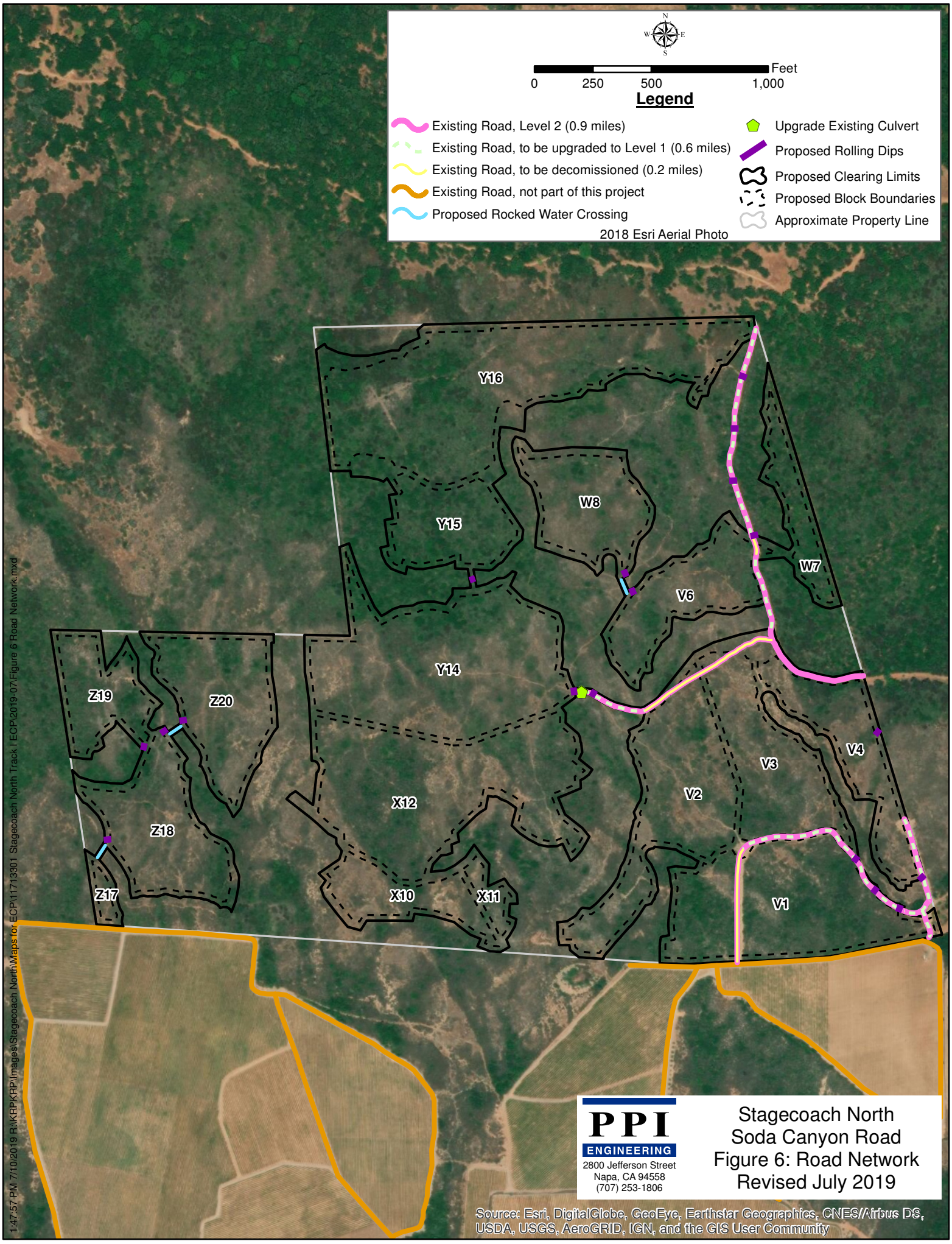
SECTION 5 - REFERENCES

Napolitano, Potter, Whyte 2009. *Napa River Sediment TMDL and Habitat Enhancement Plan.* California Regional Water Quality Control Board, San Francisco Bay Region.

Pacific Watershed Associates (PWA), 2003a. *Road Assessment and Erosion Prevention Planning Project for the Dry Creek Watershed, Napa County, California.* Prepared for Napa County Resource Conservation District, Napa, California.

Pacific Watershed Associates (PWA), 2003b. *Sediment sources assessment, a component of the watershed management plan for the Carneros Creek Watershed, Napa County, California.* Prepared for Napa County Resource Conservation District, Napa, California.

Weaver, W.E., and Hagans, D.K., 2014, *Handbook for Forest and Ranch Roads*: A Guide for Planning, Designing, Constructing, Reconstructing, Maintaining and Closing Wildland Roads: Ukiah, CA, Mendocino County Resource Conservation District.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Existing Road, Level 2 (0.9 miles)
Existing Road, to be upgraded to Level 1 (0.6 miles)
Existing Road, to be decomissioned (0.2 miles)
Existing Road, not part of this project
Proposed Rocked Water Crossing
Upgrade Existing Culvert
Proposed Rolling Dips
Proposed Clearing Limits
Proposed Block Boundaries
Approximate Property Line
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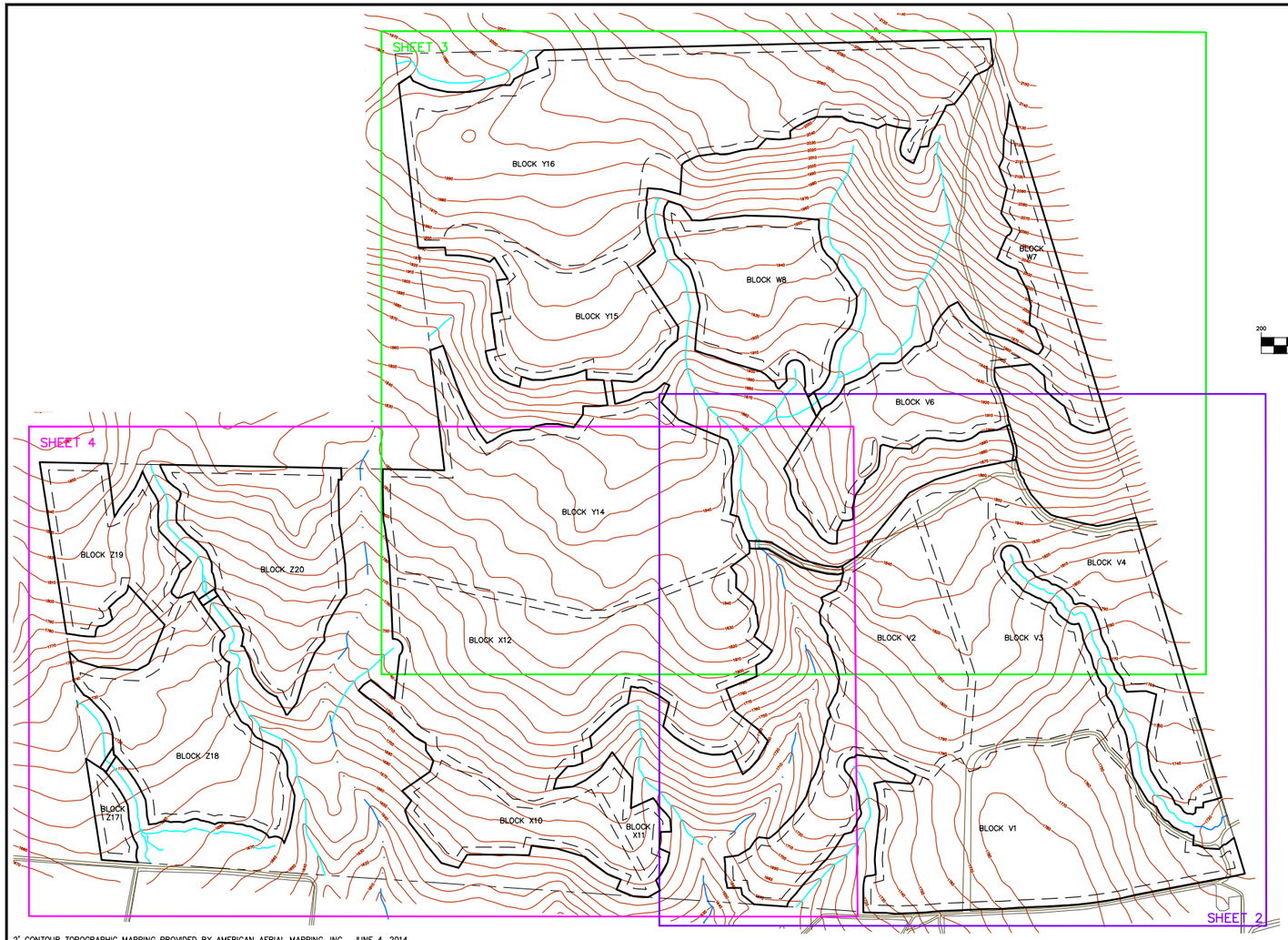
ENGINEERING
2800 Jefferson Street
Napa, CA 94558
(707) 253-1806
Stagecoach North
Soda Canyon Road
Figure 6: Road Network
Revised July 2019
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014
NOTE: INTERMEDIATE CONTOURS ARE TURNED OFF ON THIS SHEET

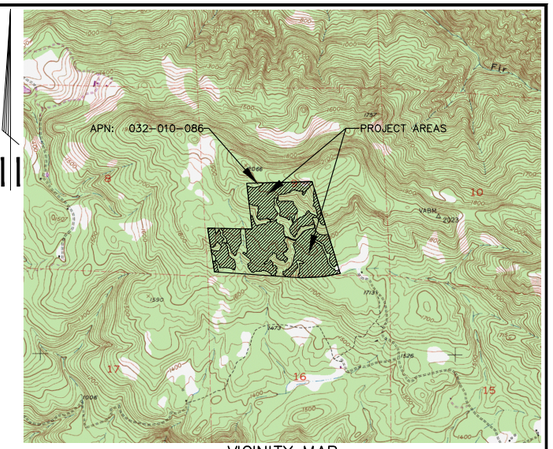
LEGEND

- AMERICAN AERIAL INDEX CONTOUR
- APPROXIMATE PROPERTY LINE (SEE NOTE 15, THIS SHEET)
- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING ROAD
- EXISTING VINEYARD BLOCK
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.



VICINITY MAP
USGS YOUNTVILLE QUADRANGLE
TOWNSHIP 7 N., RANGE 4 W.
SCALE: 1" = ±2000'

NOTES:

1. OWNER: GALLO VINEYARDS INC.
   SITE ADDRESS: NO SITUS
   APN: 032-010-086
2. ACCESS TO PROJECT IS FROM SODA CANYON ROAD. THE SITE IS GATED AND LOCKED. ADMITTANCE IS AVAILABLE UPON REQUEST.
3. EXISTING VEGETATION CONSISTS OF BRUSH, GRASS, & TREES.
4. DISTURBED AREAS SHALL BE SEEDED AS DESCRIBED BELOW. STRAW MULCH SHALL BE APPLIED TO ALL DISTURBED AREAS AT A RATE OF 3,000 POUNDS PER ACRE PRIOR TO SEPTEMBER 15 OF THE YEAR OF CONSTRUCTION.
5. PERMANENT COVER CROP (NO-TILL):
   A PERMANENT COVER CROP STRATEGY WILL BE UTILIZED. THE PERMANENT COVER CROP WILL BE GENERATED THE FIRST YEAR BY SEEDING WITH THE FOLLOWNG MIX:

VARIETY	RATE (LBS/ACRE)
BLANDO BROME	20
ZORRO FESCUE	12
SUBTERRANEAN CLOVER	4
HYKON ROSE CLOVER	4

   A PRE-APPROVED ALTERNATIVE SEED MIX MAY BE ALLOWED.

   THE PERMANENT COVER CROP WILL BE MANAGED EACH YEAR SUCH THAT ANY AREAS WHICH HAVE LESS THAN THE PERCENT VEGETATIVE COVER SPECIFIED BELOW WILL BE RESEEDED AND MULCHED UNTIL ADEQUATE COVERAGE IS ACHIEVED. THE PERMANENT COVER CROP SHALL BE MOWED ONLY AND NOT DISKED.

   BLOCKS WITH 75% VEGETATIVE COVER: V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20

   BLOCKS WITH 80% VEGETATIVE COVER: V1, Y15, Y16, & Z19

   BLOCK WITH 85% VEGETATIVE COVER: W7
6. THE PERMANENT COVER MUST BE ESTABLISHED THE FIRST YEAR. DISKING FOR THE FIRST THREE YEARS TO AID WITH VINEYARD ESTABLISHMENT IS NOT PERMITTED.
7. NO PRE-EMERGENT HERBICIDES WILL BE STRIP SPRAYED IN THE VINEROWS FOR WEED MANAGEMENT. CONTACT OR SYSTEMIC HERBICIDES MAY BE APPLIED IN SPRING (NO EARLIER THAN FEBRUARY 15TH TO ENSURE ADEQUATE VEGETATIVE COVER IN THE SPRAY STRIPS FOR THE REMAINDER OF THE RAINY SEASON). IN BLOCKS V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20 THE WIDTH OF THE SPRAY STRIP SHALL BE NO WIDER THAN 1.5' IN ORDER TO ACHIEVE 75% VEGETATIVE COVER (BASED ON A SIX FOOT VINEROW). IN BLOCKS V1, Y15, Y16, & Z19 THE WIDTH OF THE SPRAY STRIP SHALL BE NO WIDER THAN 1 FOOT IN ORDER TO ACHIEVE 80% VEGETATIVE COVER (BASED ON A SIX FOOT VINEROW). IN BLOCK W7 NO STRIP SPRAYING SHALL BE PERFORMED. IN BLOCK W7 SPOT SPRAYING OF CONTACT OR SYSTEMIC HERBICIDES IN SPRING (NO EARLIER THAN FEBRUARY 15) WILL BE ALLOWED PROVIDED THE 85% VEGETATIVE COVER IS ACHIEVED IN THE BLOCK. IF THE OWNER CHOOSES TO FARM WITHOUT HERBICIDE, AN ALTERNATIVE WILL BE TO HAND-HOE AROUND THE BASE OF THE VINE ONLY, OR OTHER METHODS THAT DO NOT RESULT IN A CONTINUOUS BARE STRIP.
8. THE VINEYARD AVENUES SHALL BE MOWED ONLY AND SHALL NOT BE DISKED. UNLESS OTHERWISE NOTED, ALL AVENUES SHALL CONFORM TO THE NATURAL GRADE. VINEYARD AVENUES SHALL BE SEEDED AND MULCHED PRIOR TO SEPTEMBER 15 OF THE YEAR OF CONSTRUCTION AND IN SUBSEQUENT YEARS IN BARE OR DISTURBED AREAS. THE COVER CROP WILL BE MANAGED EACH YEAR SUCH THAT ANY AVENUES THAT HAVE LESS THAN THE PERCENT VEGETATIVE COVER SPECIFIED BELOW WILL BE RESEEDED AND MULCHED UNTIL ADEQUATE COVERAGE IS ACHIEVED. SEEDING AND MULCHING IS NOT REQUIRED ON AVENUES AND ROADS PROPERLY SURFACED WITH GRAVEL.

   BLOCKS WITH 75% VEGETATIVE COVER: V2, V3, V4, V6, W8, X10, X11, X12, Y14, Z17, Z18, & Z20

   BLOCKS WITH 80% VEGETATIVE COVER: V1, Y15, Y16, & Z19

   BLOCK WITH 85% VEGETATIVE COVER: W7
9. FERTILIZER SHALL BE APPLIED AS NECESSARY BY VINEYARD MANAGEMENT PERSONNEL FOR BOTH THE VINEYARD AND TO ENSURE SPECIFIED PERCENT VEGETATIVE COVER CROP IS ACHIEVED. SITE-SPECIFIC SOIL ANALYSIS SHOULD BE PERFORMED.
10. THE PROPOSED VINE BY ROW SPACING IS EXPECTED TO BE 6' BY 4,' HOWEVER IN AREAS WHERE CROSS-SLOPE EXCEEDS 15% THE OWNER SHALL INCREASE THE ROW SPACING AS NEEDED TO ENSURE THERE IS ADEQUATE ROOM FOR EQUIPMENT. WIDTH OF TILLAGE EQUIPMENT SHALL BE NO MORE THAN 75% OF ROW WIDTH TO ALLOW FOR BENCH FORMATION AND TO MINIMIZE EROSION.
11. THE OWNER HAS THE FREEDOM TO FURTHER SUBDIVIDE VINEYARD BLOCKS WITHIN THE FOOTPRINT OF THE PROPOSED VINEYARD FOR IRRIGATION AND VITICULTURE PURPOSES. THE PROPOSED VINEROW DIRECTIONS SHALL NOT BE ALTERED WITHOUT AN APPROVED MODIFICATION FROM NAPA COUNTY.
12. THE LOCATION OF THE WELLS, THE PROPOSED WATER SOURCES, ARE SHOWN ON SHEET 2.
13. A PORTION OF THE PROPERTY IS CURRENTLY DEER FENCED. PLEASE SEE FIGURE 4 IN APPENDIX E FOR THE PROPOSED DEER FENCE MAP.
14. REQUESTS FOR FURTHER INFORMATION, CLARIFICATION OF WORK TO BE DONE, OR INSPECTION INFORMATION CAN BE MADE TO JIM BUSHEY OR MATT BUENO AT PPI ENGINEERING IN NAPA, (707) 253-1806.
15. PROPERTY LINES AS SHOWN ARE APPROXIMATE. OWNER SHALL BE RESPONSIBLE FOR SURVEYING PROPERTY LINE(S) AS NECESSARY PRIOR TO ANY SITE DISTURBANCE. THERE IS CURRENTLY A LOT-LINE ADJUSTMENT BEING PURSUED FOR THE PARCEL, THE PROJECT ASSUMES THE LOT-LINE ADJUSTMENT WAS RECORDED.
16. THE OWNER SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS.
17. AT LEAST 48 HOURS PRIOR TO EXCAVATING, THE CONTRACTOR SHALL CALL UNDERGROUND SERVICES ALERT (U.S.A.) AT 1-800-642-2444 IN ORDER TO LOCATE EXISTING UTILITIES. IT IS THE OWNER'S RESPONSIBILITY TO LOCATE ANY ADDITIONAL UNDERGROUND UTILITIES THAT MAY HAVE BEEN INSTALLED "IN-HOUSE" OR BY PRIVATE CONTRACTORS AND THEREFORE MAY NOT BE LOCATED THROUGH UNDERGROUND SERVICE ALERT.
18. IT IS THE OWNER'S RESPONSIBILITY TO INSTALL ALL STRUCTURAL MEASURES AS SHOWN ON THE SITE PLAN AND DETAILS AND AS DESCRIBED IN THE SPECIFICATIONS WITHIN THE TIME FRAMES SPECIFIED FOR THIS PROJECT. ANY DEVIATION FROM THESE PLANS MUST BE REVIEWED AND APPROVED BY NAPA COUNTY PLANNING, BUILDING AND ENVIRONMENTAL SERVICES DEPARTMENT. IT IS THE OWNER'S RESPONSIBILITY TO INITIATE THIS MODIFICATION PROCESS. PPI ENGINEERING MUST BE NOTIFIED AT LEAST 48 HOURS IN ADVANCE OF CONSTRUCTION IN ORDER TO SCHEDULE A PRE-CONSTRUCTION MEETING WITH THE OWNER/MANAGER AND CONTRACTOR(S). FOR ONGOING MULTI-YEAR PROJECTS PPI ENGINEERING MUST BE NOTIFIED AT LEAST 48 HOURS IN ADVANCE OF RESUMING CONSTRUCTION EACH YEAR.

REGISTERED PROFESSIONAL ENGINEER — JAMES C. JOHNSON — No. 49931 — EXPIRES: 9-30-20 — Civil — STATE OF CALIFORNIA

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707/253-1806 FAX 707/253-1604

JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
SITE PLAN

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	JCJ, CC	07-10-19	1 OF: 7

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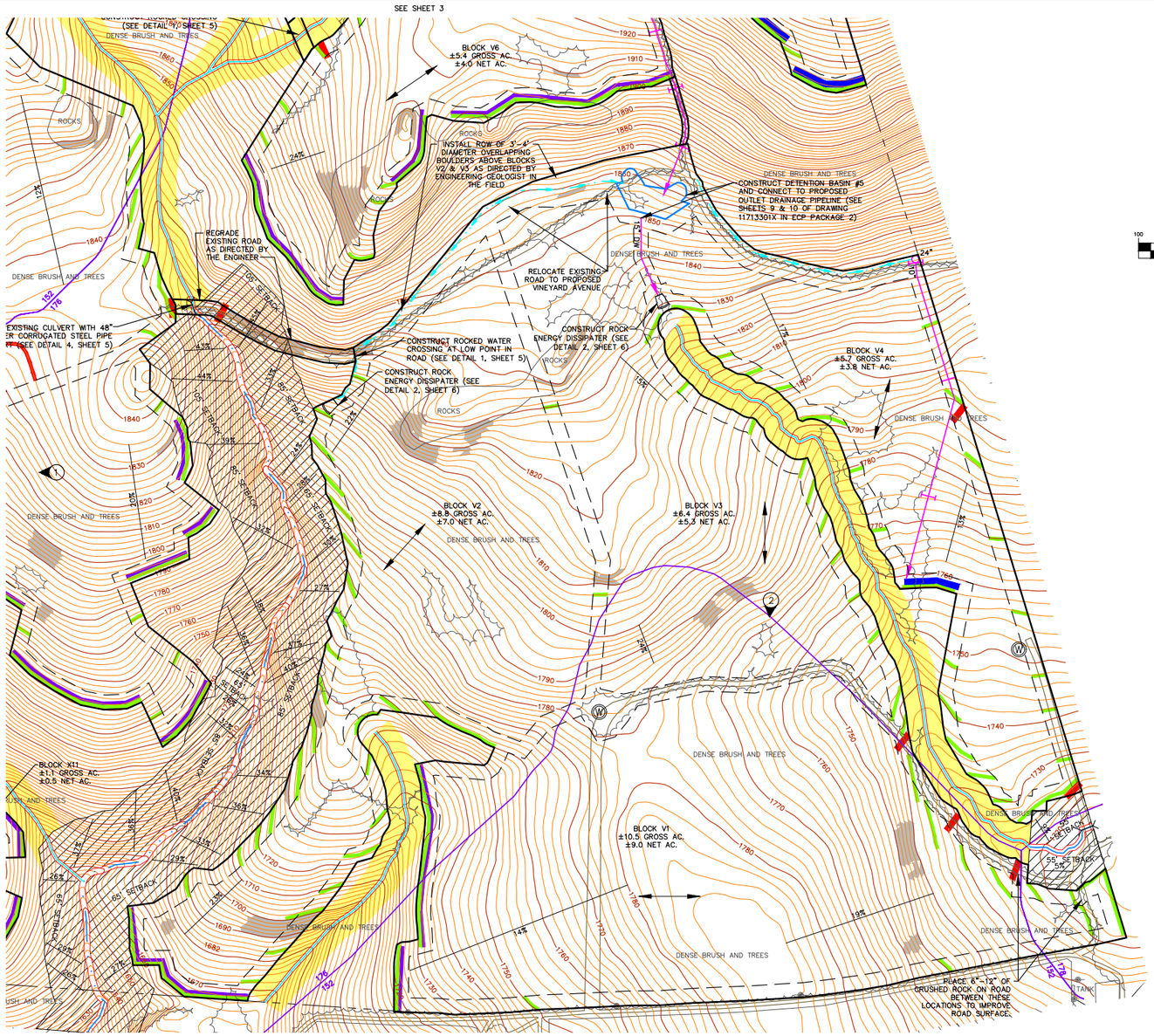

2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- APPROXIMATE PROPERTY LINE (SEE NOTE 15, SHEET 1)
- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- TOP OF BANK, APPROXIMATE LOCATION
- NAPA COUNTY STREAM SETBACK
- 26' UNDISTURBED FILTER STRIP
- EXISTING ROAD
- EXISTING CULVERT TO BE MAINTAINED
- EXISTING VINEYARD BLOCK
- (W) EXISTING WELL, APPROXIMATE LOCATION
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DIVERSION DITCH (SEE DETAIL 2, SHEET 5)
- X" PROPOSED DROP INLET AND DIAMETER (SEE DETAIL 6, SHEET 5)
- X" PROPOSED SURFACE DRAINAGE PIPELINE AND DIAMETER, SINGLE WALL UNLESS OTHERWISE NOTED (SEE DETAIL 3, SHEET 6)
- PROPOSED CUTOFF COLLAR (SEE DETAIL 5, SHEET 6)
- DW DUAL WALL CORRUGATED POLYETHYLENE PIPE
- PROPOSED STRAW WATTLE (SEE DETAIL 4, SHEET 6)
- PROPOSED ROCK BENCH/LEVEL SPREADER (SEE DETAIL 1, SHEET 6)
- PROPOSED ROCK FILLED AVENUE (SEE DETAIL 2, SHEET 7)
- PROPOSED ROLLING DIP (SEE DETAIL 1, SHEET 7)
- AREA WHERE GROUND SLOPE IS 30 PERCENT OR GREATER
- PROPOSED VINEROW DIRECTION
- (X) PHOTO POINT NUMBER & LOCATION (SEE APPENDIX A)
- X% AVERAGE SURFACE SLOPE
- 176 / 152 SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

152	HAMBRIGHT ROCK–OUTCROP COMPLEX, 30–75% SLOPE
176	ROCK OUTCROP–HAMBRIGHT COMPLEX, 50–75% SLOPE
178	SOBRANTE LOAM, 5–30% SLOPE

REGISTERED PROFESSIONAL ENGINEER
JAMES R. BUSHEY
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

REV. NO.	DESCRIPTION	BY	DATE
1	THIS DRAWING SUPERSEDES DRAWING 11713301A. ADDED NOTE TO INSTALL ROW OF BOULDERS ABOVE BLOCKS V2 AND V3 AS DIRECTED BY ENGINEERING GEOLOGIST IN THE FIELD.	ALB	07–10–19

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STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
BLOCKS V1–V4

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

JOB NO:	SCALE:	DRAWN BY:	DATE:	SHEET:
11713301	AS SHOWN	JCJ, CC	07–10–19	2 OF: 7

DWG. NO: 11713301B

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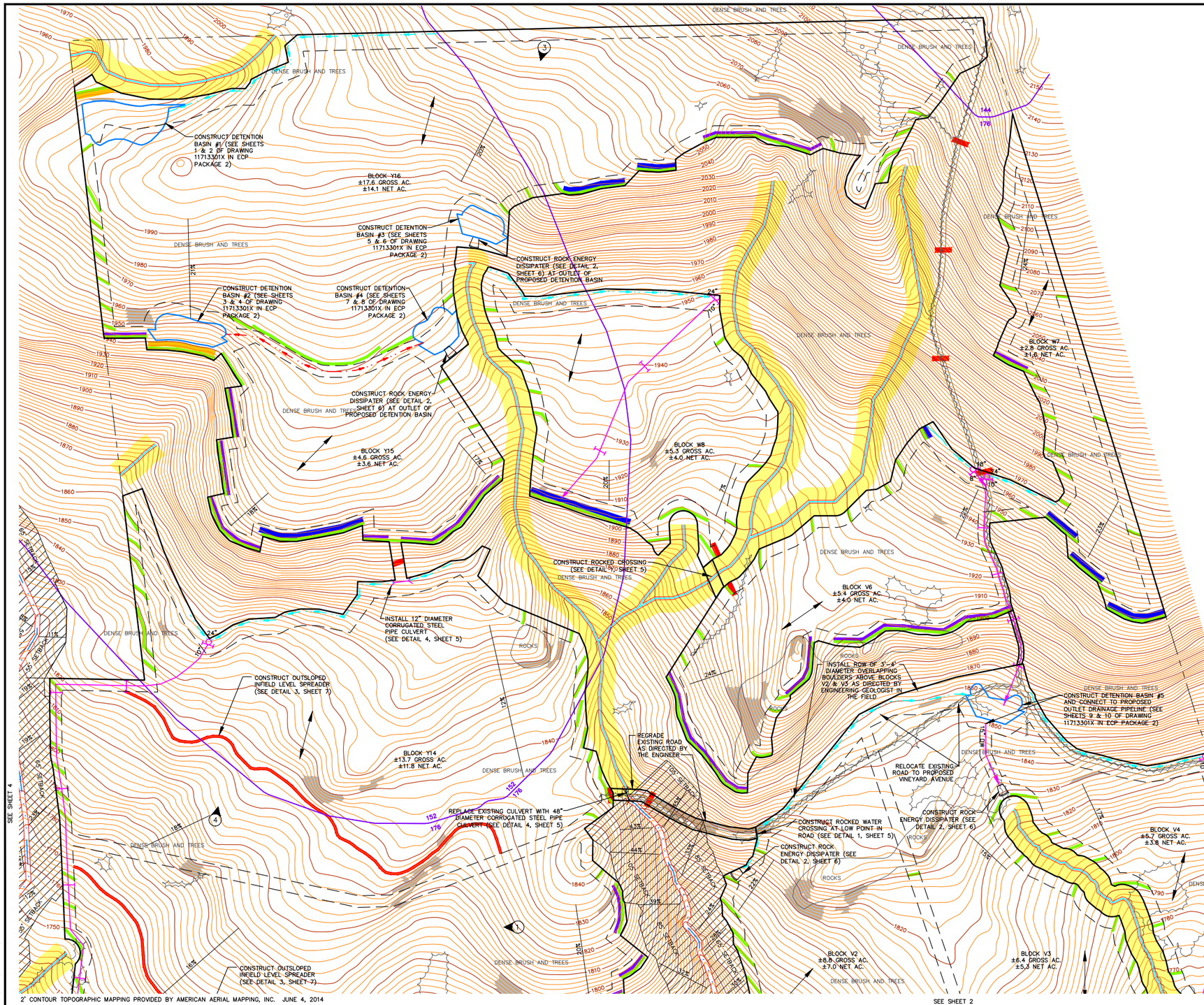

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- APPROXIMATE PROPERTY LINE (SEE NOTE 15, SHEET 1)
- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- TOP OF BANK, APPROXIMATE LOCATION
- NAPA COUNTY STREAM SETBACK
- 26' UNDISTURBED FILTER STRIP
- EXISTING ROAD
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DIVERSION DITCH (SEE DETAIL 2, SHEET 5)
- PROPOSED DIVERSION AVENUE (SEE DETAIL 3, SHEET 5)
- X" — PROPOSED DROP INLET AND DIAMETER (SEE DETAIL 6, SHEET 5)
- X" — PROPOSED SURFACE DRAINAGE PIPELINE AND DIAMETER, SINGLE WALL UNLESS OTHERWISE NOTED (SEE DETAIL 3, SHEET 6)
- PROPOSED CUTOFF COLLAR (SEE DETAIL 5, SHEET 6)
- DW — DUAL WALL CORRUGATED POLYETHYLENE PIPE
- PROPOSED STRAW WATTLE (SEE DETAIL 4, SHEET 6)
- PROPOSED ROCK BENCH/LEVEL SPREADER (SEE DETAIL 1, SHEET 6)
- PROPOSED DETENTION BASIN ROCK LEVEL SPREADER (SEE DETAIL 4, SHEET 7)
- PROPOSED ROCK FILLED AVENUE (SEE DETAIL 2, SHEET 7)
- PROPOSED ROLLING DIP (SEE DETAIL 1, SHEET 7)
- AREA WHERE GROUND SLOPE IS 30 PERCENT OR GREATER
- PROPOSED VINEROW DIRECTION
- X — PHOTO POINT NUMBER & LOCATION (SEE APPENDIX A)
- X% — AVERAGE SURFACE SLOPE
- 144 / 176 — SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

- 144 — GUENOC–ROCK OUTCROP COMPLEX, 30–75% SLOPE
- 152 — HAMBRIGHT ROCK–OUTCROP COMPLEX, 30–75% SLOPE
- 176 — ROCK OUTCROP–HAMBRIGHT COMPLEX, 50–75% SLOPE

REGISTERED PROFESSIONAL ENGINEER — JAMES A. BUSHEY — No. 49931 — EXPIRES 9-30-20 — Civil — STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
BLOCKS V6, W7, W8, & Y14–Y16

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

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AS SHOWN	JCJ, CC	07–10–19	3 OF: 7

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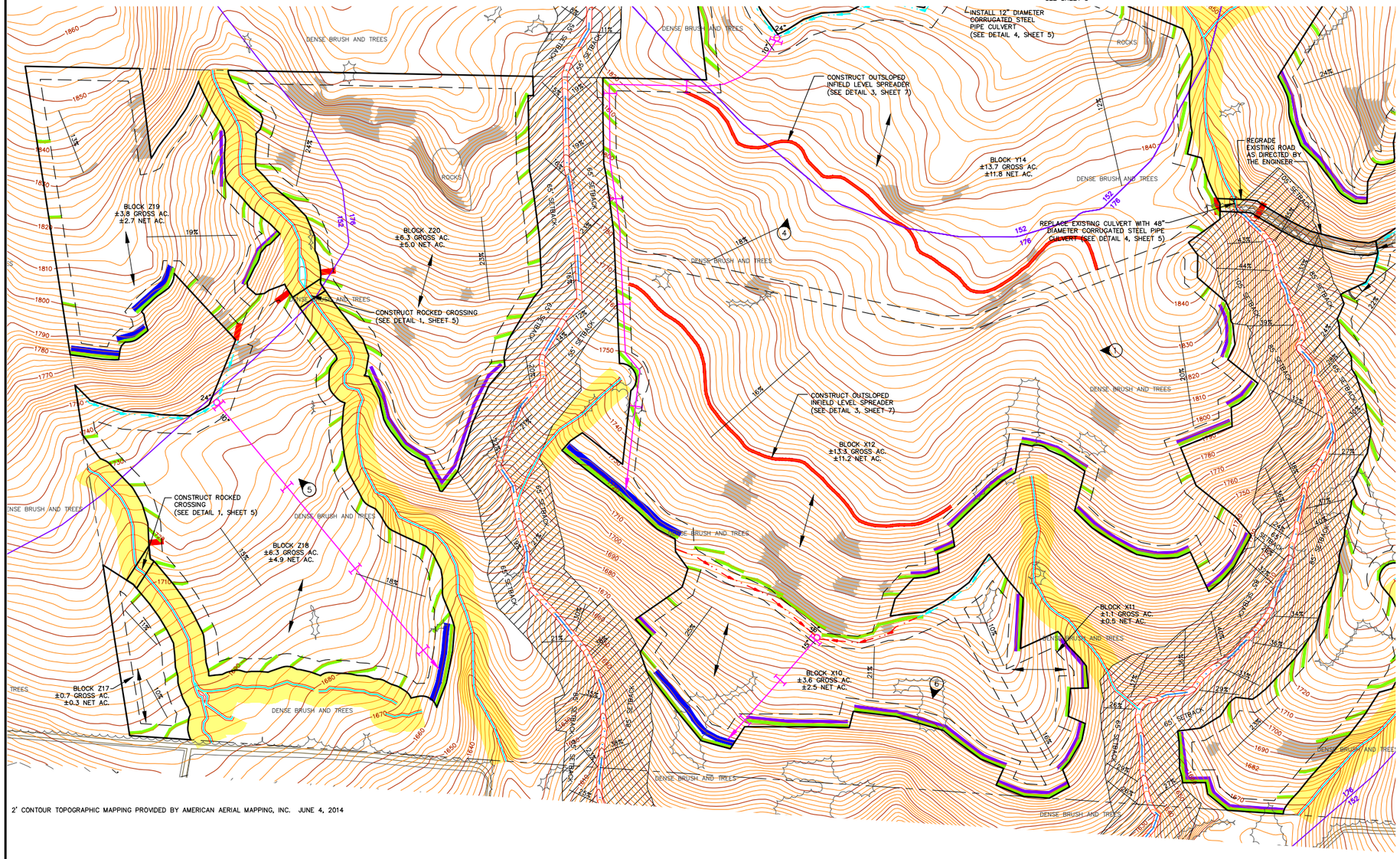

2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- APPROXIMATE PROPERTY LINE (SEE NOTE 15, SHEET 1)
- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- TOP OF BANK, APPROXIMATE LOCATION
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- PROPOSED STRAW WATTLE (SEE DETAIL 4, SHEET 6)
- PROPOSED ROCK BENCH/LEVEL SPREADER (SEE DETAIL 1, SHEET 6)
- PROPOSED ROCK FILLED AVENUE (SEE DETAIL 2, SHEET 7)
- PROPOSED ROLLING DIP (SEE DETAIL 1, SHEET 7)
- AREA WHERE GROUND SLOPE IS 30 PERCENT OR GREATER
- PROPOSED VINEROW DIRECTION
- X — PHOTO POINT NUMBER & LOCATION (SEE APPENDIX A)
- X% — AVERAGE SURFACE SLOPE
- 152 / 176 — SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

152	HAMBRIGHT ROCK–OUTCROP COMPLEX, 30–75% SLOPE
176	ROCK OUTCROP–HAMBRIGHT COMPLEX, 50–75% SLOPE

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JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
BLOCKS X10–X12 & Z17–Z20

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

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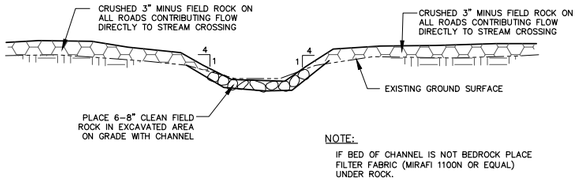
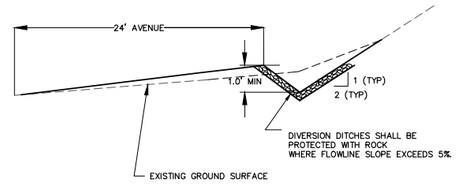
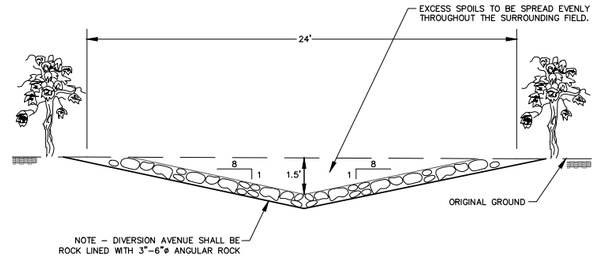


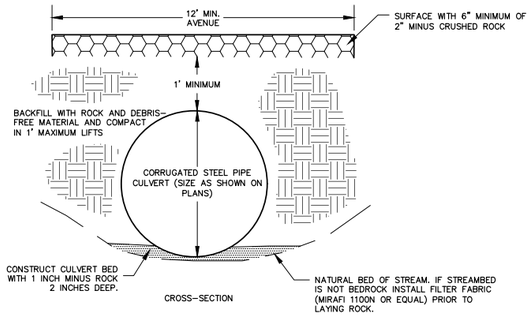
1/5 TYPICAL ROCKED WATER CROSSING
N.T.S.



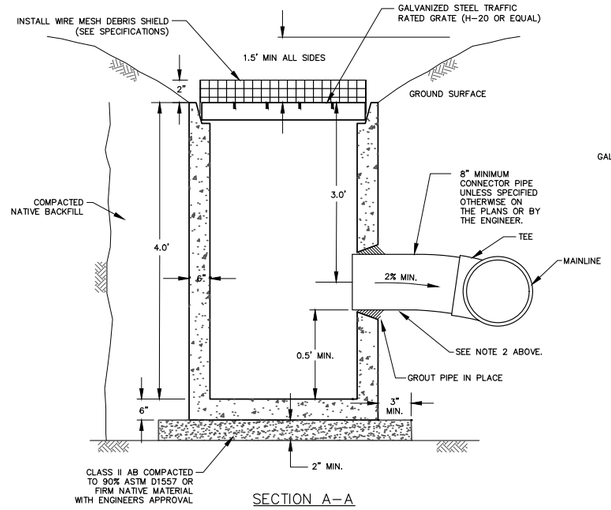
2/5 DIVERSION DITCH TYPICAL X–SECTION
N.T.S.



3/5 DIVERSION AVENUE TYPICAL X–SECTION
N.T.S.



4/5 CULVERT INSTALLATION
N.T.S.

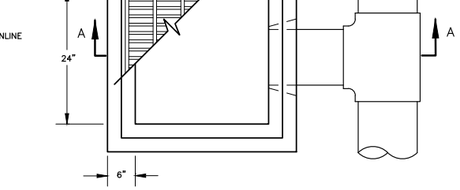


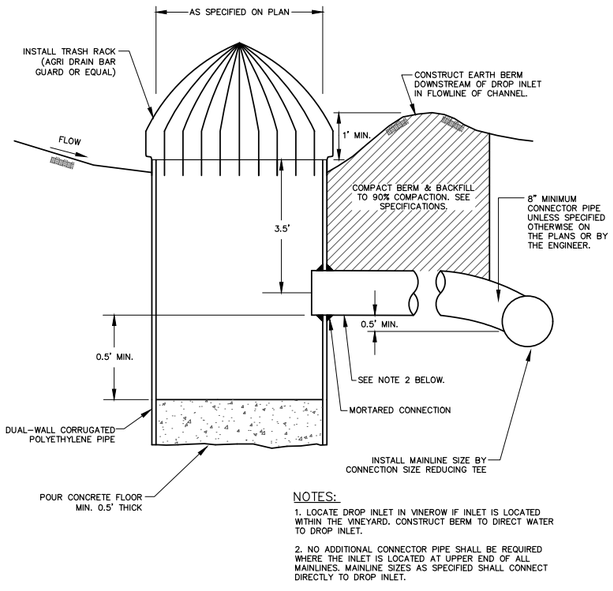
5/5 CONCRETE DROP INLET
N.T.S.

NOTES:

1. LOCATE DROP INLET IN VINEROW IF INLET IS LOCATED WITHIN THE VINEYARD. CONSTRUCT BERM TO DIRECT WATER TO DROP INLET.

2. NO ADDITIONAL CONNECTOR PIPE SHALL BE REQUIRED WHERE THE INLET IS LOCATED AT UPPER END OF ALL MAINLINES. MAINLINE SIZES AS SPECIFIED SHALL CONNECT DIRECTLY TO DROP INLET.





NOTES:

1. LOCATE DROP INLET IN VINEROW IF INLET IS LOCATED WITHIN THE VINEYARD. CONSTRUCT BERM TO DIRECT WATER TO DROP INLET.

2. NO ADDITIONAL CONNECTOR PIPE SHALL BE REQUIRED WHERE THE INLET IS LOCATED AT UPPER END OF ALL MAINLINES. MAINLINE SIZES AS SPECIFIED SHALL CONNECT DIRECTLY TO DROP INLET.

6/5 STANDARD DROP INLET
N.T.S.

DETAILS ON THIS SHEET:
TYPICAL ROCKED WATER CROSSING
DIVERSION DITCH TYPICAL X–SECTION
DIVERSION AVENUE TYPICAL X–SECTION
CULVERT INSTALLATION
CONCRETE DROP INLET
STANDARD DROP INLET

REGISTERED PROFESSIONAL ENGINEER
JAMES B. BUSHEY
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

REV. NO.	DESCRIPTION	BY	DATE
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JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
DETAILS

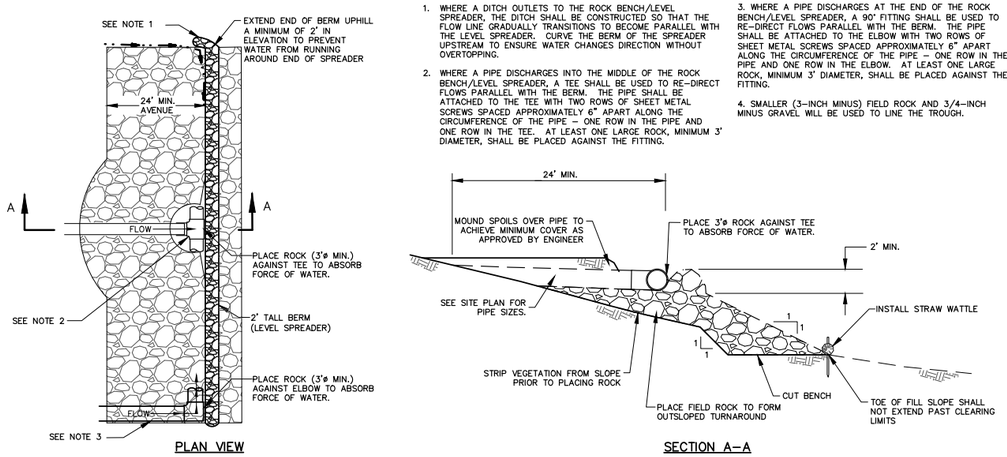
DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	JCJ, CC	07–10–19	5 OF: 7

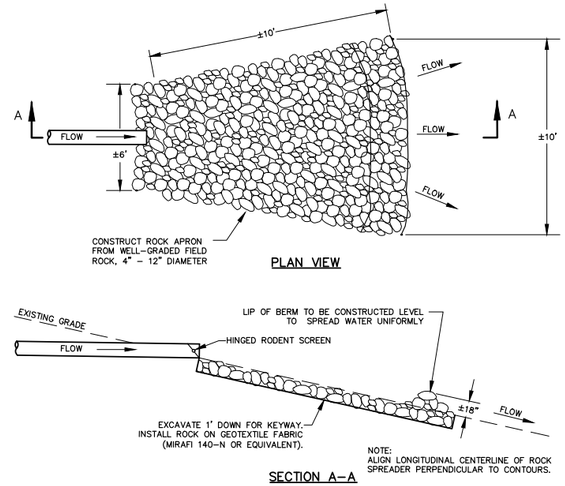
K:\JOBS\PJ\11713301\Stagecoach North Track I ECP Redesign\Drawings\11713301B.dwg, 5/15 DETAILS, 7/10/2019 11:39:14 AM

NOTES:

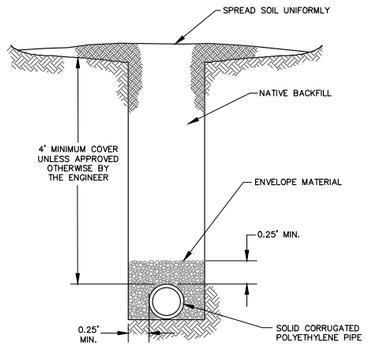
1. WHERE A DITCH OUTLETS TO THE ROCK BENCH/LEVEL SPREADER, THE DITCH SHALL BE CONSTRUCTED SO THAT THE FLOW LINE GRADUALLY TRANSITIONS TO BECOME PARALLEL WITH THE LEVEL SPREADER. CURVE THE BERM OF THE SPREADER UPSTREAM TO ENSURE WATER CHANGES DIRECTION WITHOUT OVERTOPPING.
2. WHERE A PIPE DISCHARGES INTO THE MIDDLE OF THE ROCK BENCH/LEVEL SPREADER, A TEE SHALL BE USED TO RE-DIRECT FLOWS PARALLEL WITH THE BERM. THE PIPE SHALL BE ATTACHED TO THE TEE WITH TWO ROWS OF SHEET METAL SCREWS SPACED APPROXIMATELY 6" APART ALONG THE CIRCUMFERENCE OF THE PIPE – ONE ROW IN THE PIPE AND ONE ROW IN THE TEE. AT LEAST ONE LARGE ROCK, MINIMUM 3' DIAMETER, SHALL BE PLACED AGAINST THE FITTING.
3. WHERE A PIPE DISCHARGES AT THE END OF THE ROCK BENCH/LEVEL SPREADER, A 90° FITTING SHALL BE USED TO RE-DIRECT FLOWS PARALLEL WITH THE BERM. THE PIPE SHALL BE ATTACHED TO THE ELBOW WITH TWO ROWS OF SHEET METAL SCREWS SPACED APPROXIMATELY 6" APART ALONG THE CIRCUMFERENCE OF THE PIPE – ONE ROW IN THE PIPE AND ONE ROW IN THE ELBOW. AT LEAST ONE LARGE ROCK, MINIMUM 3' DIAMETER, SHALL BE PLACED AGAINST THE FITTING.
4. SMALLER (3-INCH MINUS) FIELD ROCK AND 3/4-INCH MINUS GRAVEL WILL BE USED TO LINE THE TROUGH.



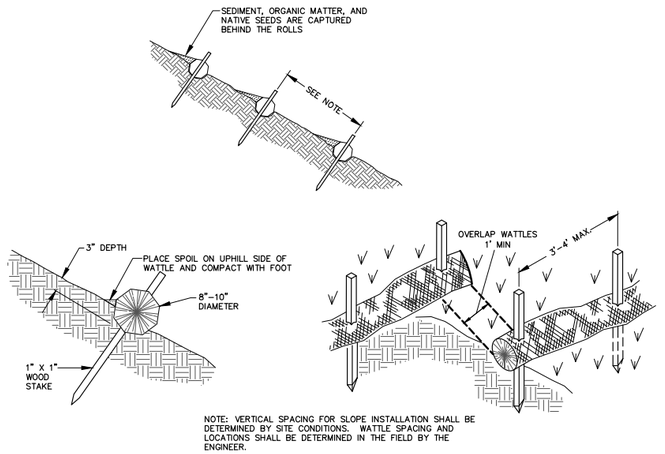
1/6 ROCK BENCH/LEVEL SPREADER
N.T.S.



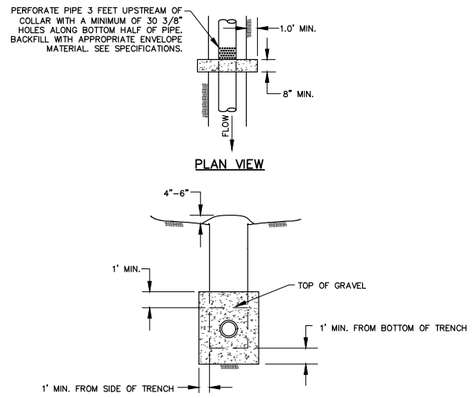
2/6 ROCK ENERGY DISSIPATER
N.T.S.



3/6 SURFACE DRAINAGE PIPELINE
N.T.S.



4/6 STRAW WATTLE INSTALLATION
N.T.S.



5/6 CUTOFF COLLAR
N.T.S.

DETAILS ON THIS SHEET:
ROCK BENCH/LEVEL SPREADER
ROCK ENERGY DISSIPATER
SURFACE DRAINAGE PIPELINE
STRAW WATTLE INSTALLATION
CUTOFF COLLAR

REGISTERED PROFESSIONAL ENGINEER
JAMES C. JUSHEY
No. 49931
EXPIRES 9-30-20
Civil
STATE OF CALIFORNIA

REV. NO.	DESCRIPTION	BY	DATE
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NAPA, CA 94558
707/253-1806 FAX 707/253-1604

JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
DETAILS

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	JCJ, CC	07-10-19	6 OF: 7

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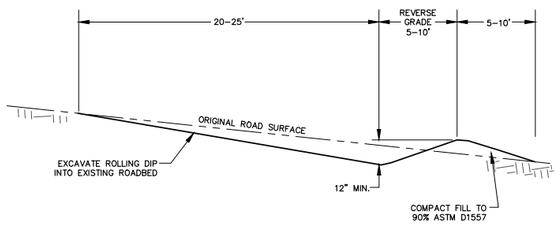
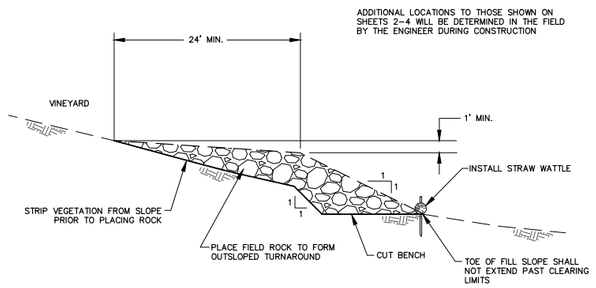
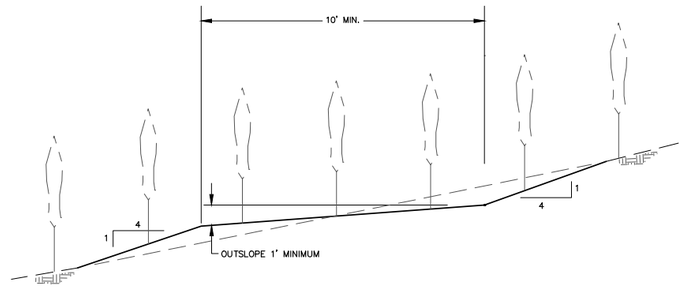


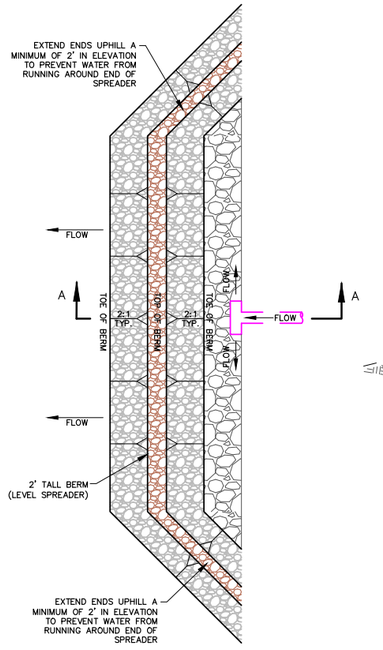
1/7 TYPICAL ROLLING DIP
N.T.S.



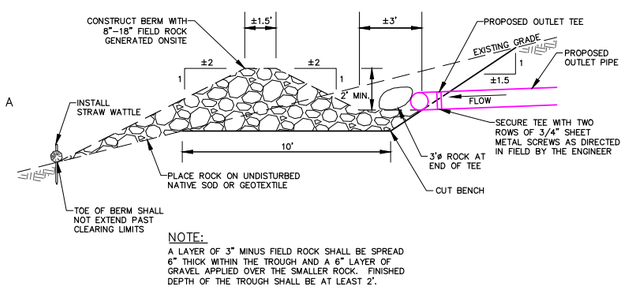
2/7 ROCK–FILLED AVENUE
N.T.S.



3/7 OUTSLOPED INFIELD LEVEL SPREADER
N.T.S.



PLAN VIEW



NOTE:
A LAYER OF 3" MINUS FIELD ROCK SHALL BE SPREAD 6" THICK WITHIN THE TROUGH AND A 6" LAYER OF GRAVEL APPLIED OVER THE SMALLER ROCK. FINISHED DEPTH OF THE TROUGH SHALL BE AT LEAST 2'.

SECTION A–A

4/7 DETENTION BASIN ROCK LEVEL SPREADER
N.T.S.

DETAILS ON THIS SHEET:
TYPICAL ROLLING DIP
ROCK–FILLED AVENUE
OUTSLOPED INFIELD LEVEL SPREADER
DETENTION BASIN ROCK LEVEL SPREADER

REGISTERED PROFESSIONAL ENGINEER
JAMES C. JACKSON
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301B

STAGECOACH NORTH
SODA CANYON ROAD
TRACK I EROSION CONTROL PLAN
DETAILS

DESIGN ENGINEER: J. BUSHEY, M. BUENO, C. CORSETTI

SCALE:	DRAWN BY:	DATE:	SHEET: 7
AS SHOWN	JCJ, CC	07–10–19	OF: 7

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STAGECOACH NORTH
SODA CANYON ROAD

EROSION CONTROL PLAN
PACKAGE 2 OF 2

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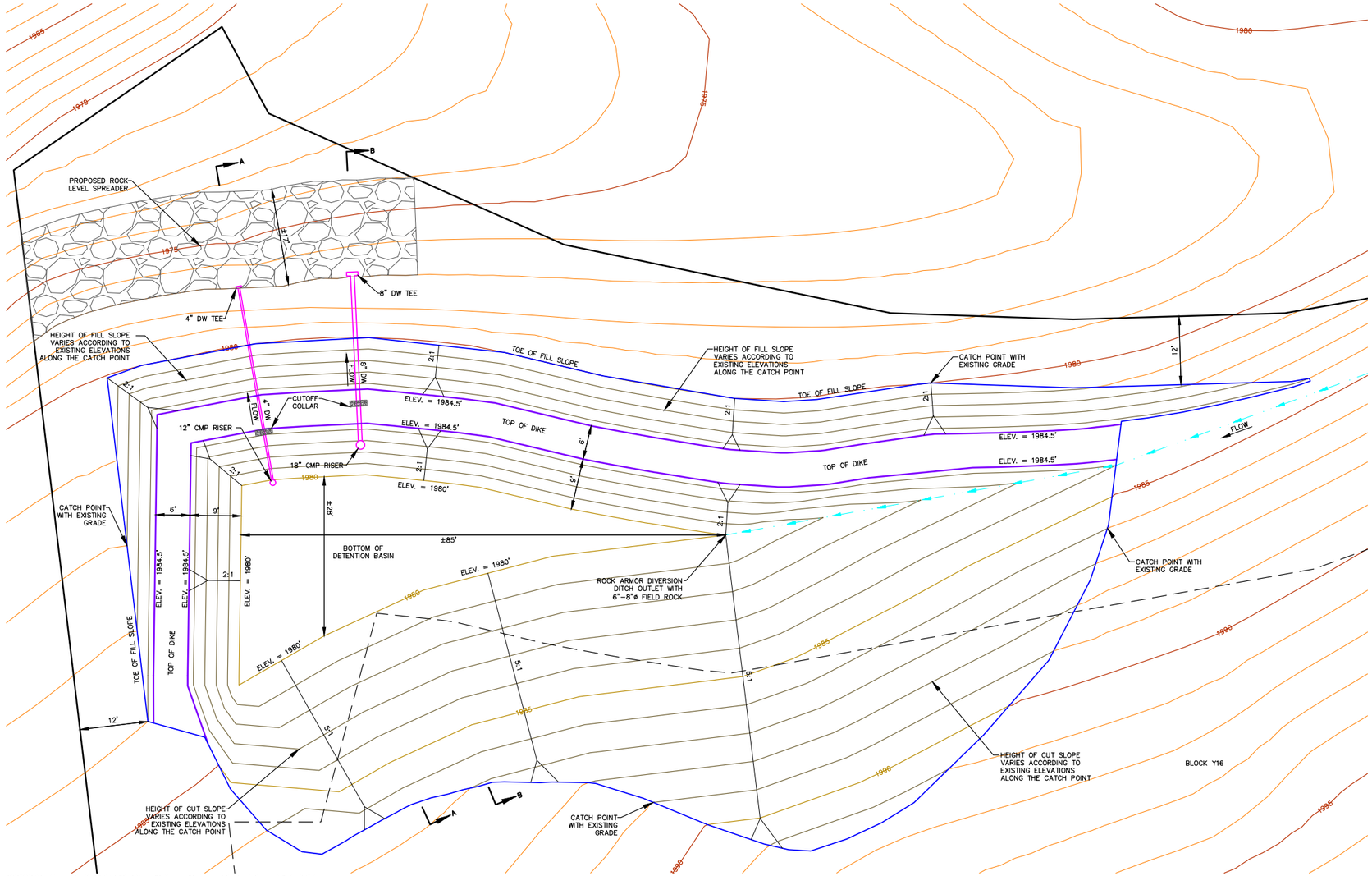
ENGINEERING



TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.

DETENTION BASIN #1 – PLAN VIEW

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

LEGEND

- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- PROPOSED FINISH GRADE INDEX CONTOUR
- PROPOSED FINISH GRADE INTERMEDIATE CONTOUR
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DETENTION BASIN AREA
- PROPOSED TOP OF DIKE CONTOUR
- PROPOSED DIVERSION DITCH (SEE DETAIL 1, SHEET 11)
- X X PROPOSED DETENTION BASIN CROSS SECTION (SEE SHEET 2)
- DW DUAL WALL CORRUGATED POLYETHYLENE PIPE
- CMP CORRUGATED METAL PIPE

REGISTERED PROFESSIONAL ENGINEER
JAMES R. BUSHEY
No. 49931
EXPIRES 9-30-20
Civil
STATE OF CALIFORNIA

REV. NO.	DESCRIPTION	BY	DATE
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JOB NO: 117133O1
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #1

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	ALB	07-10-19	1 OF: 11

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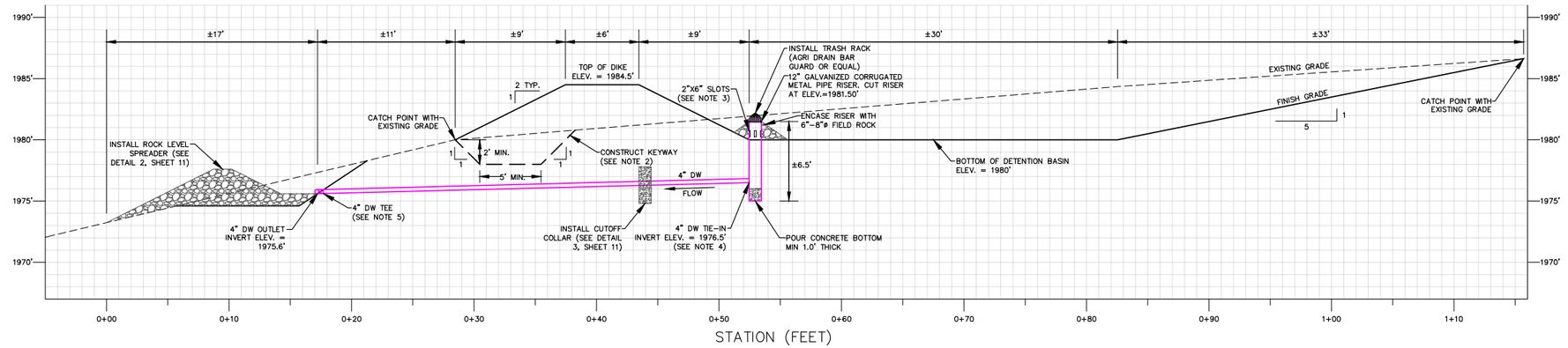
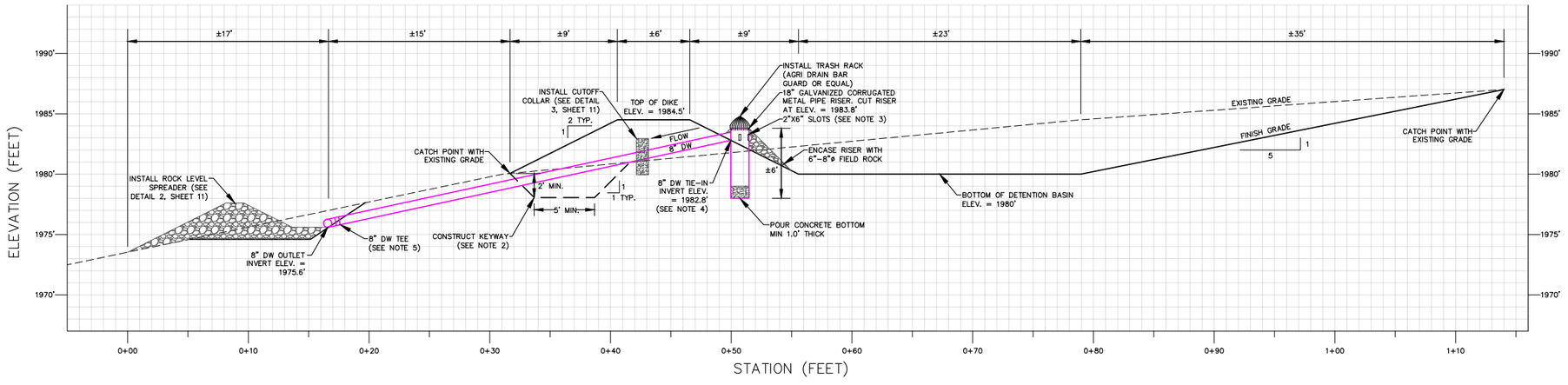


DETENTION BASIN #1 – SECTION A–A

SCALE: 1"=5'



DETENTION BASIN #1 – SECTION B–B

SCALE: 1"=5'

NOTES:

1. ALL FILL SLOPES SHALL BE COMPACTED TO 90% RELATIVE COMPACTION PER ASTM D1557.
2. KEYWAY SHALL BE EMBEDDED A MINIMUM 2' INTO FIRM NATIVE SOIL OR BEDROCK. BASE OF KEYWAY SHALL BE A MINIMUM 5' WIDE AS SHOWN.
3. 2"X6" SLOTS SHALL BE CUT INTO THE RESPECTIVE RISERS. FOUR (4) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATION SHOWN.
4. DW PIPE CONNECTIONS TO THE RISERS SHALL BE MORTARED TO FORM A WATERTIGHT SEAL.
5. DW TEES SHALL BE SECURED WITH TWO ROWS OF 3/4" SHEET METAL SCREWS AS DIRECTED IN FIELD BY THE ENGINEER.

REGISTERED PROFESSIONAL ENGINEER
JAMES B. BUSHEY
No. 49931
EXPIRES 9-30-20
Civil
STATE OF CALIFORNIA

REV. NO.	DESCRIPTION	BY	DATE
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JOB NO: 11713301

DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #1

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE–BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
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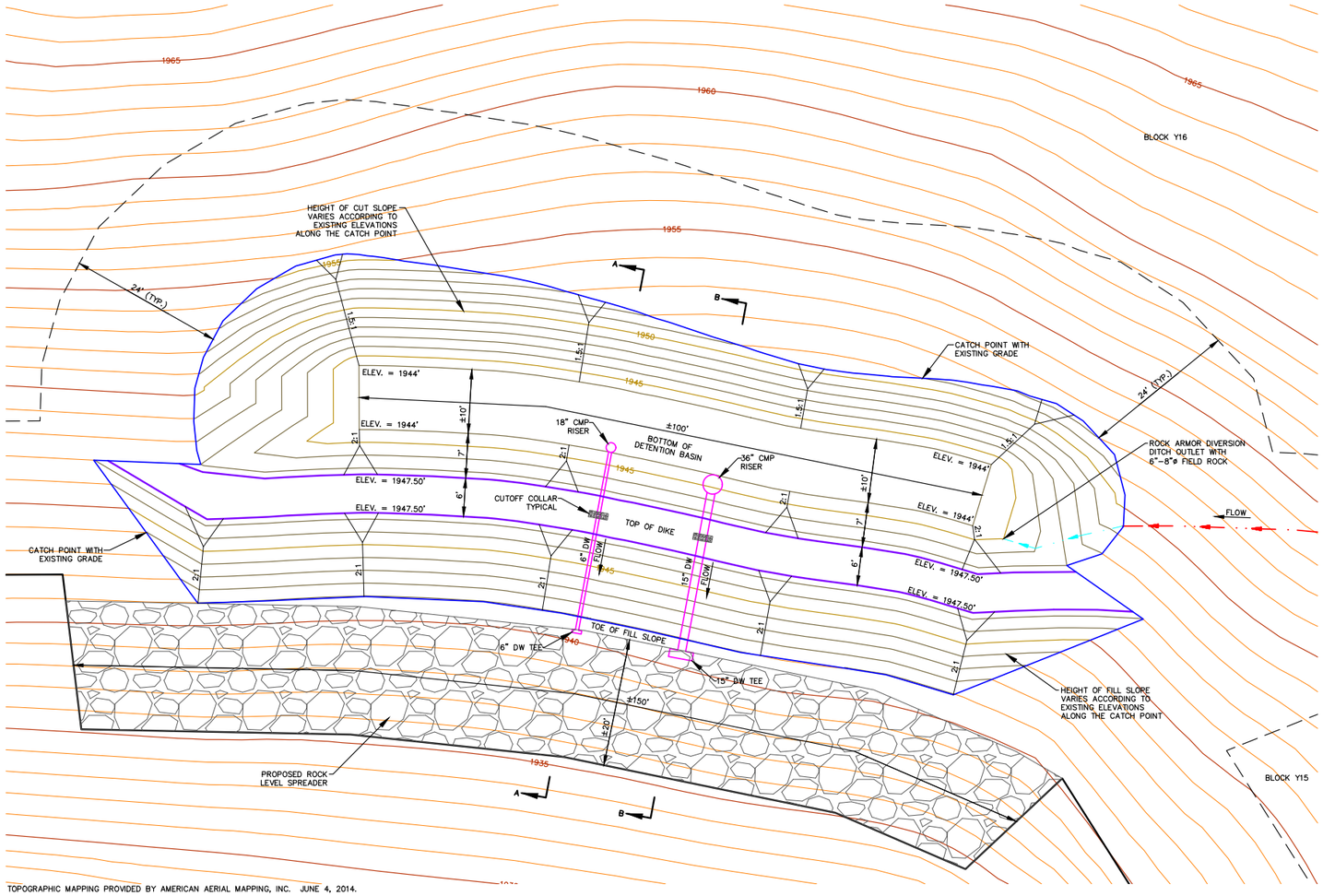

TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.

DETENTION BASIN #2 – PLAN VIEW

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

LEGEND

- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- PROPOSED FINISH GRADE INDEX CONTOUR
- PROPOSED FINISH GRADE INTERMEDIATE CONTOUR
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DETENTION BASIN AREA
- PROPOSED TOP OF DIKE CONTOUR
- PROPOSED DIVERSION AVENUE (SEE DETAIL 4, SHEET 11)
- PROPOSED DIVERSION DITCH (SEE DETAIL 1, SHEET 11)
- X X — PROPOSED DETENTION BASIN CROSS SECTION (SEE SHEET 4)
- DW — DUAL WALL CORRUGATED POLYETHYLENE PIPE
- CMP — CORRUGATED METAL PIPE

REGISTERED PROFESSIONAL ENGINEER JAMES R. BUSHEY No. 49931 EXPIRES: 9-30-20 Civil STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #2

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	ALB	07-10-19	3 OF: 11

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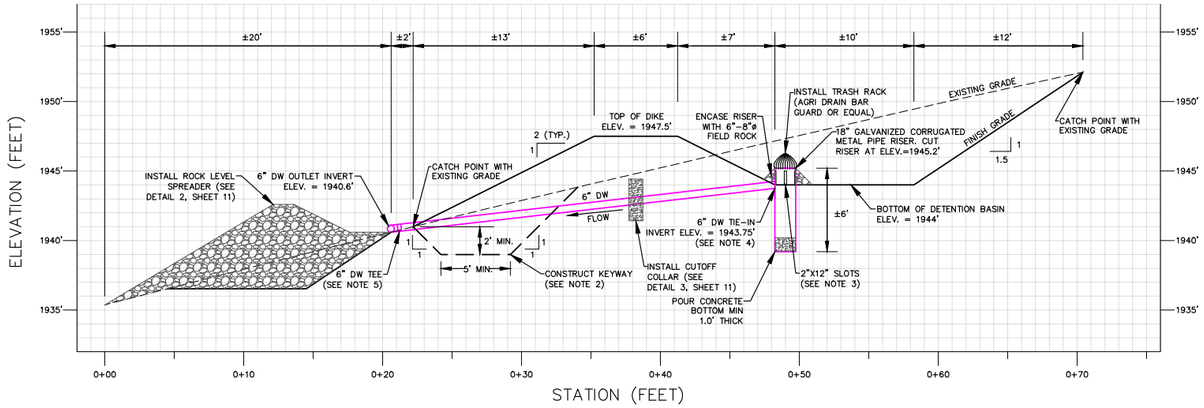
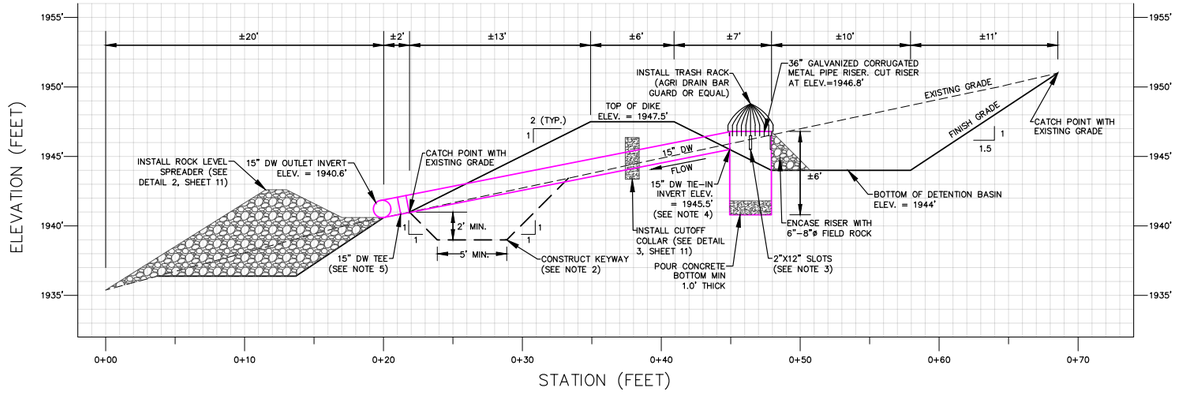


DETENTION BASIN #2 – SECTION A–A

SCALE: 1"=5'



DETENTION BASIN #2 – SECTION B–B

SCALE: 1"=5'

NOTES:

1. ALL FILL SLOPES SHALL BE COMPACTED TO 90% RELATIVE COMPACTION PER ASTM D1557.

2. KEYWAY SHALL BE EMBEDDED A MINIMUM 2' INTO FIRM NATIVE SOIL OR BEDROCK. BASE OF KEYWAY SHALL BE A MINIMUM 5' WIDE AS SHOWN.

3. 2"X12" SLOTS SHALL BE CUT INTO THE RESPECTIVE RISERS. FIVE (5) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATION SHOWN.

4. DW PIPE CONNECTIONS TO THE RISERS SHALL BE MORTARED TO FORM A WATERTIGHT SEAL.

5. DW TEES SHALL BE SECURED WITH TWO ROWS OF 3/4" SHEET METAL SCREWS AS DIRECTED IN FIELD BY THE ENGINEER.

REGISTERED PROFESSIONAL ENGINEER
JAMES L. BUSHEY
No. 19931
EXPIRES 9-30-20
Civil
STATE OF CALIFORNIA

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707/253-1806 FAX 707/253-1604

JOB NO: 11713301

DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD

DETENTION BASIN DESIGN

DETENTION BASIN #2

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

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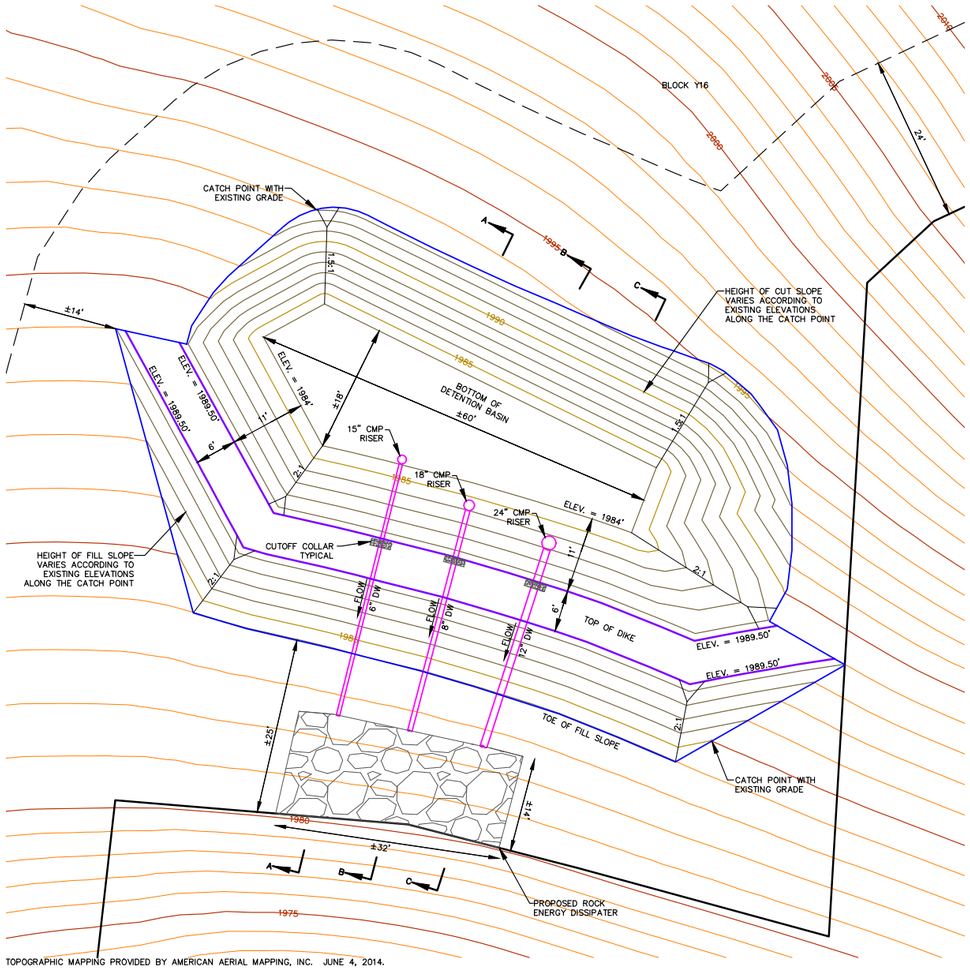

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DETENTION BASIN #3 – PLAN VIEW

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

LEGEND

- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- PROPOSED FINISH GRADE INDEX CONTOUR
- PROPOSED FINISH GRADE INTERMEDIATE CONTOUR
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DETENTION BASIN AREA
- PROPOSED TOP OF DIKE CONTOUR
- X X — PROPOSED DETENTION BASIN CROSS SECTION (SEE SHEET 6)
- DW — DUAL WALL CORRUGATED POLYETHYLENE PIPE
- CMP — CORRUGATED METAL PIPE

REGISTERED PROFESSIONAL ENGINEER JAMES R. LEMIRE No. 49931 EXPIRES: 9-30-20 Civil STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #3

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
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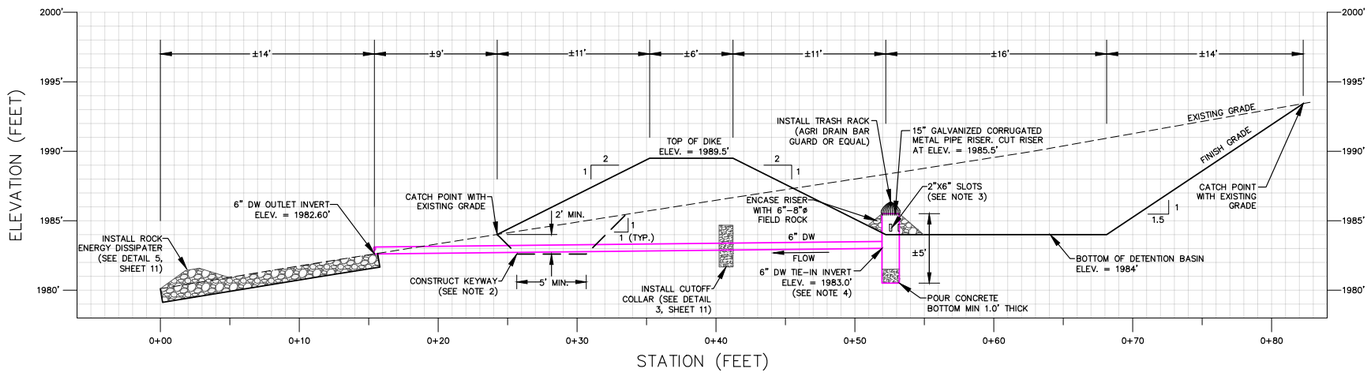
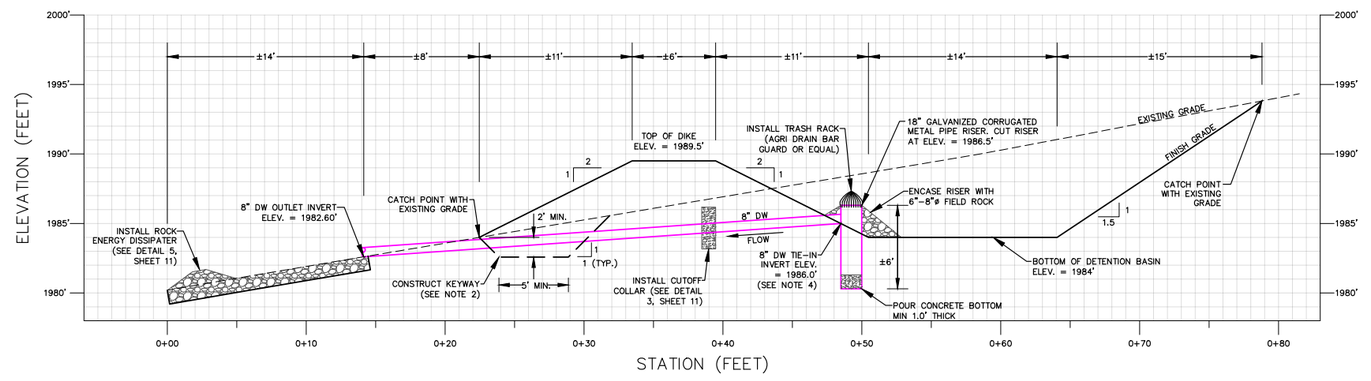


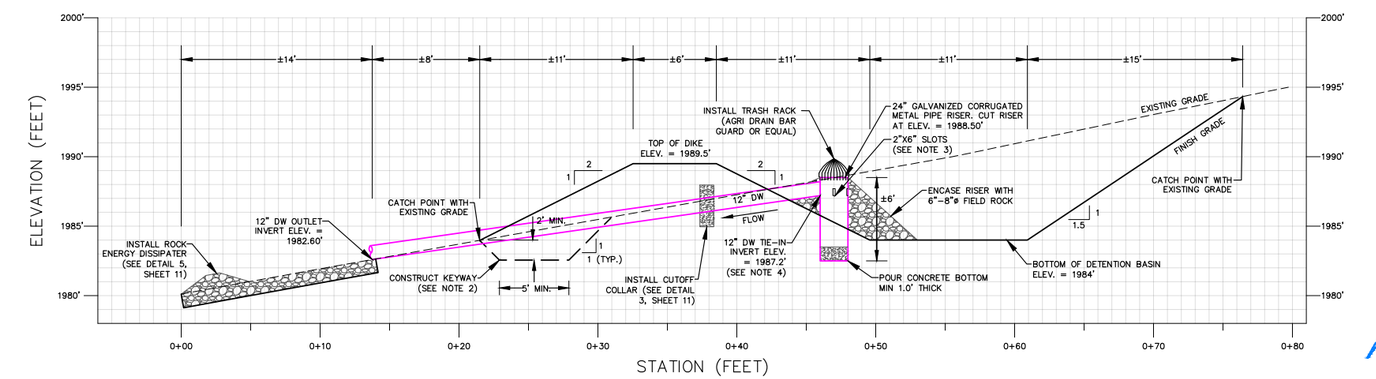
DETENTION BASIN #3 – SECTION A–A

SCALE: 1"=5'



DETENTION BASIN #3 – SECTION B–B

SCALE: 1"=5'



DETENTION BASIN #3 – SECTION C–C

SCALE: 1"=5'

NOTES:

1. ALL FILL SLOPES SHALL BE COMPACTED TO 90% RELATIVE COMPACTION PER ASTM D1557.
2. KEYWAY SHALL BE EMBEDDED A MINIMUM 2' INTO FIRM NATIVE SOIL OR BEDROCK. BASE OF KEYWAY SHALL BE A MINIMUM 5' WIDE AS SHOWN.
3. 2"X6" SLOTS SHALL BE CUT INTO THE RESPECTIVE RISERS. FOUR (4) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATION SHOWN.
4. DW PIPE CONNECTIONS TO THE RISERS SHALL BE MORTARED TO FORM A WATERTIGHT SEAL.

REGISTERED PROFESSIONAL ENGINEER
JAMES R. WEBER
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

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707/253-1806 FAX 707/253-1604

JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #3

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE–BAETEN

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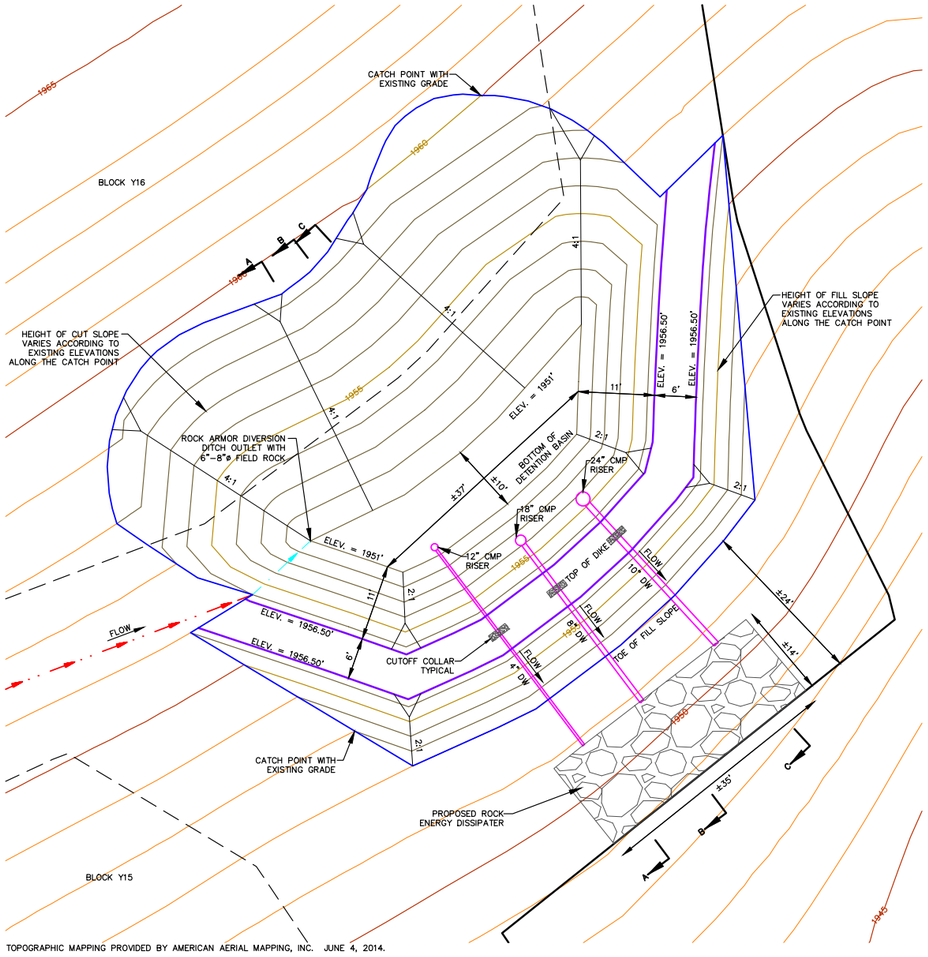

TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.

DETENTION BASIN #4 – PLAN VIEW



GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

LEGEND

- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- PROPOSED FINISH GRADE INDEX CONTOUR
- PROPOSED FINISH GRADE INTERMEDIATE CONTOUR
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DETENTION BASIN AREA
- PROPOSED TOP OF DIKE CONTOUR
- PROPOSED DIVERSION AVENUE (SEE DETAIL 4, SHEET 11)
- PROPOSED DIVERSION DITCH (SEE DETAIL 1, SHEET 11)
- PROPOSED DETENTION BASIN CROSS SECTION (SEE SHEET 8)
- DW — DUAL WALL CORRUGATED POLYETHYLENE PIPE
- CMP — CORRUGATED METAL PIPE

REGISTERED PROFESSIONAL ENGINEER
JAMES R. HOUK
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

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707/253-1806 FAX 707/253-1604

JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #4

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	ALB	07-10-19	7 OF: 11

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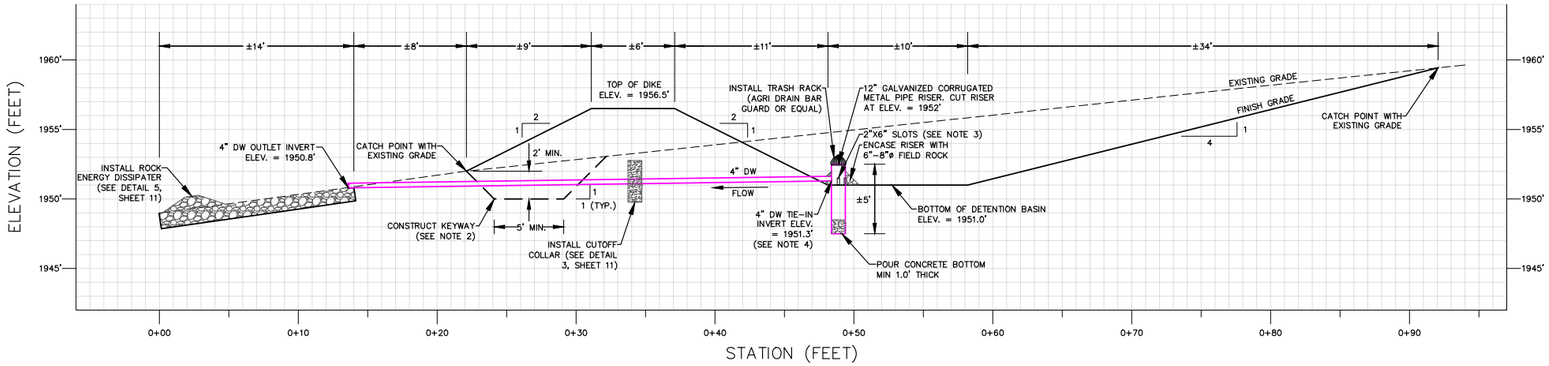
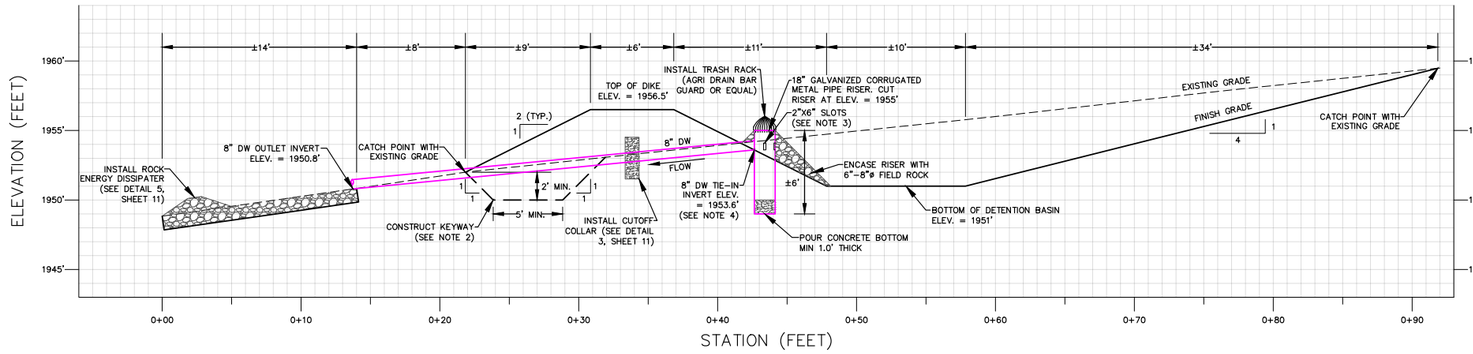


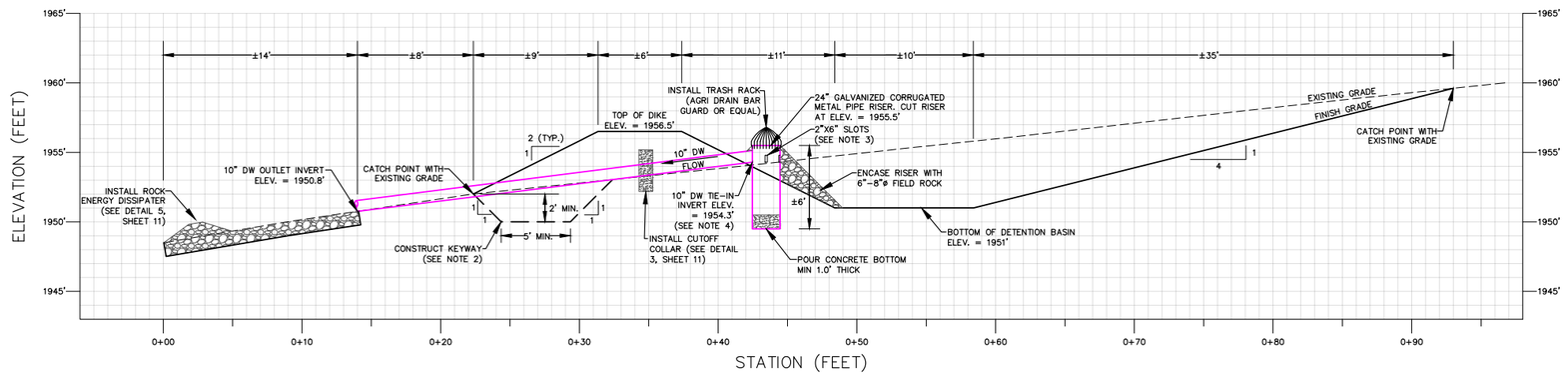
DETENTION BASIN #4 – SECTION A–A

SCALE: 1"=5'



DETENTION BASIN #4 – SECTION B–B

SCALE: 1"=5'



DETENTION BASIN #4 – SECTION C–C

SCALE: 1"=5'

NOTES:

1. ALL FILL SLOPES SHALL BE COMPACTED TO 90% RELATIVE COMPACTION PER ASTM D1557.
2. KEYWAY SHALL BE EMBEDDED A MINIMUM 2' INTO FIRM SOIL OR BEDROCK. BASE OF KEYWAY SHALL BE A MINIMUM 5' WIDE AS SHOWN.
3. 2"X6" SLOTS SHALL BE CUT INTO THE RESPECTIVE RISERS. FOUR (4) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATION SHOWN.
4. DW PIPE CONNECTIONS TO THE RISERS SHALL BE MORTARED TO FORM A WATERTIGHT SEAL.

REGISTERED PROFESSIONAL ENGINEER
JAMES R. BUSHEY
No. 49931
EXPIRES 9-30-20
Civil
STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #4

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	ALB	07-10-19	8 OF: 11

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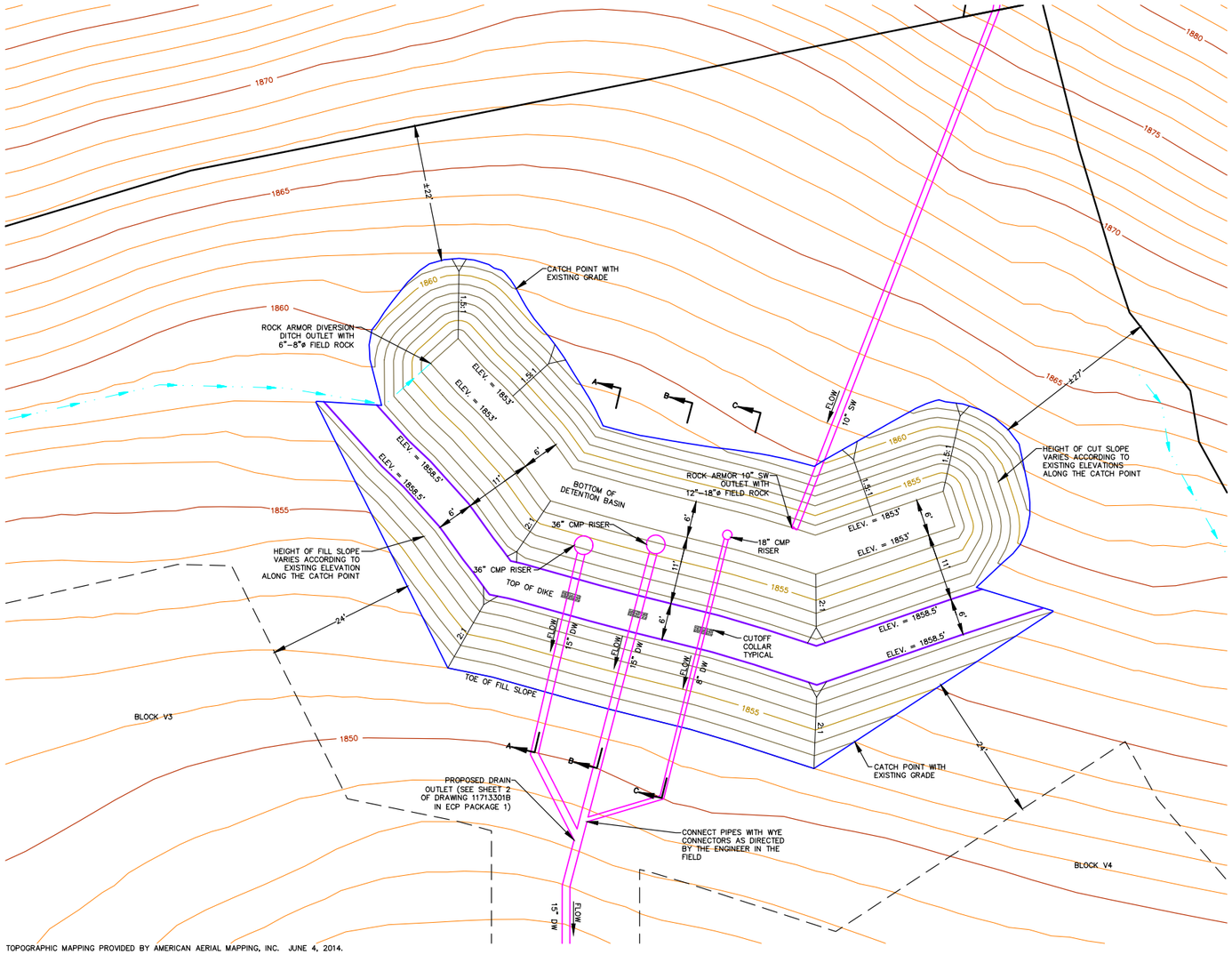

TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.

DETENTION BASIN #5 – PLAN VIEW

GRAPHIC SCALE

10 0 5 10 20 40

(IN FEET)
1 inch = 10 ft.

LEGEND

- EXISTING GRADE INDEX CONTOUR
- EXISTING GRADE INTERMEDIATE CONTOUR
- PROPOSED FINISH GRADE INDEX CONTOUR
- PROPOSED FINISH GRADE INTERMEDIATE CONTOUR
- PROPOSED CLEARING LIMITS
- PROPOSED VINEYARD BLOCK BOUNDARY
- PROPOSED DETENTION BASIN AREA
- PROPOSED TOP OF DIKE CONTOUR
- PROPOSED DIVERSION DITCH (SEE DETAIL 1, SHEET 11)
- X X PROPOSED DETENTION BASIN CROSS SECTION (SEE SHEET 10)
- SW SINGLE WALL CORRUGATED POLYETHYLENE PIPE
- DW DUAL WALL CORRUGATED POLYETHYLENE PIPE
- CMP CORRUGATED METAL PIPE

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REGISTERED PROFESSIONAL ENGINEER
JAMES A. BUSHEY
No. 49931
EXPIRES: 9-30-20
Civil
STATE OF CALIFORNIA

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JOB NO: 11713301
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STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #5

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
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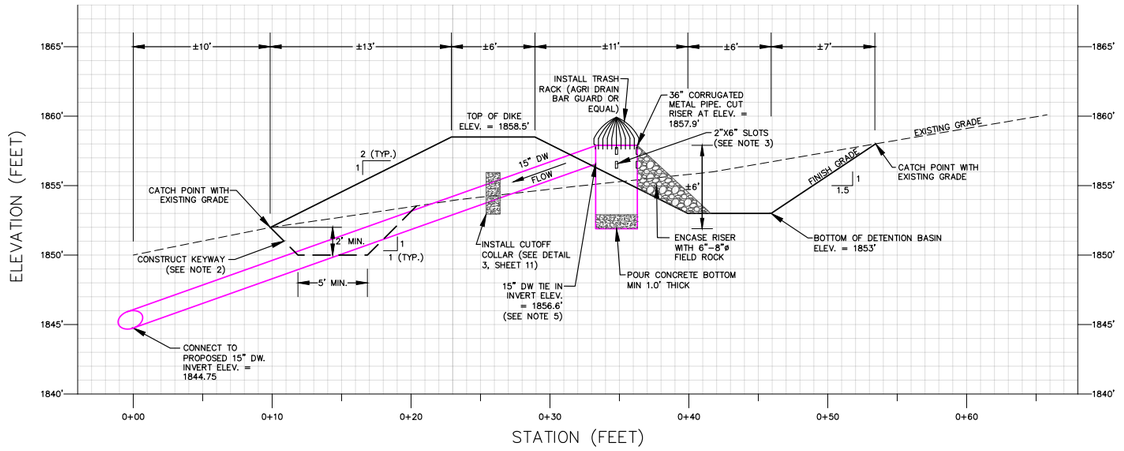
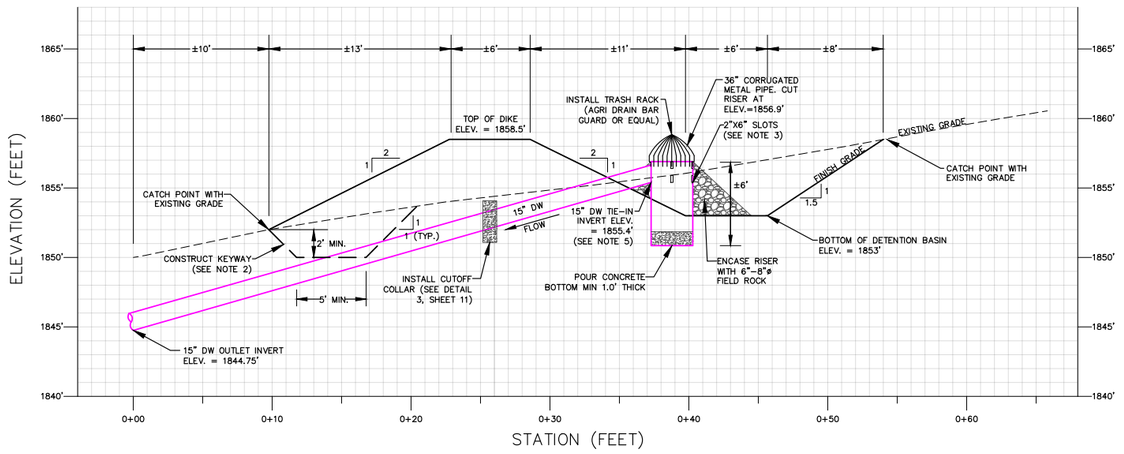


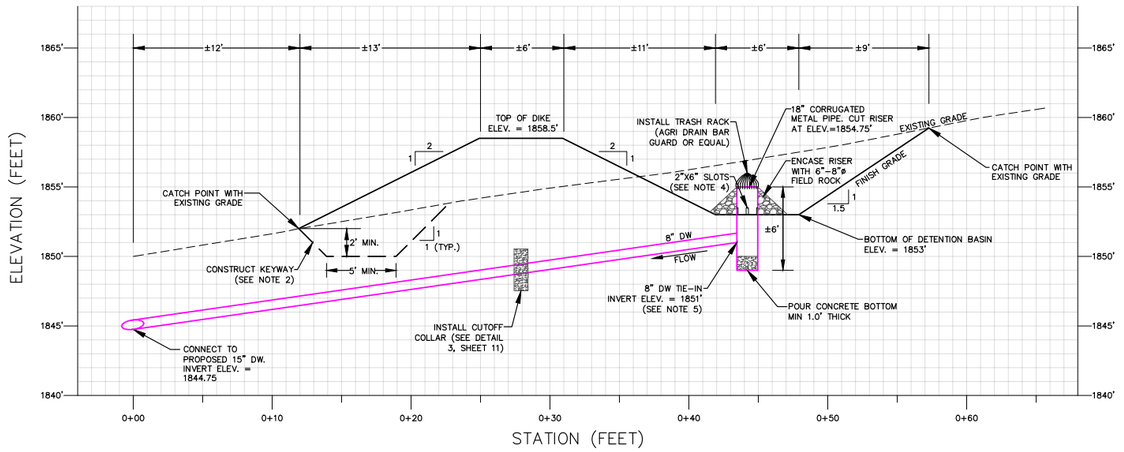
DETENTION BASIN #5 – SECTION A–A

SCALE: 1"=5'



DETENTION BASIN #5 – SECTION B–B

SCALE: 1"=5'



DETENTION BASIN #5 – SECTION C–C

SCALE: 1"=5'

NOTES:

1. ALL FILL SLOPES SHALL BE COMPACTED TO 90% RELATIVE COMPACTION PER ASTM D1557.
2. KEYWAY SHALL BE EMBEDDED A MINIMUM 2' INTO FIRM NATIVE SOIL OR BEDROCK. BASE OF KEYWAY SHALL BE A MINIMUM 5' WIDE AS SHOWN.
3. 2"X6" SLOTS SHALL BE CUT INTO BOTH 36" RISERS. SLOTS SHALL BE SPACED 0.5' APART VERTICALLY. FIVE (5) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATIONS SHOWN.
4. 2"X6" SLOTS SHALL BE CUT INTO THE 18" RISER. TEN (10) EQUALLY SPACED SLOTS SHALL BE CUT ALONG THE CIRCUMFERENCE OF THE RISER AT THE ELEVATIONS SHOWN.
5. DW PIPE CONNECTIONS TO THE RISERS SHALL BE MORTARED TO FORM A WATERTIGHT SEAL.

REGISTERED PROFESSIONAL ENGINEER — JAMES R. BUSHEY — No. 49931 — EXPIRES: 9-30-20 — Civil — STATE OF CALIFORNIA

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JOB NO: 11713301
DWG. NO: 11713301X

STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETENTION BASIN #5

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

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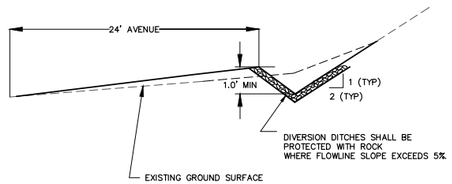
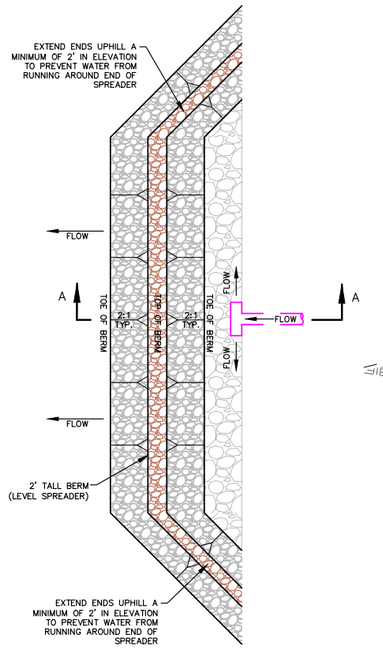
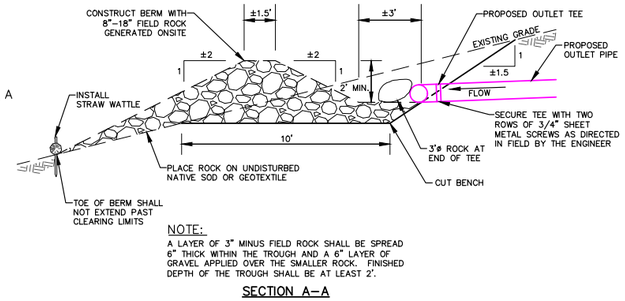


1/11 DIVERSION DITCH TYPICAL X-SECTION
N.T.S.



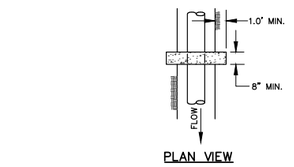
PLAN VIEW



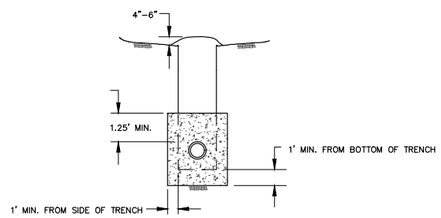
NOTE:
A LAYER OF 3" MINUS FIELD ROCK SHALL BE SPREAD 6" THICK WITHIN THE TROUGH AND A 6" LAYER OF GRAVEL APPLIED OVER THE SMALLER ROCK. FINISHED DEPTH OF THE TROUGH SHALL BE AT LEAST 2'.

SECTION A-A

2/11 DETENTION BASIN ROCK LEVEL SPREADER
N.T.S.

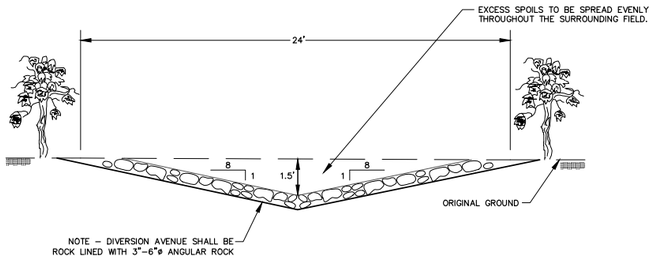


PLAN VIEW

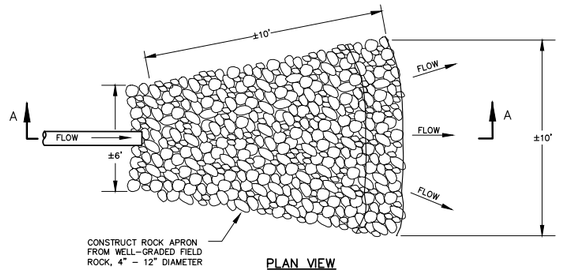


SECTION

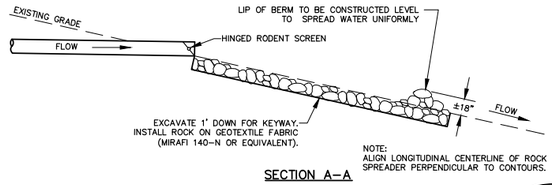
3/11 CUTOFF COLLAR
N.T.S.



4/11 DIVERSION AVENUE TYPICAL X-SECTION
N.T.S.



PLAN VIEW



NOTE:
ALIGN LONGITUDINAL CENTERLINE OF ROCK SPREADER PERPENDICULAR TO CONTOURS.

SECTION A-A

5/11 ROCK ENERGY DISSIPATER
N.T.S.



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JOB NO: 11713301
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STAGECOACH NORTH
SODA CANYON ROAD
DETENTION BASIN DESIGN
DETAILS

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI, A. LEMIRE-BAETEN

SCALE:	DRAWN BY:	DATE:	SHEET:
AS SHOWN	ALB	07-10-19	11 OF: 11

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Attachment A

SUPPLEMENTAL PROJECT INFORMATION

File #:__ __-__ __ __ Owner: Gallo Vineyards Inc Parcel #: 032-010-086

Vineyard Development Area Specifics

1. **Size of Area Disturbed:** 116.2 acres
2. **Size of Vineyard:** 91.3 acres
3. **Acres of Vines:** 91.3 acres
4. **Slopes of Area Disturbed:** 7 % to 25 %
5. **Amount of Total Acreage Equal to or Above 30% Slope:** 2.1 acres
6. **Total Number of Trees Removed** TBD trees
   a) natives _____ trees
   b) non-natives _____ trees

Vineyard Development Schedule

1. **Pre-Planting Stage:**
   (i.e. land clearing, ripping, installation of drainage system., vineyard staking, installation of irrigation system., installation and maintenance of permanent and temporary erosion control measures, planting of cover crop, straw mulching)
   Start Date: 4-1 End Date: 9-15 Duration: 164 days
   Temporary Cover Crop Planted _____Yes _____No
2. **Planting Stage:**
   (i.e planting of vines, seeding permanent cover crop, apply straw mulch, maintenance of erosion control measures)
   Start Date: 4-1 End Date: 9-15 Duration: 164 days
3. **Operational Stage:**
   (maintenance and adjustment as needed of permanent erosion control practices, implementation of annual vineyard and erosion control measures, commencement of annual harvests)
   Start Date: 4-1

Vineyard Operations Information

1. **Farming Equipment:**

1 Track-laying	Percent of Use	15 %
3 Rubber-tired	Percent of Use	40 %
2 ATV	Percent of Use	25 %
12 Hand/Manual	Percent of Use	20 %
____Other (describe) _____	Percent of Use	____ %

2. **Annual Pruning:**
   Time of Year: January/February Number of days: 20 Number of Workers: 20
3. **Annual Sulfuring:**
   Time of Year: June-August Estimated applications/year: 3
4. **Weed Control:**

	Under Vines	***Between Rows***
Type of control	mow, weed whack, herbicide	
Method of application		
Months:		
Applications/year:		
Number of Workers:		

5. **Harvest (Crush):**
   Length 30 days Number of Workers: 34

6. Frost Protection Method(s)

	Hours of Operation	Frequency (times/year)
____ Return-stack heaters		
___ Sprinklers		
____ Misters		
X___ Wind Machines		April-May
____ Late Pruning		
____ Other _____		

7. Rodent Protection Method(s):

_____Rodenticides X__ Raptors

X___ Traps ____ Other _____

____ Fencing

8. Bird Protection Method(s):

	Time of Year (months)	Time of Day	Duration of Use (days per year)
____ Netting			
____ Bird Cannons			
X___ Visual Distracters *(Mylar strips, etc)*	July - August		
X___ Raptor Perches	year round		
____ Other _____			

9. Proposed Nighttime Activities:

	Time of Night	Duration of Use (days per year)
X___ Harvest	10pm - 6am	October - harvest
X___ Sulphur Application	10pm - 6am	May - June
____ Pesticide/Herbicide Application		
____ Other _____		

10. Irrigation Methods

____ Sprinklers X__ Drip System ____ Other _____

11. Other Proposed Activities:

N/A

Traffic Characteristics Information

1. Estimated size of grape trucks/truck & trailers to be used: 12 tons

2. Estimated number of truck trips per day: during Crush: 2 annually: 0

3. Estimated number of farmworkers/vehicle: 6 Crush 6 Pruning

4. Lunch provided on-site for farmworkers: ____ Yes X__ No

5. Proposed primary access: Soda Canyon Road

6. Proposed secondary access, if any: N/A

Itemized Fertilizer and Pesticide Information

	Application Method (broadcast, spray, drip system, etc)	Application Amount (per acre)	Number of Applications per Year.	Annual Amount Used (per acre)	Total Annual Amount Used Overall.
1. Fertilizers					
CAN-17	drip	3 gal	2	6 gal	540 gal
K-Carb	drip	5 gal	1	5 gal	450 gal
10-34-0	drip	5 gal	1	5 gal	450 gal
Micronutrient blend	spray	2 qts	2	4 qts	90 gal

2. Mildewcides						
Wettable Sulfur	spray	4 lbs	3	12 lbs	1,000 lbs
Quinoxyfen	spray	5 fl oz	2	10 fl oz	7 gal
Tetraconazole	spray	5 fl oz	2	10 fl oz	7 gal
3. Herbicides						
Glyphosate	spray	2 qts	2	4 qts	90 gal
Gluphosinate	spray	48 fl oz	1	48 fl oz	34 gal
4. Rodenticides						
None						
5. Other Chemicals						
Imidacloprid	spray	1 fl oz	≤1	1 fl oz	1 gal
Spirotetramat	spray	8 fl oz	≤1	8 fl oz	6 gal
Etoxazole	spray	3 oz	≤1	3 oz	17 lbs
Stylet Oil	spray	1 gal	1	1 gal	90 gal

6. Proposed Storage, Mixing/Handling and Safety Measures:

Type of onsite chemical storage facility in use or proposed: In Block V1, see Figure 5.

Location of current or potential area(s) used for the mixing agricultural chemicals and the description of the facilities present thereat: In Block V1, see Figure 5.

Location of current or proposed area designated for the cleaning and washing of chemical application equipment: In Block V1, see Figure 5.

Water Source and Usage Information

** Use Attachment D to calculate information requested**

1. Current and/or Proposed Water Supply Source(s):

Agricultural Water Source(s) :	***Percent of Total Agricultural Use:***
X Well	100 %
____ Spring	____ %
____ Stream or Creek	____ %
____ Reservoir(s)	____ %
____ Other _____	____ %
	100%

Residential and Non-Agricultural Water Source(s) :	***Percent of Total Resid & Non-Ag***
___ Well	___ %
____ Spring	____ %
____ Stream or Creek	____ %
____ Other _____	____ %
	100%

2. Current and Future/Proposed Water Usage *(acre-foot per year = AF/yr)* **:**

	Current Usage :	***Future Usage*** :
Vineyard & other Agricultural. Uses:	_____AF/yr	_____AF/yr
Residential/Domestic Uses:	_____ AF/yr	_____AF/yr
Other Uses:	_____AF/yr	_____AF/yr
Total Usage:	_____AF/yr	_____AF/yr

3. Allowable Groundwater Allotment: _____AF/yr

Rock/Spoils/Debris Disposal Information

1. Use/Disposal of Rock Generated (brought to the surface during the vineyard preparation ripping and raking process)**:**

Proposed Use/Disposal Method :	***Percent of Total***	***Location***
X Road Base (crushed to aggregate size)	50 %	X on-site _____ off-site
____"Rock Mulch" (crushed to fist size and returned to fields)	_____%	_____ on-site _____ off-site
____Decorative Rock	_____%	_____ on-site _____ off-site
____Fill (buried)	_____%	_____ on-site _____ off-site
____Stacked In Pile	_____%	_____ on-site _____ off-site
X Other Erosion control measures	50 %	X on-site _____ off-site

2. Estimated Amount of Cut & Fill: ±2,000 cubic yards (total)
±1,000 cubic yards (cut) ±1,000 cubic yards(fill)

3. If rock/spoils material is to be disposed of off-site, where, what for and how much:

Location of Disposal Site	***Use of Material***	***Quantity***
_____	_____	_____ cubic yards
_____	_____	_____ cubic yards
_____	_____	_____ cubic yards

4. Debris Disposal (Location & Method):
____On-site_____ ____Off-site_____

Related Permits

1. Please indicate any other related or required permits associated with the proposed conversion plan:

County:

Grading: Yes ____ No X
Building: Yes ____ No X
Structural ECP: Yes ____ No X
Sewage Disposal: Yes ____ No X
Groundwater/Well Permit: Yes ____ No X
Use Permit: Yes ____ No X
Variance: Yes ____ No X
Other Not Listed: _____

State Dept of Forestry:

Timber Harvest Plan: Yes ____ No X
Timber Conversion Exemption: Yes ____ No X
Timber Conversion Permit: Yes ____ No X ____ acres
_____ acres

State Dept of Fish & Game:

Streambed Alteration Permit: Yes ____ No X

State Division of Water Rights:

Appropriate Water Rights Permit: Yes ____ No X

State Environmental Protection Agency:

Chemical Application Permit(s): Yes ____ No X

Other State & Federal Permits *(please list)* **:**

_____

2. Consultation with, or letter of agreement from:

Regional Water Quality Control Brd: Yes ____ No X
National Marine Fisheries Service/NOAA: Yes ____ No X
Army Corps of Engineers: Yes ____ No X
U.S. Fish and Wildlife Service: Yes ____ No X

APPENDIX B

NOTICE OF PREPARATION, INITIAL STUDY AND COMMENTS RECEIVED AND APPLICATION

A Tradition of Stewardship
A Commitment to Service

PLANNING, BUILDING & ENVIRONMENTAL SERVICES
1195 THIRD STREET SUITE 210
NAPA, CA 94559
www.countyofnapa.org

To: State Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

From: Brian Bordona, Deputy Director
Napa County Department of Planning,
Building & Environmental Services
1195 Third Street, Suite 210
Napa, CA 94559

Subject: Notice of Preparation of Draft Environmental Impact Report
Stagecoach North Vineyard Conversion #P18-00446-ECPA

The County of Napa is the Lead Agency and will prepare an Environmental Impact Report (EIR) for the project identified below. We need to know the views of your agency on the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency will need to use the EIR prepared by our agency when considering your permit or other approval for the project.

The project description, location, and the potential environmental effects are contained in the attached materials. An Initial Study has been prepared and is available for review between the hours of 8:00 a.m. and 4:45 p.m., Monday through Friday at the Planning, Building and Environmental Services Department, Second Floor of the County Administration Building located at 1195 Third Street, Napa, California, and online at https://www.countyofnapa.org/2552/Stagecoach-North-Vineyard-ECP.

Project Location: Access to the project site is off Soda Canyon Road, approximately 5 miles northeast of Yountville in Napa County (**Figure 1**). The project site is in the Rector Reservoir watershed.

General Plan/Zoning Designations: Agricultural, Watershed and Open Space (AWOS)/Agricultural Watershed (AW)

Project Description: The Stagecoach North Erosion Control Plan Application (ECPA) #P18-00446 proposes vegetation removal and earthmoving activities on slopes greater than five percent in connection with the development of approximately 91.3 net acres of vineyard within approximately 116.2 gross acres on an approximately 170.2-acre parcel.

Proposed activities associated with vineyard development include removal of brush and trees within the proposed clearing limits, ripping, rock removal, blasting, soil cultivation, seeding of a cover crop, mulching, trenching for storm drain and irrigation pipelines, installation of a trellis system and deer fence, laying out vine rows, installation of temporary and permanent erosion control measures, and planting of grapevines.

Vineyard development would take place between April 1 and September 15 in one phase. The development area would be winterized by September 15. Temporary erosion control measures could include installing water bars, straw wattles, straw bale dikes, and other practices as needed. Permanent erosion control measures include:

- Five detention basins constructed in the development area to attenuate small increases in runoff associated with vineyard development:
    - Detention Basin #1 in the northwest corner of Block Y16;
    - Detention Basin #2 in the southwest corner of Block Y16;
    - Detention Basins #3 and #4 on the south side of Block Y16; and
    - Detention Basin #5 north of Blocks V3 and V4.
- Seeding of a permanent cover crop with vegetative cover maintained according to the ECP.

- Surface drainage pipelines installed to collect surface runoff at low points throughout the development area and transport it to protected outlets.

- Cutoff collars installed on all solid pipelines with slopes greater than 5 percent.

- Standard drop inlets and concrete drop inlets installed at designated locations in the development area.

- Diversion ditches constructed to convey surface water through and/or around proposed vineyard areas and direct it to a stable outlet or drop inlet.

- Diversion avenues constructed to reduce slope run length and intercept runoff throughout the vineyard while directing it to a stable outlet.

- Rock level spreaders installed in designated locations at the outfall of conveyance infrastructure to uniformly spread water onto the ground surface.

- Rock-filled avenues constructed to dispose of rock generated onsite, create safer turning for equipment, and disperse and filter runoff.

- Rock energy dissipaters constructed to help disperse concentrated flow.

- Rolling dips installed in designated locations in the development area to direct water off the roadway surface and back onto the native ground surface. These designated locations include areas where the existing road runs uphill and the potential exists for runoff to run down the roadway surface and cause erosion or gullying, or areas where rolling dips are needed to ensure that roads are hydrologically disconnected from receiving waters.

- Three new rocked water crossings over waters of the U.S. installed in designated locations in the development area, to be used for vineyard access during low-flow or dry conditions. Other rocked water crossings are proposed in the ECP that cross proposed ditches, and therefore would not affect waters of the U.S.

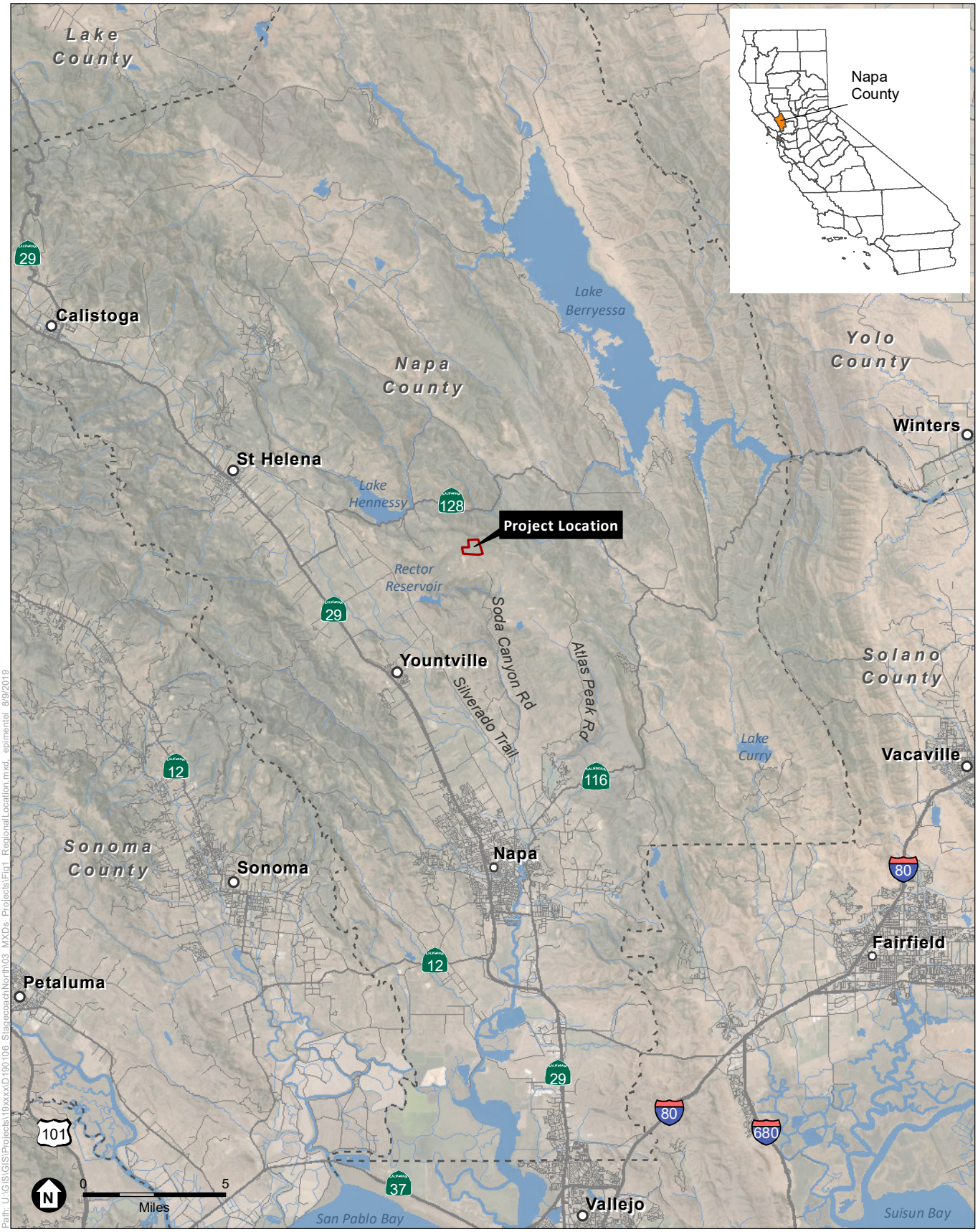
- One existing undersized culvert upgraded to a larger diameter culvert (48 inches) to minimize the potential for plugging and other issues that could be caused by an undersized culvert.

- Outsloped infield level spreader constructed to prevent surface flows from becoming concentrated through the vineyard areas.

In order for your comments to be considered, please submit your written comments no later than **4:45 p.m. on Wednesday, November 13, 2019** to:

Don Barrella
Napa County Department of Planning, Building & Environmental Services
1195 Third Street, Suite 210
Napa, CA 94559

Email: Donald.Barrella@countyofnapa.org



SOURCE: Esri, 2015; ESA, 2019

Stagecoach North Vineyard Conversion #P18-00446-ECPA

Figure 1
Regional Location

ESA

COUNTY OF NAPA
DEPARTMENT OF PLANNING, BUILDING AND ENVIRONMENTAL SERVICES
1195 THIRD STREET, 2ND FLOOR
NAPA, CA 94559
(707) 253-4416

Initial Study Checklist

(Reference Napa County's Procedures for Implementing CEQA, Appendix C)

1. **Project Title:** Stagecoach North Vineyard Conversion Erosion Control Plan Application #P18-00446-ECPA

2. **Property Owner:** Gallo Vineyards Inc.

3. **Contact Person, Phone Number and Email:** Don Barrella, Planner III, (707) 253-4417, Donald.Barrella@countyofnapa.com

4. **Project Location and APNs:** Access from Soda Canyon Road, Napa, California; Assessor's Parcel Number 032-010-086 (**Figure 1** and **Figure 2**)

5. **Project Sponsor's Name and Address:** Gallo Vineyards Inc.
   Attn: Trini Amador
   P.O. Box 1130
   Modesto, CA 95353

6. **General Plan Description:** Agricultural, Watershed and Open Space (AWOS)

7. **Zoning:** Agricultural Watershed (AW)

8. **Description of Project:**

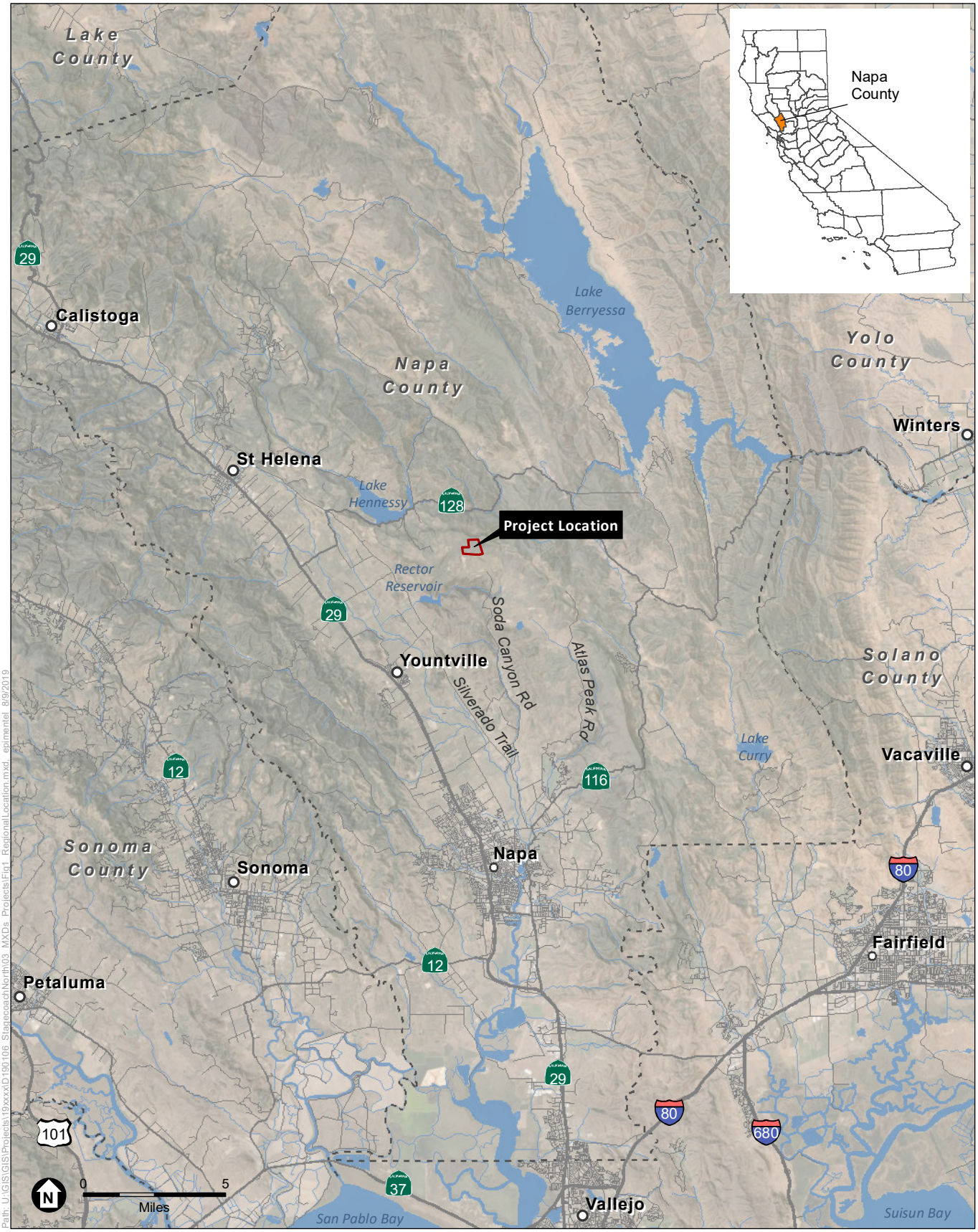
   Gallo Vineyards Inc. (Applicant) filed an erosion control plan (ECP) application (#P18-00446-ECPA) with the Napa County Planning, Building and Environmental Services Department (County) on December 20, 2018. The ECP application proposed vegetation removal and earthmoving activities on slopes greater than 5 percent in connection with the development of approximately 91.3 net acres of new vineyard within 116.2 gross acres (**Figure 3**). Vineyard avenues would be constructed around each proposed vineyard block, and their acreage is included in the proposed clearing limits boundary.

   In total, 17 vineyard blocks are proposed. The acreages of the proposed vineyard blocks and their associated clearing limits are described in **Table 1** below.

   Proposed activities associated with vineyard development include removal of brush and trees within the proposed clearing limits, ripping, rock removal, blasting, soil cultivation, seeding of a cover crop, mulching, trenching for storm drain and irrigation pipelines, installation of a trellis system and deer fence, laying out vine rows, installation of temporary and permanent erosion control measures, and planting of grapevines.

   Figure 4 shows the location of the proposed deer fence. Fencing would match the existing deer fence and would be 7 feet tall and made of smooth wire, with mesh spacing of approximately 6 inches by 6 inches up to 6 feet. The top 1 foot of the fence would be made of two bare (not barbed) wire strands.

   There is approximately 0.9 mile of existing dirt road on the project site **(Figure 4**); approximately 0.6 mile of the existing roads would be upgraded to Level 1 roads to provide primary access to the proposed vineyard blocks. A 3-inch minus aggregate base material would be applied to the existing roadway width concurrent with vineyard development, at a depth of 3–6 inches, to ensure that vehicular traffic would not degrade the roadway surface during wet periods of the year. Roadways would be improved to reproduce natural drainage patterns and promote sheet flow through the use of best management practices, such as outsloping, berm removal, and construction of frequent (spaced at approximately 150-foot intervals) rolling dips or water bars where needed.

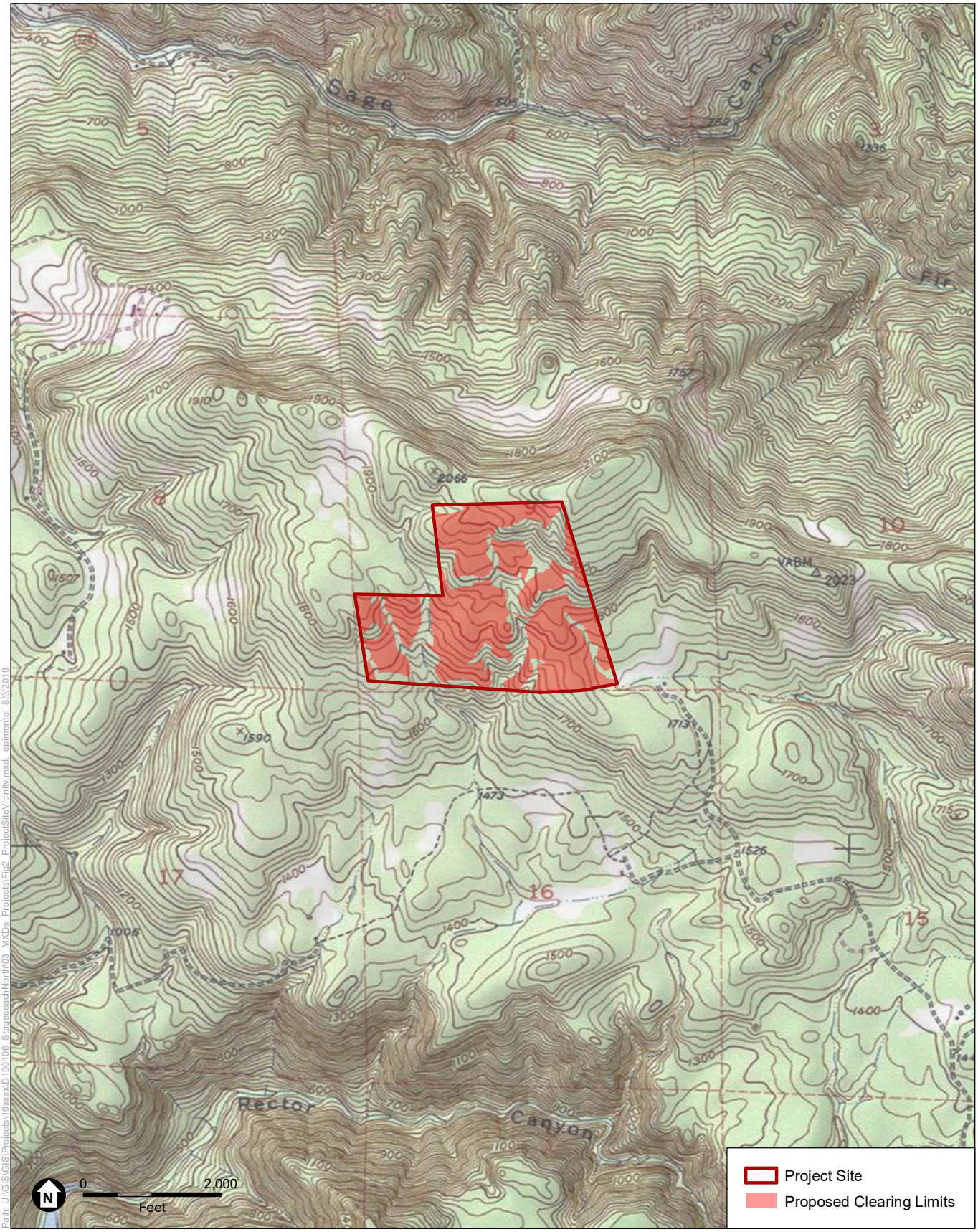


SOURCE: Esri, 2015; ESA, 2019

Stagecoach North Vineyard Conversion #P18-00446-ECPA

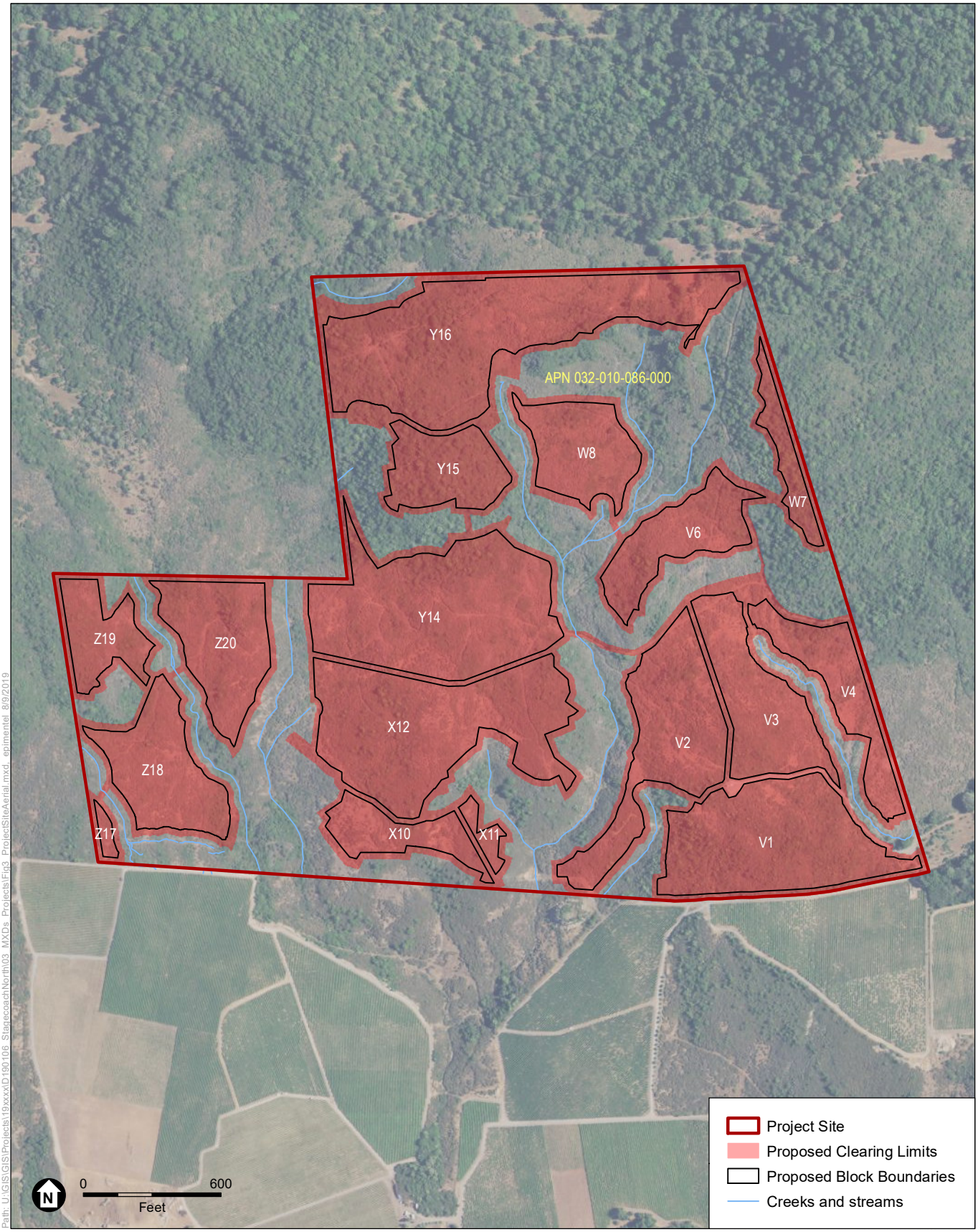
Figure 1
Regional Location

ESA



SOURCE: USGS 7.5' Topo Quad (Chiles Valley, 1951); PPI Engineering, 2019; ESA, 2019 Stagecoach North Vineyard Conversion #P18-00446-ECPA

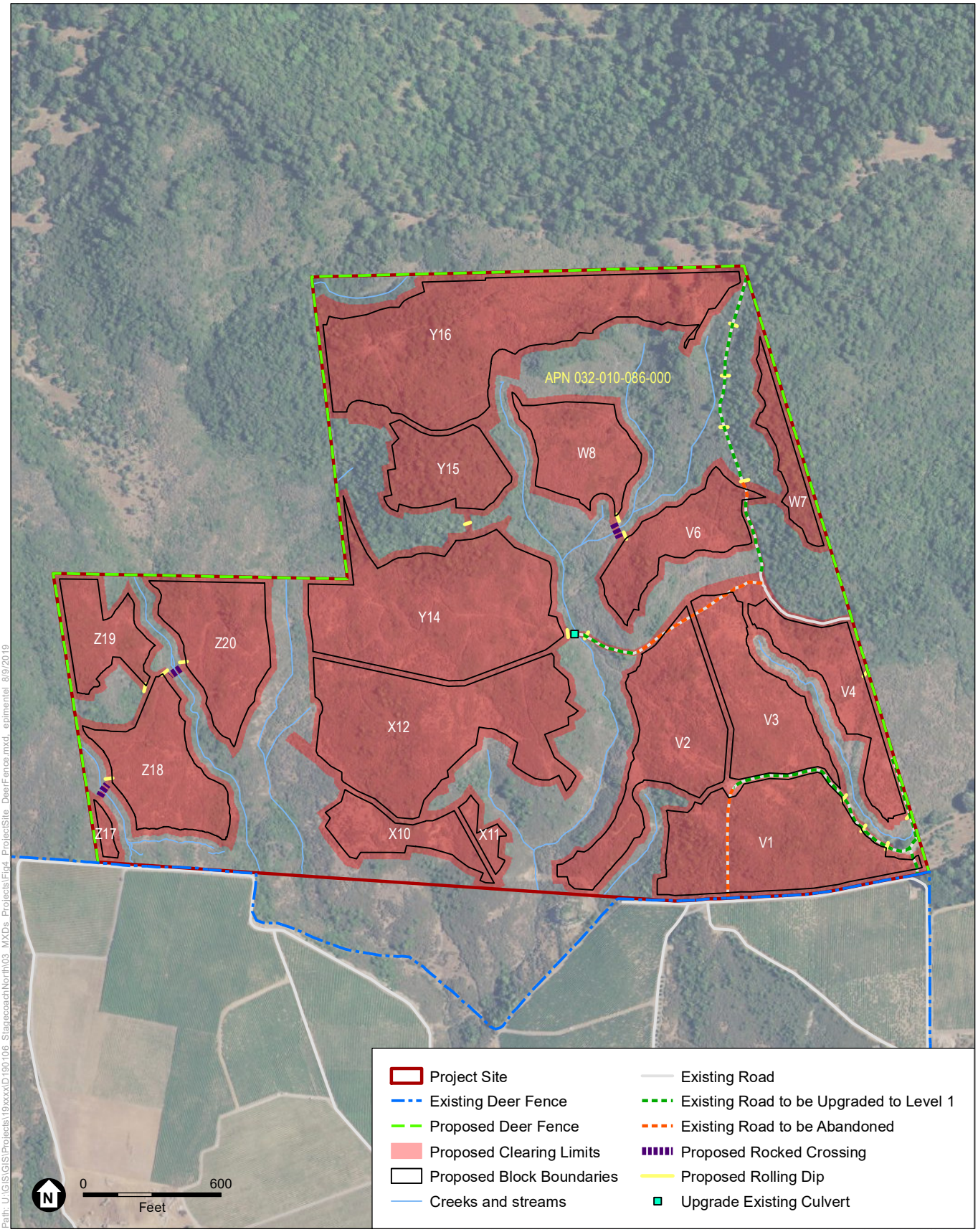
Figure 2
Project Site and Vicinity



SOURCE: USDA, 2016; PPI Engineering, 2019; LSA, 2019; ESA, 2019

Stagecoach North Vineyard Conversion #P18-00446-ECPA

Figure 3
Project Site



SOURCE: USDA, 2016; PPI Engineering, 2019; LSA, 2019; ESA, 2019

Stagecoach North Vineyard Conversion #P18-00446-ECPA

Figure 4
Deer Fence and Roads

Table 1
Acreages of Proposed Vineyard Blocks

Block	Proposed Clearing Limits (Gross Acres)	Proposed Block Boundaries (Net Acres)	Block	Proposed Clearing Limits (Gross Acres)	Proposed Block Boundaries (Net Acres)
V1	10.5	9.0	Y14	13.7	11.8
V2	8.8	7.0	Y15	4.6	3.6
V3	6.4	5.3	Y16	17.6	14.1
V4	5.7	3.8	Z17	0.7	0.3
V6	5.4	4.0	Z18	6.3	4.9
W7	2.8	1.6	Z19	3.8	2.7
W8	5.3	4.0	Z20	6.3	5.0
X10	3.6	2.5	Avenues and Rock Disposal Areas	0.3	N/A
X11	1.1	0.5	**Total**	**116.2**	**91.3**
X12	13.3	11.2			

Source: PPI Engineering 2019

The project site has 0.1 mile of existing Level 2 roads that would be used seasonally during dry periods to provide secondary access to some vineyard blocks. Level 2 roads would receive the same best management practices and road shaping as Level 1 roads, except that the roadway surface would not be surfaced with crushed rock. The Level 2 roads would be part of vineyard avenues after implementation of the project and would be subject to the same vegetative cover crop requirements as the adjacent vineyard block pursuant to the ECP.

Approximately 0.2 mile of existing dirt roads would be decommissioned by incorporating them into the proposed vineyard blocks. In these locations, the access roads would be realigned to the outer vineyard avenue. Roadways proposed for decommissioning would be decompacted using a bulldozer, ripping to a depth of at least 6 inches.

In addition to the gravel and dirt roads on the project site, a network of vegetated vineyard avenues would surround the proposed vineyard blocks and provide access for farming equipment and workers. These avenues would be reseeded as needed to ensure appropriate levels of vegetative cover, as required by the engineered ECP that would cover these avenues.

The ECP includes a road plan that describes operational roadway use and use restrictions, maintenance practices, and improvements.

Rock would be generated during construction of the proposed project. Some of the rock generated would be used for erosion control features such as rock energy dissipaters and rock level spreaders. Crushed rock would be used on existing roads where needed and for rock-filled avenues. Rock not used immediately would be temporarily stockpiled for future use within the proposed clearing limits. Stockpiles would be less than 30 feet tall.

With the exception of crossings required for access, all drainages on the project site have received setbacks incorporated into the project design. The two ephemeral streams on the project site that meet Napa County's definition of a stream have received no-touch setbacks ranging from 55 to 105 feet based on slope, in accordance with Napa County Code Section 18.108.025. In addition, the other non-County definitional streams on the project site have been avoided and afforded a 50-foot buffer consisting of 26 feet of undisturbed native vegetation and 24 feet of vegetated vineyard avenue. The avenues would be subject to the same vegetative cover crop requirements as the adjacent vineyard block pursuant to the ECP.

The proposed vineyard would be irrigated entirely by groundwater from two wells located in the southeastern portion of the project site. Additional wells may be developed in the future, but the overall groundwater demand would not change. The project proposes to use approximately 54.8 acre-feet of groundwater per year to irrigate the 91.3 net acres of vineyard during the first four years while the vines are established, and approximately 45.7 acre-feet of groundwater per year to irrigate the 91.3 net acres of vineyard after the fourth year.

Project Construction

Vineyard Development

Vineyard development would take place between April 1 and September 15 in one phase. An average of approximately 0.8 acre per day would be disturbed during construction. The project has been designed so that no import or export of material is required; approximately 1,000 cubic

yards of cut would be generated and 1,000 cubic yards of fill would occur on the project site. Approximately 1,640 trees with a stem diameter at breast height of 5 inches or more are present in the development area. Roughly half of the vegetation removed would be chipped onsite and the other half would be burned onsite in accordance with Bay Area Air Quality Management District regulations. Solid waste would be removed from the site by Napa County Recycling and Waste Services.

Two truck trips would deliver and remove heavy equipment during the first week and last two weeks of project construction. **Table 2** lists the typical construction equipment and the estimated quantity of equipment needed for the proposed project. All equipment, except one D6 and one D9 bulldozer, is already on the adjacent property owned by the Applicant and would not require transport. On average, construction equipment would operate for seven hours per day during the construction period, and work would take place six days per week.

Construction would require eight to 10 workers daily. An estimated 10 passenger vehicle round trips per day would occur six days per week from April to September, with average round trip mileage of 28 miles per vehicle. Construction worker hours would typically be 6 a.m. to 6 p.m.

All staging would be conducted within the development area. The primary staging area would be in the southeastern portion of the project site, in proposed Block V1.

Blasting would be conducted by drilling and blasting. It is conservatively estimated that five blasting events may be required during project construction.

The limits of ripping would be within the proposed vineyard clearing areas. Average ripping depth would be 42 inches, with a maximum ripping depth up to 60 inches, depending on site conditions. The proposed vine and row spacing would be 4 feet by 6 feet; however, in areas where the cross-slope exceeds 15 percent, row spacing would be increased to provide adequate room for equipment.

Irrigation pipelines would be located within existing roadways, vineyards and vineyard avenues, and/or proposed clearing limits.

The development area would be winterized, including seeding and installation of straw mulch and straw wattles, by September 15. All disturbed areas (including vineyard avenues) would be seeded with a permanent cover crop according to the ECP.

Table 2
Typical Equipment during Construction

Equipment	Estimated Quantity
Large Excavator	2
Medium Excavator	1
D9 Bulldozer	3
D8 Bulldozer	1
D6 Bulldozer	2
Haul Truck	2
Loader	2
Water Truck	1
Farm Tractor with Trailer	4

Source: Data provided by PPI Engineering in 2019

Erosion Control Measures

Temporary erosion control measures could include installing water bars, straw wattles, straw bale dikes, and other practices as needed.

Permanent erosion and runoff control measures described in the ECP (PPI Engineering 2019) include:

- Five detention basins constructed in the development area to attenuate small increases in runoff associated with vineyard development:
    - Detention Basin #1 in the northwest corner of Block Y16;
    - Detention Basin #2 in the southwest corner of Block Y16;
    - Detention Basins #3 and #4 on the south side of Block Y16; and
    - Detention Basin #5 north of Blocks V3 and V4.

- Seeding of a permanent cover crop with vegetative cover maintained according to the ECP.
- Surface drainage pipelines installed to collect surface runoff at low points throughout the development area and transport it to protected outlets.
- Cutoff collars installed on all solid pipelines with slopes greater than 5 percent.
- Standard drop inlets and concrete drop inlets installed at designated locations in the development area.
- Diversion ditches constructed to convey surface water through and/or around proposed vineyard areas and direct it to a stable outlet or drop inlet.
- Diversion avenues constructed to reduce slope run length and intercept runoff throughout the vineyard while directing it to a stable outlet.
- Rock level spreaders installed in designated locations at the outfall of conveyance infrastructure to uniformly spread water onto the ground surface.
- Rock-filled avenues constructed to dispose of rock generated onsite, create safer turning for equipment, and disperse and filter runoff.
- Rock energy dissipaters constructed to help disperse concentrated flow.
- Rolling dips installed in designated locations in the development area to direct water off the roadway surface and back onto the native ground surface. These designated locations include areas where the existing road runs uphill and the potential exists for runoff to run down the roadway surface and cause erosion or gullying, or areas where rolling dips are needed to ensure that roads are hydrologically disconnected from receiving waters.
- Three new rocked water crossings over waters of the U.S. installed in designated locations in the development area, to be used for vineyard access during low-flow or dry conditions. Other rocked water crossings are proposed in the ECP that cross proposed ditches, and therefore would not affect waters of the U.S.
- One existing undersized culvert upgraded to a larger diameter culvert (48 inches) to minimize the potential for plugging and other issues that could be caused by an undersized culvert.
- Outsloped infield level spreader constructed to prevent surface flows from becoming concentrated through the vineyard areas.

Vineyard Operations and Maintenance

Table 3 summarizes the operations and maintenance activities that would take place after construction of the vineyard.

Table 3
Annual Operations Schedule

Months	Activity	Approximate Number of Workers
January and February	Annual pruning of vines	20
June–August	Chemical, mechanical, and manual weed control Sulfur applications to protect against mildew	15
September and October	Harvest Winterization of vineyard, vineyard avenues, and vineyard roads	34
November–April	Monitoring and maintenance of erosion control measures	15

Sources: Gallo Vineyards Inc. Erosion Control Plan Application P18-00446, 2018; data provided by PPI Engineering in 2019

Nighttime activities would include:

- *Frost protection*, with two wind machines operating, typically in April and May for approximately 15 hours per month
- *Harvest* between 10 p.m. and 6 a.m., typically in October
- *Sulfur applications* approximately 12 times per year between 9 p.m. and 6 a.m., typically in May and June

Permanent erosion control measures would be maintained regularly. Measures would be monitored throughout the rainy season and repairs and/or maintenance would be performed immediately. The permanent cover crop would be mowed only, and not disked.

An integrated pest management plan would be implemented as part of the sustainable farming practices on the project site. No pre-emergent herbicides would be sprayed in the vine rows for weed management. Contact or systemic herbicides may be applied in the spring (no earlier than February 15). Chemicals would be stored and mixed in a shipping container that would be placed in Block V1 as shown in Figure 5 of the ECP.

An estimated two truck trips (12 tons each) and 12 worker round trips would occur during harvest (with approximately 34 workers). Grape-hauling trucks may travel an average of 8 miles to the nearest processing facility. Worker trips would average approximately 28 miles. Approximately 12 worker round trips would occur during pruning (with 20 workers). Outside of the peak harvest and pruning periods, an average of 15 workers would carpool together.

Operation of the irrigation system would require the use of diesel generators.

9. Description of the environmental setting and surrounding land uses.

Access to the approximately 170.2-acre Stagecoach North Soda Canyon Ranch parcel (i.e., the project site) is available via a private road off Soda Canyon Road, which crosses an adjacent property owned by the Applicant, Gallo Vineyards Inc. The project site consists of undeveloped areas, dirt roads, and hand-cut trails. The southern portion of the project site is currently bounded by a deer fence (**Figure 4**).

Vegetation types on the project site include chamise chaparral, grassland, California black oak forest, California bay forest, and intermixed scrub oak communities (including canyon live oak, leather oak, interior live oak, and scrub oak). Rock outcrops are also present, along with approximately 2,790 trees with a stem diameter at breast height of 5 inches or more. Several ephemeral streams exist on the project site, including one depicted as a blue line stream on the Yountville U.S. Geological Survey topographic quadrangle map.

Elevations in the proposed vineyard conversion areas (i.e., proposed clearing limits or development area) range from approximately 1,660 feet to 2,140 feet above mean sea level. Ground slopes in the development area range from approximately 7 percent to 25 percent and average 18 percent. Small areas within the proposed vineyard blocks have ground slopes of 30 percent or steeper; approximately 2.1 acres would be developed on such slopes. Soils on the project site include Guenoc-Rock Outcrop Complex 30 to 75 percent slopes, Hambright Rock-Outcrop Complex 30 to 75 percent slopes, Rock Outcrop-Hambright Complex 50 to 75 percent slopes, and Sobrante Loam 5 to 30 percent slopes.

The project site is located within the Rector Reservoir watershed, which is designated by Napa County (County) as a Sensitive Domestic Water Supply Drainage. Chapter 19.108.027, Sensitive Domestic Water Supply Drainages, of the County Code outlines provisions applicable to such designated drainages, including vegetation clearing limits and winter shutdown requirements.

The project site is zoned Agricultural Watershed (AW). As defined in Chapter 18.20, AW District, of the County Code, the AW district classification is intended to be applied in areas of Napa County where the predominant use is agriculturally oriented; where watershed areas, reservoirs, and floodplain tributaries are located; where development would adversely affect all such uses; and where the protection of agriculture, watersheds, and floodplain tributaries from fire, pollution, and erosion is essential to the general health, safety, and welfare.

10. Other agencies whose approval is required (e.g., permits, financing approval, or participation agreement).

Agency	Type of Approval
Federal Agencies	
U.S. Army Corps of Engineers	Clean Water Act Section 404 permit
	National Historic Preservation Act Section 106 compliance
U.S. Fish and Wildlife Service	Federal Endangered Species Act compliance (Section 7)

Agency	Type of Approval
State Agencies	
California Department of Fish and Wildlife	California Endangered Species Act compliance (Section 2081)
	Section 1602 Streambed Alteration Agreement
State Water Resources Control Board, Division of Water Rights	Approval of Petitions for Change on Water Right License 9125 and Permit 18459
San Francisco Bay Regional Water Quality Control Board (Region 2)	General Waste Discharge Requirements for Vineyard Properties in the Napa River and Sonoma Creek Watersheds
	Clean Water Act Section 401 Water Quality Certification
Local/Other Agencies	
Napa County Planning, Building and Environmental Services	California Environmental Quality Act Lead Agency; Agricultural Erosion Control Plan approval; Assembly Bill 52 compliance; grading and/or building permits

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, has consultation begun?

Consultation with California Native American tribes has begun. Notice of the proposed project was sent to Yocha Dehe Wintun Nation, Middletown Rancheria, and Mishewal Wappo Tribe of Alexander Valley on January 29, 2019. On February 22, 2019, the County received a response letter from Yocha Dehe Wintun Nation indicating that the project is not within the aboriginal territories of the Yocha Dehe Wintun Nation.

Environmental Factors Potentially Affected

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agriculture and Forestry Resources	☒ Air Quality
☒ Biological Resources	☒ Cultural Resources	☐ Energy
☒ Geology/Soils	☒ Greenhouse Gas Emissions	☒ Hazards & Hazardous Materials
☒ Hydrology/Water Quality	☒ Land Use/Planning	☐ Mineral Resources
☒ Noise	☐ Population/Housing	☐ Public Services
☐ Recreation	☒ Transportation	☒ Tribal Cultural Resources
☒ Utilities/Service Systems	☐ Wildfire	☒ Mandatory Findings of Significance

ENVIRONMENTAL IMPACTS AND BASIS OF CONCLUSIONS

The conclusions and recommendations contained herein are professional opinions derived in accordance with current standards of professional practice. They are based on a review of the Napa County Environmental Resource Maps, the other sources of information listed in the file, and the comments received, conversations with knowledgeable individuals; the preparer's personal knowledge of the area; and visits to the project site. For further information, see the environmental background information contained in the permanent file on this project.

On the basis of this initial evaluation:

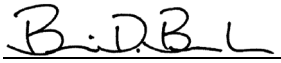
☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.



Signature

October 1, 2019
Date

Brian Bordona
Printed Name

Napa County Planning, Building and Environmental Services

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
1.	**AESTHETICS**. Except as provided in Public Resources Code Section 21099, would the project:				
a)	Have a substantial adverse effect on a scenic vista?	☐	☐	☒	☐
b)	Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☒	☐
c)	Substantially degrade the existing visual character or quality of public views of the site and its surroundings?	☐	☐	☒	☐
d)	Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area?	☐	☐	☒	☐

Discussion

a–b) The project site is located on the south-facing slopes of the Vaca Mountains in north-central Napa County. The site is not located on a prominent hillside, on a major or minor ridgeline (Napa County GIS, Ridgelines Layer), or within a scenic corridor (Napa County GIS, Scenic Corridors Layer). There are no historic buildings, significant rock outcroppings, or geologic features on the project parcel that would be affected by the project. Rock generated during construction would be used for erosion control features, crushed for use on existing roads and rock-filled avenues, or temporarily stockpiled for future use within the proposed clearing limits in piles less than 30 feet tall. Trees and vegetation would be removed from the proposed development area, but the project site is not visible from a state scenic highway (Caltrans 2018). Therefore, the proposed project would have a less-than-significant impact on a scenic vista, scenic highway, historic buildings, scenic trees, or rock outcrops. The Environmental Impact Report (EIR) will not analyze these issues.

c) The proposed project would result in the removal of existing vegetation and the temporary stockpiling of rock in the proposed development area, but there are no public roadways or views in the project vicinity. The proposed project would be consistent with the land uses in the surrounding area, which include vineyards, and with the Napa County General Plan designation of AWOS. The presence of construction equipment for approximately 5½ months also would not result in a significant effect, as the presence of the equipment would be only temporary. The proposed project would not construct any new roads. Therefore, the project would have a less-than-significant impact on the existing visual character or quality of public views of the site and its surroundings. The EIR will not analyze this issue.

d) The proposed agricultural operations on the project site would require some lighted nighttime activities consistent with the activities that already occur at night in the surrounding area, which include vineyard and agricultural uses. Lighting would take the form of headlights, or lights directed downward, on the equipment used during nighttime activities. Such activities would include harvest (typically in October between 10 p.m. and 6 a.m.), frost protection work (approximately 15 hours per month, typically between April and May), and sulfur application (approximately 12 times per year, typically in May and June between 9 p.m. and 6 a.m.). Although the proposed project would involve some nighttime activity for limited periods, it would not introduce a new source of substantial light or glare. Therefore, the project would have a less-than-significant impact on daytime or nighttime views in the area. The EIR will not analyze this issue.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
2.	**AGRICULTURE AND FORESTRY RESOURCES.** In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a)	Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b)	Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c)	Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d)	Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e)	Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

Discussion

a) The Napa County General Plan emphasizes agricultural preservation, with the overarching goal to have agriculture as the county's primary land use. Goals and policies in the General Plan focus on preserving current and promoting new agricultural land uses, and encourage active, sustainable forest management practices.

The Napa County Important Farmland 2016 map prepared by the California Department of Conservation, Division of Land Resource Protection does not identify the project site as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (DOC 2016), and the proposed project would not convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to nonagricultural use, resulting in no impact. The EIR will not analyze this issue.

b) The project site has a General Plan designation of AWOS and is zoned AW. Therefore, the establishment of a vineyard totaling approximately 116.2 gross acres (91.3 net acres) is consistent with the parcel's land use and zoning designations. The project parcel is not under a Williamson Act contract. Therefore, the proposed project would not conflict with the project site's land use designation or with a Williamson Act contract, resulting in no impact. The EIR will not analyze these issues.

c–d) California Public Resources Code Section 12220(g) defines "forest land" as "land that can support 10% native tree cover of any species, including hardwoods, under natural conditions, and that allows for management of one or more forest resources, including timber, aesthetics, fish and wildlife, biodiversity, water quality, recreation, and other public benefits."

The project parcel does not contain forest land or coniferous forest (LSA 2018), and is not zoned forest land as defined in Public Resource Code Section 12220(g), timberland as defined in Public Resource Code Section 4526, or a Timberland Production Zone as defined in Government Code Section 51104(g). Therefore, the proposed project would not have an impact on forest land or timberland and the EIR will not analyze these issues. The Biological Resources section of the EIR will include an analysis of on-site vegetation communities and proposed tree removal.

e) The proposed project is agricultural in nature and would not result in the conversion of existing farmland or forest land in the area to nonagricultural or nonforest land uses. As such, the project would not have an impact on the agriculture or forestry resources of Napa County. The EIR will not analyze this issue.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
3.	**AIR QUALITY.** Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the project:				
a)	Conflict with or obstruct implementation of the applicable air quality plan?	☒	☐	☐	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?	☒	☐	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☒	☐	☐	☐

Discussion

a–b) The project site is located in the hills bordering the east side of the Napa Valley northeast of Yountville, in the Napa County climatological subregion of the San Francisco Bay Area Air Basin, which is under the jurisdiction of the Bay Area Air Quality Management District. The topographical and meteorological features of the Napa Valley subregion create the potential for air pollution. Criteria air pollutants of concern include ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter.

Project construction activities may result in short-term impacts on air quality. Construction-related emissions, which would be temporary, would consist mainly of particulate matter from fugitive dust generated during grading or other earthmoving activities and other criteria pollutants generated by construction equipment exhaust, haul and worker trips using vehicles, and burning of cleared vegetation. Ongoing activities to operate and maintain the proposed vineyard may result in long-term air quality impacts. Operational emissions, which would be seasonal, would be generated primarily by vehicular trips by workers to and from the site and by the equipment necessary for ongoing vineyard maintenance.

The EIR will analyze the potential for the proposed project to conflict with or obstruct implementation of an air quality plan or result in a cumulatively considerable net increase of a criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard.

c–d) Land uses such as schools, playgrounds, child care centers, hospitals, and convalescent homes are considered sensitive to poor air quality. Infants and children, the elderly, and people with health afflictions, especially respiratory ailments, are more susceptible to respiratory infections and other air quality–related health problems than the general public. Residential areas are also considered sensitive to air pollution because residents, who include children and the elderly, tend to be at home for extended periods of time.

Land uses surrounding the project site include agricultural areas, open space, and scattered residences. The project site is undeveloped, with no residences or structures on-site. The EIR will analyze the potential for the proposed project to expose sensitive receptors to substantial pollutant concentrations or result in other emissions (such as those leading to objectionable odors) adversely affecting a substantial number of people.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
4. BIOLOGICAL RESOURCES. Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐	☐

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d)	Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐	☐
e)	Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☒	☐	☐	☐
f)	Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒

Discussion

a–e) The project site contains chamise chaparral, eastwood manzanita chaparral, grassland, California black oak forest, California bay forest, and intermixed scrub oak communities (such as canyon live oak, leather oak, interior live oak, and scrub oak), as well as habitat for special-status plant species (LSA 2018). Biological field surveys of the project site have included wildlife and botanical surveys in 2015, 2016, 2018, and 2019. The EIR will summarize the findings from these surveys.

The EIR will analyze the potential for the proposed project to have a substantial adverse effect on any species identified as a candidate, sensitive, or special-status in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or the U.S. Fish and Wildlife Service; on any riparian habitat or other sensitive natural community; and on state or federally protected wetlands. The EIR will analyze potential direct and indirect species impacts, such as impacts caused by habitat fragmentation and habitat loss.

In addition, the EIR will analyze the potential for the proposed project to interfere substantially with the movement of a native resident or migratory fish or wildlife species, or with established native resident or migratory wildlife corridors, or to impede the use of native wildlife nursery sites. Further, the EIR will analyze the potential for the proposed project to conflict with local policies or ordinances protecting biological resources, such as the County's Conservation Regulations, through activities such as tree removal for the proposed vineyard development.

f) No Habitat Conservation Plans, Natural Community Conservation Plans, or other similar plans are applicable to the project site; therefore, no impact would occur. The EIR will not analyze this issue.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
5.	**CULTURAL RESOURCES.** Would the project:				
a)	Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	☒	☐	☐	☐
b)	Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☒	☐	☐	☐
c)	Disturb any human remains, including those interred outside of formal cemeteries?	☒	☐	☐	☐

Discussion

See Section 18, *Tribal Cultural Resources*, for additional disclosure of and details regarding the tribal notification and consultation required by Assembly Bill 52 (Gatto).

a–c) Cultural resources field surveys of the project site were conducted in 2015 and the Native American Heritage Commission was contacted in 2018 to request a search of the sacred lands file. Notice of the proposed project was sent to Yocha Dehe Wintun Nation, Middletown Rancheria, and Mishewal Wappo Tribe of Alexander Valley on January 29, 2019. On February 22, 2019, the County received a response letter from Yocha Dehe Wintun Nation indicating that the project is not within the aboriginal territories of the Yocha Dehe Wintun Nation. Based on the field surveys, records searches, literature review, and agency and Native American consultation, the EIR will analyze the potential for the proposed project to cause a substantial adverse change in the significance of a historical resource or archaeological

resource as defined in State CEQA Guidelines Section 15064.5, or to disturb any human remains, including those interred outside of formal cemeteries.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
6.	**ENERGY.** Would the project:				
a)	Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b)	Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☒	☐

Discussion

Consistent with Public Resources Code Section 21100(b)(3), this impact analysis evaluates the potential for the proposed project to result in a substantial increase in energy demand and wasteful use of energy during project construction, operation, and maintenance. The impact analysis is informed by Appendix G of the State CEQA Guidelines. The analysis of potential impacts involved evaluating whether the proposed project's estimated construction-related and operational energy use would be excessive, wasteful, or inefficient.

a) During project construction, the construction equipment, truck trips for hauling materials, and construction workers' commutes to and from the project site would consume fuel. Construction of the proposed project is anticipated to occur over approximately 5½ months. Construction activities and corresponding fuel energy consumption would be temporary and localized. In addition, the proposed project has no unusual characteristics that would cause equipment or haul vehicles to be less energy efficient than when used at other similar agricultural construction sites in Napa County.

Once construction is complete, equipment and energy use would be slightly higher than existing levels. The proposed project would not include any unusual maintenance activities that would cause a significant difference in energy efficiency compared to the surrounding developed land uses. Thus, the project would not result in wasteful, inefficient, or unnecessary use of energy. This impact would be less than significant and the EIR will not analyze this issue.

b) The transportation sector is a major end user of energy in California, accounting for approximately 39 percent of total statewide energy consumption in 2014 (EIA 2019). In addition, energy is consumed during construction and maintenance of transportation infrastructure, such as streets, highways, freeways, rail lines, and airport runways. California's 30 million vehicles consume more than 16 billion gallons of gasoline and 3 billion gallons of diesel each year, making California the second largest consumer of gasoline in the world (CEC 2019). In Napa County, farm equipment (not including irrigation pumps) accounted for approximately 60 percent of agricultural emissions in 2014, with the percentage anticipated to increase through 2050 (Napa County 2018).

Existing transportation energy standards are put into effect through the regulation of fuel refineries and products such as the Low Carbon Fuel Standard, which mandates reducing the non-biogenic carbon content of vehicle fuels by 10 percent by 2020. Other regulatory programs with emissions and fuel efficiency standards have been established by the U.S. Environmental Protection Agency and the California Air Resources Board, such as Pavley II/Low-Emission Vehicle III from California's Advanced Clean Cars Program and the Heavy-Duty (Tractor-Trailer) Greenhouse Gas (GHG) Regulation. Further, construction sites need to comply with state requirements to minimize idling and associated emissions, which also minimize the use of fuel. Specifically, the Commercial Motor Vehicle Idling Regulation and Off-Road Regulation 13 limit idling by commercial vehicles and off-road equipment to five minutes. The proposed project would comply with these state requirements; the EIR's Air Quality section will address this topic.

Napa County has not implemented an energy action plan. Therefore, the proposed project would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency or impede progress toward achieving goals and targets, and impacts would be less than significant. The EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
7. GEOLOGY AND SOILS. Would the project:				
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☒	☐	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☒	☐	☐	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☒	☐	☐	☐

Discussion

a) The project site has the potential to experience strong ground shaking and other seismic hazards based on the number of active faults in the San Francisco Bay region. The proposed project would involve earthmoving activities to install erosion control measures for agricultural development, but would not construct new residences or other facilities (enclosed areas where people can congregate) that would be subject to seismic forces. In addition, given the project's agricultural nature, it would not result in a substantial increase in the number of people accessing the site. Therefore, the proposed project would not directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving fault rupture, ground shaking, liquefaction, and landslides, and less-than-significant impacts would occur. Additional information supporting these conclusions is provided below.

i) No faults have been mapped on the project site, and the site is not located on an active fault or within an "Earthquake Fault Hazard Rupture Zone" designated by the Alquist-Priolo Earthquake Zoning Act (CGS 2018). The closest active faults (i.e., those that have moved during the last 11,000 years) are the West Napa fault segment and the Hunting Creek–Berryessa fault segment, which are approximately 5 miles southwest and east of the project site, respectively. In addition, two unnamed fault lineaments within 0.25 mile of the project site are considered part of the Atlas Peak–Foss Valley Lineament Zone (Gilpin Geosciences 2018). Therefore, the rupture of a known earthquake fault is low and the proposed project would have a less-than-significant impact related to the rapture of a known earthquake fault. The EIR will not analyze this issue.

ii) The project site is in an area that may be subject to strong or very strong seismic ground shaking potential during an earthquake (CGS 2016), but the proposed project would not construct any new residences or enclosed areas where people would congregate. Therefore, this impact would be less than significant and the EIR will not analyze this issue.

iii) Liquefaction occurs when water-saturated soil "liquefies" during an earthquake and buildings and other structures sink into the ground. The Napa County General Plan identifies the project area as having very low liquefaction potential (Napa County 2009). Further, the proposed project is agricultural in nature, would not include any facilities or housing, and would not result in a substantial increase in the number of people on-site. Therefore, the impact related to the potential for liquefaction to result in adverse effects on people or buildings would be less than significant. The EIR will not analyze this issue.

iv) During a site visit on October 20, 2015, the project site was surveyed to document geologic conditions. No active landsliding was observed on the site. Surficial landslide deposits are mapped along the southeastern portion of the project site; however, the survey determined that these features could be attributed to a combination of the local volcanic bedrock structure and differential erosion, and they are unrelated to landsliding (Gilpin Geosciences 2018). A less-than-significant impact would occur, and the EIR will not analyze this issue.

b) Vegetation removal and earthmoving activities during development of the proposed project could lead to slope instability, which may increase erosion and loss of topsoil. In addition, development and operation of the vineyard could cause change to existing erosion patterns. Implementing temporary and permanent erosion control measures could greatly reduce the potential for erosion. The EIR will analyze the potential for the proposed project to lead to potentially significant erosion and loss of topsoil and will evaluate proposed erosion control measures that could reduce these impacts.

c) The Napa County General Plan identifies the project area as having very low liquefaction potential (Napa County 2009). Installing temporary and permanent erosion control measures proposed with the project would improve the management of runoff and erosion and lessen the potential for liquefaction, and for later spreading and subsidence. The EIR will analyze the potential for clearing, grading, and earthmoving associated with the proposed project to lead to unstable soils and result in on- or off-site landslide or collapse.

d) Soils in the project site (Guenoc-Rock Outcrop Complex, Hambright Rock-Outcrop Complex, Rock Outcrop-Hambright Complex, and Sobrante Loam) exhibit low to moderate shrink-swell potential (USDA 1978). The lack of buildings for the proposed project and the agricultural nature of the project site would reduce risks to life or property. Therefore, the impact related to risks to life and property from expansive soils would be less than significant. The EIR will not analyze this issue.

e) The proposed project would involve development of a vineyard. No septic tanks or alternative wastewater disposal systems are needed or proposed for the project parcel. Therefore, no impact would occur and the EIR will not analyze this issue.

f) The EIR will analyze the potential for the proposed project to affect a unique paleontological resource, site, or unique geologic feature.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
8. GREENHOUSE GAS EMISSIONS. Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☒	☐	☐	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☒	☐	☐	☐

Discussion

a–b) The terms “global warming” and “global climate change” describe the increase in the average temperature of the earth’s near-surface air and oceans since the mid-20th century, and the projected continuation of that increase. Natural processes and human actions have been identified as the causes of this warming. Increases in GHG concentrations in the earth’s atmosphere are thought to be the main cause of human-induced climate change. Certain gases in the atmosphere naturally trap heat by impeding the exit of solar radiation that has hit the earth and is reflected back into space. This is sometimes referred to as the “greenhouse effect” and the gases that cause it are called “greenhouse gases.” Some GHGs occur naturally and are necessary to keep the earth’s surface habitable. However, increases in the concentrations of these gases in the atmosphere during the last 100 years have reduced the amount of solar radiation that is reflected back into space, intensifying the natural greenhouse effect and resulting in an increase in the global average temperature.

Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are the principal GHGs. When concentrations of these gases exceed natural concentrations in the atmosphere, the greenhouse effect may be intensified.

Construction emissions from vineyard development projects include the soil carbon stocks that are lost (or released) when site vegetation is removed and soil is ripped in preparation for vineyard development and planting. Construction emissions are also associated with the energy used to develop and prepare the project site and plant the vineyard, including construction equipment and worker vehicle trips. The vineyard’s operational emissions include any reduction in the amount of carbon sequestered by existing vegetation that is removed as part of the project, and the ongoing emissions from the energy used to maintain and farm the vineyard, including farm equipment and vehicles.

The EIR will analyze the potential for the proposed project to generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment. The EIR will analyze the change in annual sequestration and soil carbon storage that would result from vegetation conversion for development of the proposed project. The EIR also will analyze the potential for the proposed project to conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing GHG emissions.

		Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
9.	**HAZARDS AND HAZARDOUS MATERIALS.** Would the project:				
a)	Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☒	☐	☐	☐
b)	Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☒	☐	☐	☐
c)	Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d)	Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e)	For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?	☐	☐	☐	☒
f)	Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
g)	Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	☐	☐	☒	☐

Discussion

a–b) Materials and waste may be considered hazardous if they are poisonous (toxic), can be ignited by open flame (ignitable), corrode other materials (corrosive), or react violently, explode, or generate vapors when mixed with water (reactive). The term "hazardous material" is defined in law as any material that, because of quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment. In some cases, past industrial or commercial uses can result in spills or leaks of hazardous materials and petroleum to the ground, resulting in soil and groundwater contamination.

Construction and operation of the proposed project would involve the routine transport, use, storage, and/or disposal of materials generally regarded as hazardous materials that are used in construction and operational activities. Limited quantities of miscellaneous hazardous substances, such as gasoline, diesel fuel, hydraulic fluids, and other similarly related materials, would likely be brought onto the project site, used, and stored during construction and operation. The improper use, storage, handling, transport, or disposal of hazardous materials could result in the accidental release of hazardous materials, thereby exposing construction workers, the public, and the environment, including soil and/or groundwater or surface water, to contamination by hazardous materials. The California Highway Patrol and the California Department of Transportation regulate transportation of hazardous materials on area roadways, and the California Department of Toxic Substances Control regulates the use of these materials, as outlined in California Code of Regulations Title 22. Any project facilities that would use or store hazardous materials would be required to obtain permits and comply with appropriate regulatory agency standards designed to avoid releases of hazardous wastes. The EIR will analyze potential hazards to the public or the environment through the routine transport, use, storage, and/or disposal of hazardous materials associated with the proposed project.

c) The project site is not located within 0.25 mile of any existing or proposed school. The closest school, Yountville Elementary School, is approximately 4.66 miles southwest of the project site. Therefore, no impact would occur and the EIR will not analyze this issue.

d) Information about hazardous materials sites in the project area was collected by reviewing the California Environmental Protection Agency's Cortese List Data Resources (Cortese List). The Cortese List includes the following data lists that provide information regarding the facilities or sites identified as meeting Cortese List requirements:

- Hazardous waste and substances sites, from the California Department of Toxic Substances Control's EnviroStor database
- Leaking underground storage tank sites, from the GeoTracker database
- Solid waste disposal sites, identified by the State Water Resources Control Board
- Active cease-and-desist orders and cleanup and abatement orders, from the State Water Resources Control Board
- Hazardous waste facilities subject to corrective action under Health and Safety Code Section 25187.5, identified by the California Department of Toxic Substances Control.

The Cortese List is a reporting document used by the state, local agencies, and developers to comply with CEQA requirements in providing information about the location of hazardous materials release sites. The Cortese List is updated at least annually, in compliance with California regulations (California Government Code Section 65964.6[a][4]). The Cortese List includes federal Superfund sites, state response sites, nonoperating hazardous waste sites, voluntary cleanup sites, and school cleanup sites. Review of the Cortese List revealed that no past or present hazardous materials contamination exists in the project area (DTSC 2019).

The project site is not on any of the lists of hazardous waste sites identified in Government Code Section 65962.5. Therefore, no impact would occur and the EIR will not analyze this issue.

e) The project site is not located in the vicinity of a public or private airport, or within an airport land use plan area. The nearest airport is the Moskowite Airport, which is more than 5 miles southeast of the project site. Therefore, the proposed project would not impair operation of any nearby airports and would not affect airport safety. No impact would occur and the EIR will not analyze this issue.

f) The project site would be accessed via a private road off Soda Canyon Road. The Napa County General Plan classifies Soda Canyon Road as a collector street. In rural areas of Napa County, many roadways do not serve regional traffic and serve more as collectors, providing access between rural destinations and the regional roadway network (Napa County 2007). The main evacuation routes in Napa County are along State Routes 12 and 29. The proposed project would not impair implementation of or physically interfere with any adopted emergency plan or emergency evacuation plan, and would have a less-than-significant impact. The EIR will not analyze this issue.

g) No structures are proposed as part of the project. The project site is located in a rural part of Napa County identified as having high fire severity (CAL FIRE 2007). In general, the risk of fire in vineyards is very low because of the limited amount of fuel, combustibles, and ignition sources present. Vineyards are irrigated and cover crops are typically mowed in May and August, thereby reducing the fuel load in the vineyard. Also, the removal of vegetation and management of the vineyard would reduce fuel loads in the area compared with existing conditions. Therefore, the proposed project would not increase the exposure of people or structures to wildland fires, and impacts would be less than significant. The EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
10. HYDROLOGY AND WATER QUALITY. Would the project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☒	☐	☐	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☒	☐	☐	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i) result in substantial erosion or siltation on- or off-site;	☒	☐	☐	☐
ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;	☒	☐	☐	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
iii) create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or	☒	☐	☐	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☐	☒
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☒	☐	☐	☐

Discussion

a) The proposed project would have a potentially significant impact on water quality during construction and operation or could provide substantial additional sources of polluted runoff. Earthmoving activities and the use of hazardous materials during construction could affect water quality. Erosion, sedimentation, and spills of hazardous materials could significantly affect water quality. In addition, using chemicals during operation of the proposed project could impair water quality. The EIR will analyze the potential for the proposed project to violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality.

b) The irrigation demand for the proposed vineyard, approximately 54.8 acre-feet per year during the first four years and 45.7 acre-feet per year after the fourth year once the vines are established, would be met entirely by groundwater from two existing wells in the southeastern portion of the project site, and possibly by additional wells that may be developed in the future. The EIR will analyze the potential for the proposed project to substantially decrease groundwater supplies or interfere substantially with groundwater recharge.

c) **Potentially Significant Impact.** Earthmoving activities have the potential to alter the natural pattern of surface runoff, which could lead to areas of concentrated runoff and/or increased erosion. The conversion of existing vegetation to vineyard would alter the composition of the existing land cover and infiltration rates, which could affect erosion and runoff. The EIR will analyze the potential for the proposed project to substantially alter existing drainage patterns in a manner that would result in substantial erosion, siltation, or flooding on- or offsite. The EIR also will analyze the potential for the proposed project to contribute or create runoff water that would exceed the capacity of existing or planned stormwater drainage systems.

d) The development area is not located in a 100-year flood hazard area, tsunami zone, or seiche zone. Therefore, the proposed project would not risk the release of pollutants due to project inundation. No impact would occur and the EIR will not analyze this issue.

e) The proposed project would rely on groundwater pumped from two on-site wells and possibly from additional wells that may be developed in the future. The EIR will analyze the potential for the proposed project to conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
11. LAND USE AND PLANNING. Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☒	☐	☐	☐

Discussion

a) The project site is not located in or near any established community. Therefore, the proposed project would not physically divide an established community and no impact would occur. The EIR will not analyze this issue.

b) The Napa County General Plan describes the intent of the AWOS designation as follows:

> To provide areas where the predominant use is agriculturally oriented; where watersheds are protected and enhanced; where reservoirs, floodplain tributaries, geologic hazards, soil conditions, and other constraints make the land relatively

> unsuitable for urban development; where urban development would adversely impact all such uses; and where the protection of agriculture, watersheds, and floodplain tributaries from fire, pollution, and erosion is essential to the general health, safety, and welfare.

The Agricultural Preservation and Land Use Element contains goals and policies aimed at preserving existing agricultural land uses, planning for future agricultural uses, supporting the economic well-being of agriculture, and planning for adjacent land uses to be in locations compatible with agricultural land uses. General uses for the AWOS designation include processing of agricultural products and single-family dwellings.

The Conservation Element contains goals and policies related to the protection and preservation of agricultural land uses, conservation of special-status species, protection of habitat, minimization of impacts from discretionary projects, offsetting of discretionary project impacts, evaluation of biological resources for discretionary projects in areas containing or potentially containing special-status species, protection of groundwater, protection of surface water, and protection of wetlands.

The Napa County zoning ordinance describes the project parcel's AW zoning district as follows:

> The AW district classification is intended to be applied in those areas of the county where the predominant use is agriculturally oriented, where watershed areas, reservoirs and floodplain tributaries are located, where development would adversely impact on all such uses, and where the protection of agriculture, watersheds and floodplain tributaries from fire, pollution and erosion is essential to the general health, safety and welfare.

Agriculture is one of the uses allowed in AW districts without a use permit.

The Napa County Conservation Regulations contain general provisions for intermittent/perennial streams. The regulations state that the clearing of land for new agricultural uses must comply with designated stream setbacks that are based on slope, unless a use permit is obtained from Napa County, or unless an exemption listed in Section 18.108.050 applies. Setbacks are measured from the top of the bank on both sides of the stream as it exists at the time of replanting, redevelopment, or new agricultural activity.

The EIR's environmental resource sections will discuss the proposed project's compliance with applicable general plan policies, zoning ordinance requirements, and other regulatory requirements. For example, potential conflicts with applicable plans and policies regarding air quality and GHG emissions will be discussed and analyzed in the Air Quality and Greenhouse Gas Emissions sections of the EIR, and the Biological Resources section of the EIR will discuss any potential conflict with wildlife corridors and consistency with applicable federal, state, and local plans and policies regarding wildlife and vegetation.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
12. MINERAL RESOURCES. Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒

Discussion

a–b) The project site is not in an area with a known mineral resource of value to the region or state, nor is the site within a known mineral resource recovery area (Napa County 2005, 2008; CGS 2013). The nearest known mineral resource area in Napa County is located more than 12 miles south of the project site. Proposed site improvements and development of a vineyard on the parcel would not physically preclude future mining activities from occurring. Therefore, no impact would occur and the EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
13. NOISE. Would the project result in:				
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☒	☐	☐	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☒	☐	☐	☐
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Discussion

a–b) The noise environment in the area surrounding the project site is characterized by rural agricultural noise, rural roadways, and scattered residences. It includes low-volume traffic noise from tractors, large trucks, and other farm equipment, both on and off-road passenger vehicles, and traffic noise along Soda Canyon Road. Activities to install the proposed vineyard would include earthmoving and rock blasting, and operation of the vineyard could generate noise at levels exceeding existing noise levels.

The EIR will analyze the potential for the proposed project to expose people to or generate excessive groundborne vibration or noise levels in excess of standards. The EIR also will analyze the potential for the project to result in a substantial temporary or permanent increase in ambient noise levels in the project vicinity.

c) The project site is not located within an airport land use plan area or within 2 miles of a public airport or private airstrip. Therefore, no impact would occur and the EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
14. POPULATION AND HOUSING. Would the project:				
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☒	☐
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Discussion

a) The population of Napa County was approximately 139,417 in July 2018 (U.S. Census Bureau 2019). Construction and operation of the proposed project would involve earthmoving activities and the installation and maintenance of erosion control measures in connection with the development and cultivation of the vineyard. It would not involve constructing new homes, businesses, roads, or infrastructure (e.g., water, sewer, or utility lines) that would directly or indirectly induce substantial unplanned population growth. Construction and installation activities for the proposed project would require the temporary presence of a minimal number of workers (approximately eight to 10) on the property. Ongoing vineyard operation and maintenance would require the seasonal presence of a minimal number of workers (up to approximately 20) on the property. Therefore, the proposed project would not induce unplanned population growth in the project vicinity or greater region, either directly or indirectly. This impact would be less than significant and the EIR will not analyze this issue.

b) The proposed project would not displace any existing housing or people and it would not involve constructing new homes. Therefore, no impact would occur and the EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
15. PUBLIC SERVICES. Would the project:				
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for 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 for any of the following public services:				
i) Fire protection?	☐	☐	☐	☒
ii) Police protection?	☐	☐	☐	☒
iii) Schools?	☐	☐	☐	☒
iv) Parks?	☐	☐	☐	☒
v) Other public facilities?	☐	☐	☐	☒

Discussion

a) The proposed project would not construct residential or commercial structures, resulting in no substantial population growth in the area. The workers required for project construction and operation would likely come from the existing labor pool in the region; therefore, the project would not result in a population increase over existing conditions. As a result, there would be no need to construct new government facilities, and demand for the listed services and amenities would not change. No impact would occur and the EIR will not analyze these issues.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
16. RECREATION:				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

Discussion

a–b) There are no federal, state, regional, or other parks on the project site. The proposed project would not construct or expand recreational facilities, and would not result in substantial population growth that would lead to the increased use of recreational facilities or the need to construct or expand recreational facilities. Therefore, no impact would occur and the EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
17. TRANSPORTATION. Would the project:				
a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☒	☐	☐	☐
b) Would the project conflict or be inconsistent with CEQA Guidelines §15064.3, subdivision (b)?	☒	☐	☐	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☒	☐	☐	☐
d) Result in inadequate emergency access?	☒	☐	☐	☐

Discussion

a–d) The project site would be accessed by a private road off Soda Canyon Road, which is located off Silverado Trail. Traffic generated by construction of the proposed project and subsequent vineyard operation, including the harvest, would increase traffic on area roadways and increase vehicle miles traveled relative to current conditions. The EIR will analyze the potential for the proposed project to conflict with a program, plan, ordinance, or policy addressing the circulation system. In addition, the EIR will analyze the potential for the project to conflict or be inconsistent with State CEQA Guidelines Section 15064.3(b). The EIR will also analyze the potential for the project to substantially increase hazards due to a geometric design feature or incompatible uses, or to result in inadequate emergency access.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
18. TRIBAL CULTURAL RESOURCES. Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k), or	☒	☐	☐	☐
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☒	☐	☐	☐

Discussion

a–b) As defined in Public Resources Code Section 21074, tribal cultural resources are sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a tribe or tribes. These resources may also be on, or eligible for, listing in the National Register of Historic Places or California Register of Historical Resources, or may be determined by the lead agency to be considered tribal cultural resources. Tribal cultural resources also include prehistoric archaeological sites and human remains, ethnographic sites, and historic-era landscapes and sites occupied, used, or spiritually and culturally valued by Native Americans.

On January 29, 2019, pursuant to Public Resources Code Section 21074 (Assembly Bill 52, Gatto), the County notified Yocha Dehe Wintun Nation, Middletown Rancheria, and Mishewal Wappo Tribe of Alexander Valley of the proposed project. On February 22, 2019, the County received a response letter from Yocha Dehe Wintun Nation indicating that the project is not within the aboriginal territories of the Yocha Dehe Wintun Nation. Based on this consultation and a review of primary and secondary sources, the EIR will analyze the potential for the project to cause a substantial adverse change in the significance of a tribal cultural resource.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
19. UTILITIES AND SERVICE SYSTEMS. Would the project:				
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	☒	☐	☐	☐
c) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☐	☒
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☐	☒

Discussion

a) The project site is located in an unincorporated area of Napa County that is not served by public water or wastewater services. The proposed project would result in the temporary presence of a minimal number of employees on the property, and ongoing vineyard operation and maintenance would result in the seasonal presence of a minimal number of employees on the property. These employees would likely come from the existing labor pool in the region and would not generate an increase in the population relative to existing conditions. Therefore, the proposed project would not create a need to construct new or modified utilities and service systems. Further, implementing the proposed project would not result in the construction or expansion of a water or wastewater treatment facility; the project would not generate wastewater, and existing and potential future groundwater wells would provide irrigation water to the vineyard. Irrigation pipelines would be located within existing roadways, vineyards, and vineyard avenues, and/or within proposed clearing limits. Impacts would be less than significant and the EIR will not analyze this issue. The proposed project would include the installation of on-site stormwater drainage features, the effects of which will be analyzed in the Biological Resources, Geology and Soils, and Hydrology and Water Quality sections of the EIR.

b) No new or expanded water entitlements are being requested for the proposed project. The Hydrology and Water Quality section of the EIR will analyze the availability of water to serve the project in the future, including during normal, dry, and multiple dry years.

c) Given the small number of employees that the proposed project would require for construction and operation, wastewater generation by the proposed project would not be substantial enough to affect wastewater treatment capacity. The project would generate no wastewater that would require treatment, resulting in no impact on wastewater treatment providers. Therefore, no impact would occur and the EIR will not analyze this issue.

d–e) Rock generated during vineyard preparation would be used on-site for erosion control features and on existing roads and rock-filled avenues. Rock not used immediately would be stockpiled for future use inside the proposed clearing limits. Solid waste generated during construction (e.g., broken pipe, fittings, trellis, end posts) would be negligible. The proposed project would include pruning and harvesting activities that would generate waste material (cane). This material would generally be disposed of on-site by spreading it back into the vineyard, burning it, or a combination of the two. Therefore, the proposed project would not generate waste that would need to be disposed of at a landfill and exceed the permitted capacity of applicable landfills serving the project area. Clover Flat Landfill, the closest landfill to the project site, had more than half of its remaining capacity available in 2012 and an expected closure date of January 2047 (CalRecycle 2018). Furthermore, all waste would be disposed of in accordance with federal, state, and local statues and regulations. Therefore, no impact would occur and the EIR will not analyze this issue.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
20. WILDFIRE. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☒	☐
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☒	☐
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☒	☐

Discussion

a) The project site is located in a State Responsibility Area that is designated as a High Fire Hazard Severity Zone (CAL FIRE 2007). The project site would be accessed via a private road off Soda Canyon Road. Project construction and operation would not require any road closures and existing roads would continue to provide adequate emergency access to the project site and project area. The proposed project would not impair an adopted emergency plan or emergency evacuation plan, and would have a less-than-significant impact. The EIR will not analyze this issue.

b–c) Project construction would require the presence of some vehicles and heavy equipment for grading and other activities. These vehicles and equipment could spark and ignite flammable vegetation. During construction, the risk of igniting a fire would be low because vegetation would be cleared before development of the vineyard, and the risk would be temporary because of the short duration of construction (approximately 5½ months). Operation and maintenance activities would be similar to activities already occurring in the project area, which includes an existing vineyard. The proposed project would not include any infrastructure that would exacerbate the fire risk. Portions of the existing dirt roads on the project site would be upgraded and decommissioned with the project, but these activities would not significantly exacerbate fire risk or result in temporary or ongoing impacts on the environment. (The EIR will address potential impacts of the proposed project on biological resources, geology and soils, and hydrology and water quality.) The proposed project would not exacerbate wildfire risk and this impact would be less than significant. Therefore, the EIR will not analyze this issue.

d) There are no buildings or residences on the property and the proposed project would not construct any buildings or residences; therefore, the project would not expose people or structures to significant risks. The EIR will not analyze this issue. The proposed project would alter land cover and would include burning vegetation and cane. The temporary and permanent erosion control measures proposed will be analyzed in the Hydrology and Water Quality section of the EIR.

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
21. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☒	☐	☐	☐
c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐	☐

Discussion

a–c) The EIR will analyze the potential for the proposed project to affect the environment or human beings, both individually and on a cumulative basis when viewed in connection with the effects of past, current, and probable future projects.

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STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Gavin Newsom
Governor

Kate Gordon
Director

RECEIVED
OCT 17 2019
Napa County Planning, Building & Environmental Services

Notice of Preparation

October 14, 2019

To: Reviewing Agencies

Re: Stagecoach North Vineyard Conversion Erosion Control Plan Application #P18-00446
SCH# 2019100250

Attached for your review and comment is the Notice of Preparation (NOP) for the Stagecoach North Vineyard Conversion Erosion Control Plan Application #P18-00446 draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Don Barrella
Napa County
195 Third Street, Suite 210
Napa, CA 94558

with a copy to the State Clearinghouse in the Office of Planning and Research at state.clearinghouse@opr.ca.gov . Please refer to the SCH number noted above in all correspondence concerning this project on our website: https://ceqanet.opr.ca.gov/2019100250/2.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

cc: Lead Agency

Print Form

Appendix C

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

2019100250

Project Title: Stagecoach North Vineyard Conversion Erosion Control Plan Application #P18-00446

Lead Agency: Napa County Dept. of Planning, Building and Env. Services | Contact Person: Don Barrella
Mailing Address: 195 Third Street, Suite 210 | Phone: (707) 253-4417
City: Napa | Zip: 94558 | County: Napa

Project Location: County: Napa | City/Nearest Community: Yountville
Cross Streets: Soda Canyon Road | Zip Code: 94558
Longitude/Latitude (degrees, minutes and seconds): 38 ° 27 ′ 55.57″ N / 122 ° 18 ′ 47.83″ W Total Acres: 116. 2
Assessor's Parcel No.: 032-010-086 | Section: 9 | Twp.: 7N | Range: 4W | Base: M.D.B.M.
Within 2 Miles: State Hwy #: 128 | Waterways: Rector Creek, Rector Reservoir
Airports: N/A | Railways: N/A | Schools: NA

Document Type:

CEQA: ☒ NOP ☐ Early Cons ☐ Neg Dec ☐ Mit Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ☐ Other:
NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI Other: ☐ Joint Document ☐ Final Document ☐ Other:

Governor's Office of Planning & Research
OCT 11 2019
After 12pm
STATE CLEARINGHOUSE

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other: ECP

Development Type:

☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational:
☐ Recreational:
☐ Water Facilities: Type ____ MGD ____
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type ____ MW ____
☐ Waste Treatment: Type ____ MGD ____
☐ Hazardous Waste: Type
☒ Other: Vineyard - 116.2 gross acres

Project Issues Discussed in Document:

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☐ Coastal Zone
☒ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☒ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☒ Noise
☒ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☒ Schools/Universities
☒ Septic Systems
☒ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☒ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☒ Growth Inducement
☒ Land Use
☒ Cumulative Effects
☒ Other: GHG, Tribal Cult.

Present Land Use/Zoning/General Plan Designation:

Agricultural Watershed (AW)/Agricultural, Watershed and Open Space (AWOS)

Project Description: *(please use a separate page if necessary)*

The project proposes vegetation removal and earthmoving activities on slopes greater than five percent in connection with the development of approximately 91.3 net acres of vineyard within approximately 116.2 gross acres on an approximately 170.2-acre parcel. Proposed activities associated with vineyard development include removal of brush and trees within the proposed clearing limits, ripping, rock removal, blasting, soil cultivation, seeding of a cover crop, mulching, trenching for storm drain and irrigation pipelines, installation of a trellis system and deer fence, laying out vine rows, installation of temporary and permanent erosion control measures, and planting of grapevines.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

Revised 2010

NOP Distribution List

County: Napa SCH# 2019100250

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  Habitat Conservation Program
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  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Calvert
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  William Paznokas
  Marine Region

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  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] **Dept. of General Services**
  Cathy Buck
  Environmental Services Section
- [ ] **Housing & Comm. Dev.**
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  Housing Policy Division

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  Supervisor
- [ ] **Santa Monica Bay Restoration**
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- [ ] **Caltrans – Planning HQ LD-IGR**
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  Office of Special Projects

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  Division of Financial Assistance
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  Cindy Forbes – Asst Deputy
  Division of Drinking Water
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  Div. Drinking Water #_____
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  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [■] **State Water Resouces Control Board**
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  Division of Water Rights
- [■] **Dept. of Toxic Substances Control Reg. #_____**
  CEQA Tracking Center
- [■] **Department of Pesticide Regulation**
  CEQA Coordinator

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  North Coast Region (1)
- [■] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [ ] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
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  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

- [ ] **Other** _____
  _____
  _____
- [ ] _____
  Conservancy

Last Updated 5/22/18

YOCHA DEHE
CULTURAL RESOURCES

October 21, 2019

Napa County – Planning Division
Attn: Donald Barrella, Planner III
1195 Third Street, Suite 210
Napa, CA 94559

RE: Stagecoach North Vineyard Project

Dear Mr. Barrella:

Thank you for the notice of preparation letter regarding information on the proposed Stagecoach North Vineyard Project, Napa County. We appreciate your effort to contact us.

The Cultural Resources Department has reviewed the project and concluded that it is not within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we respectively decline any comment on this project. However, based on the information provided, please defer correspondence to the following:

Mishewal Wappo Tribe of Alexander Valley
Attn: Scott Gadaldon
2275 Silk Road
Windsor, CA 95492

Please refer to identification number YD-02012019-03 in any future correspondence with Yocha Dehe Wintun Nation concerning this project.

Thank you for providing us with this notice and the opportunity to comment.

Sincerely,

Isaac Bojorquez
Director of Cultural Resources

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OCT 28 2019
Napa County Planning, Building & Environmental Services

cc: Mishewal Wappo Tribe of Alexander Valley

NATIVE AMERICAN HERITAGE COMMISSION
Cultural and Environmental Department
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691 Phone: (916) 373-3710
Email: nahc@nahc.ca.gov
Website: http://www.nahc.ca.gov

October 15, 2019

Don Barrella
Napa County
195 Third Street, Suite 210
Napa, CA 94558

RE: SCH# 2019100250, Stagecoach North Vineyard Conversion Erosion Control Plan Application #P18-00446 Project, Napa County

Dear Mr. Barrella:

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.

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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 (http://ohp.parks.ca.gov/?page_id=1068) 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: Andrew.Green@nahc.ca.gov.

Sincerely,



Andrew Green
Staff Services Analyst

cc: State Clearinghouse

PPI ENGINEERING
VINEYARD DESIGN
EROSION CONTROL
WATER DEVELOPMENT
DRAINAGE
PERMITTING
GPS/GIS

2800 Jefferson Street
Napa, California 94558
707-253-1806
www.ppiengineering.com

November 4, 2019

Don Barrella
Napa County Planning, Building & Environmental Services
1195 Third Street, Room 210
Napa, CA 94559

Via email: Donald.Barrella@CountyofNapa.org

Re: Initial Study for Stagecoach North ECP #P18-00446-ECPA

Dear Don,

We have reviewed the Initial Study prepared for the above-referenced ECP on the Stagecoach North property. There is an error in Section 10 on page 6 regarding other agencies whose approval is required for this project. The table lists the State Water Resources Control Board (SWRCB), Division of Water Rights, and incorrectly states that the SWRCB needs to approve Petitions for Change on Water Right License 9125 and Permit 18459. These two water rights are actually located on the KJS / Sorrento Inc. property for which Napa County prepared an Initial Study in September 2018. There are no water rights or surface water diversions on the Stagecoach North property, nor are any proposed. The Stagecoach North Initial Study correctly states on page 2 that the "project proposes to use approximately 54.8 acre-feet of groundwater per year to irrigate the 91.3 net acres of vineyard during the first four years while the vines are established, and approximately 45.7 acre-feet of groundwater per year to irrigate the 91.3 net acres of vineyard after the fourth year." A Water Availability Analysis has been prepared to address the proposed use of groundwater and the Initial Study correctly notes on page 17 that the Environmental Impact Report will analyze this area further.

The inclusion of two water rights in the table on page 6 is a mistake that should be corrected in the record immediately and in any future environmental documents prepared for the Stagecoach North ECP #P18-00446.

Sincerely,

Jim Bushey, P.E.
President

Annalee Sanborn
Senior Project Manager

APPENDIX C

AIR QUALITY MODELING RESULTS AND CARBON SEQUESTRATION ANALYSIS

CONSTRUCTION DATA

Construction Schedule

Start Date	End Date	Days/Week	Total Workdays
4/1/2021	9/15/2021	6	144

Project Construction Equipment

Project Construction Equipment	Equivalent Equipment in CalEEMod	Number of Equipment	Workdays used in Phase	Hours per Workday	Average horsepower (hp)	Load Factor
Large Excavator	Excavators	2	144	7	400	0.38
Medium Excavator	Excavators	1	144	7	158	0.38
D9 Bulldozer	Rubber Tired Dozer	2	144	7	474	0.40
D8 Bulldozer	Rubber Tired Dozer	1	144	7	359	0.40
D6 Bulldozer	Rubber Tired Dozer	1	144	7	215	0.40
Haul Truck	Off-Highway Trucks	2	144	7	402	0.38
Loader	Rubber Tired Loaders	2	144	7	203	0.36
Water Truck	Off-Highway Trucks	1	144	7	402	0.38
Farm Tractor with Trailer	Off-Highway Tractors	4	144	7	124	0.44
Total Emissions		**16**				

Project Operation Equipment

Project Construction Equipment	Equivalent Equipment in OFFROAD	Number of Equipment	Hours per day	Average horsepower (hp) from CalEEMod	Load Factor
Farm Tractor with Trailer	Off-Highway Tractors	4	10	124	0.44

On-road Truck and Worker Commute Trips during Construction

Construction Phase	Ave. trips/day (round trips)	One way trips/day	One Way Trip length (miles)	Truck Trip miles per day
Truck trips to deliver and remove construction equipment	2	4	14	56
Worker commute trips	10	20	14	280

CONSTRUCTION EMISSIONS

Criteria Air Pollutants - Uncontrolled

No. of Construction Days	Tons over Construction Period				Average Pounds per day			
	ROG	NOx	Exhaust PM-10	Exhaust PM-2.5	ROG	NOx	Exhaust PM-10	Exhaust PM-2.5
144	0.6343	6.3141	0.2698	0.2482	8.8	87.7	3.7	3.4

Criteria Air Pollutants - Mitigated with Tier 4 Equipment

No. of Construction Days	Tons over Construction Period				Average Pounds per day			
	ROG	NOx	Exhaust PM-10	Exhaust PM-2.5	ROG	NOx	Exhaust PM-10	Exhaust PM-2.5
144	0.1275	0.5675	0.0162	0.0162	1.8	7.9	0.2	0.2

Greenhouse Gases as CO_2e

Construction equipment	890.6
Water Use during Construction	0.6
Total CO_2e (tons)	891.2
Life of project (years)	30
Ave. annual emissions (tons/year)	29.7

GHG Emissions from Water Use for Dust Suppression during Construction

Water Use	Acre-feet/year	gal/year	Mgal/year
Project	4.6	1498915	1.498915

From CalEEMod,

Electricity Intensity Factor to supply	2117	kWhr/Mgal
Electricity Intensity Factor to treat	111	kWhr/Mgal
Electricity Intensity Factor to distribute	1272	kWhr/Mgal
Total Electricity Intensity Factor for Water	3500	kWhr/Mgal

	CO_2	CH_4	N_2O
PG&E GHG emission factor (lb/MWhr)	210	0.029	0.006
PG&E GHG emission factor (lb/kWhr)	0.21	0.000029	0.000006
GW potential	1	25	298
GHG emissions from water use (tons /year)	= Mgal/year X kWhr/Mgal X lb/kWhr x 0.000		CalEEMod Users Guide, Appendx A - Page 41
	0.6	0.0	0.0
GHG emissions from water use (tons of CO_2e/year)	0.6	0.002	0.005
Total tons of CO_2e/year	0.6		

OPERATIONAL EMISSIONS

Calculation of workdays

Season	Start	End	No. of workdays
January & February	1-Jan	28-Feb	41
June - August	1-Jun	31-Aug	66
September & October	1-Sep	31-Oct	43
November - December	1-Nov	31-Dec	44
January - April	1-Jan	30-Apr	85

Calculation of annual on-road vehicle miles

Source	Workers/day	One way trips/day	Number of workdays
January & February			
Workers - Annual pruning of vines	20	14	41
June - August			
Workers - Chemical, mechanical and manual weed control, sulfur applications to protect against mildew	15	11	66
September & October			
Workers - Harvest, Winterization of vineyard, vineyard avenues, and vineyard roads	34	24	43
November - April			
Monitoring & maintenance of erosion control measures	15	11	129
Total annual		**3676**	**334**
Average trips/day over the year - workers		12	
Truck trips/day - grape hauling during harvest		4	
Average truck trips/day over the year		1	

Fleet Mix Assumed	
LDA	0.46154
LDT1	0.46154
HHD	0.07692

Operational Emissions - CAP

Emissions Source	Tons per year				Pounds per day			
	ROG	NOx	Total PM-10	Total PM-2.5	ROG	NOx	Total PM-10	Total PM-2.5
Mobile - worker and truck trips	4.5E-03	0.04	0.02	5.8E-03	0.02	0.21	0.12	0.03
Generator	0.01	0.27	0.01	0.01	0.1	1.5	4.6E-02	4.5E-02
Offroad Equipment	0.14	1.40	0.07	0.06	0.8	7.7	0.4	0.3
TOTAL	0.16	1.71	0.10	0.08	0.9	9.3	0.5	0.4

Operational Emissions - GHG

Source	CO_2e (tons/year)
Mobile - worker and truck trips	23.2
Onsite equipment - 4 tractors	270.5
Generator	28.3
TOTAL	322.0

Stagecoach North Soda Canyon Vineyard

Generator Emissions

Conversion Factors

HP/kW	1.3410	
PM_{10} Fraction of Total PM	0.960	Table A - Updated CEIDARS Table with PM2.5 Fractions, INTERNAL COMBUSTION - DISTILLATE AND DIESEL-ELECTRIC GENERATION
$PM_{2.5}$ Fraction of Total PM	0.937	Table A - Updated CEIDARS Table with PM2.5 Fractions, INTERNAL COMBUSTION - DISTILLATE AND DIESEL-ELECTRIC GENERATION
CO_2 kg/gal	10.21	Climate Registry, Table 13.1: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf
CH_4 g/gal	0.58	Climate Registry, Table 13.7: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf
N_2O g/gal	0.26	Climate Registry, Table 13.7: https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf
GWP CH_4	25	IPCC AR4, https://ww2.arb.ca.gov/ghg-gwps
GWP N_2O	298	IPCC AR4, https://ww2.arb.ca.gov/ghg-gwps
CO_2e g/gal	10,302	
CO_2 g/gal	10,210	
CO_2/CO_2e	0.9911	

Generator Rating:	75	kW	*(Source: Project Description)*
	101	HP	*(based on conservative engineering assumptions; conversion from kW to hp)*
Load Factor:	0.74		*(based on CalEEMod Generator Set Load Factor)*
Engine Emissions Tier:			*(compliance with CARB diesel regulations)*
Operating Hours per Unit:	714	hours/year	
	1.96	hours/day	

Units	Criteria Pollutants [1, 2]					Greenhouse Gases [3]	
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	CO_2	CO_2e
g/kW-hr	—	—	3.50	—	—	—	—
g/HP-hr	0.15	2.85	2.61	0.1440	0.1406	526.17	530.91
lbs/hr	0.04	0.75	0.43	0.02	0.02	86.70	87.48
lbs/day (average daily)	**0.08**	**1.47**	**0.84**	**0.05**	**0.05**	169.60	171.12
lbs/yr	28.24	536.48	307.06	16.94	16.54	61,902.66	62,460.33
tons/yr	0.01	0.27	0.15	0.01	0.01	30.95	31.23
metric tons/yr	—	—	—	—	—	**28.08**	**28.33**

Notes:

1. Emission factors for VOC and NOX: ARB 2011 Final Regulation Order for the ATCM for stationary engines, Table 1, Model year 2008+: https://www.arb.ca.gov/regact/2010/atcm2010/finalregorder.pdf; Policy: CARB Emission Factors for CI Diesel Engines – Percent HC in Relation to NMHC + NOx: http://www.baaqmd.gov/~/media/Files/Engineering/policy_and_procedures/Engines/EmissionFactorsforDieselEngines.ashx
2. Emission factors for CO, PM_{10}, and $PM_{2.5}$: ARB 2011 Final Regulation Order for the ATCM for stationary engines, Table 1, Model year 2008+: https://www.arb.ca.gov/regact/2010/atcm2010/finalregorder.pdf
3. Emission factor for CO_2: U.S. Environmental Protection Agency, AP-42 Compilation of Air Pollutant Emission Factors, Fifth Edition, Section 3.4, Table 3.4-1.

   Emissions of GHGs assume 99.11% of the CO_2e emissions occur as CO_2, based on Climate Registry emission factors as referenced above.

Source: ESA 2020.

Table 1: Emission Standards for New Stationary Emergency Standby Diesel-Fueled CI Engines g/bhp-hr (g/kW-hr)

Maximum Engine Power	Model year(s)	PM	NMHC+NOx	CO
50 ≤ HP < 75 (37 ≤ kW < 56)	2007	0.15 (0.20)	5.6 (7.5)	3.7 (5.0)
	2008+		3.5 (4.7)	
75 ≤ HP < 100 (56 ≤ kW < 75)	2007	0.15 (0.20)	5.6 (7.5)	3.7 (5.0)
	2008+		3.5 (4.7)	
100 ≤ HP < 175 (75 ≤ KW < 130)	2007	0.15 (0.20)	3.0 (4.0)	3.7 (5.0)
	2008+			
175 ≤ HP < 300 (130 ≤ kW < 225)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
300 ≤ HP < 600 (225 ≤ kW < 450)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
600 ≤ HP < 750 (450 ≤ kW < 560)	2007	0.15 (0.20)	3.0 (4.0)	2.6 (3.5)
	2008+			
HP > 750 (kW > 560)	2007	0.15 (0.20)	4.8 (6.4)	2.6 (3.5)
	2008+			

1. May be subject to additional emission limitations as specified in current applicable district rules, regulations or policies.

Stagecoach North EIR - Napa County, Annual

Stagecoach North EIR

Napa County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
User Defined Recreational	1.00	User Defined Unit	116.00	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	3.6	**Precipitation Freq (Days)**	64
Climate Zone	4			**Operational Year**	2022
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	294	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - PG&E GHG emission factor based on https://www.pgecurrents.com/2018/03/26/independent-registry-confirms-record-low-carbon-emissions-for-pge/

Land Use - Are of land cleared

Construction Phase - Project schedule

Off-road Equipment - Phase not used

Off-road Equipment - Phase not used

Off-road Equipment - Phase not used

Off-road Equipment - Equipment list from applicant

Off-road Equipment - Phase not used

Off-road Equipment - Phase not used

Trips and VMT - Project data

Grading - Area to be cleared

Vehicle Trips - Operational trip data

Energy Use -

Construction Off-road Equipment Mitigation - Tier 4 Final equipment for mitigation

Operational Off-Road Equipment - Operational equipment

Fleet Mix - Adjusted to include only worker (50% LDA and 50% LDT1 assumed) and grape hauling truck trips

Stationary Sources - Emergency Generators and Fire Pumps -

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	120.00	0.00
tblConstructionPhase	NumDays	200.00	0.00
tblConstructionPhase	NumDays	310.00	144.00
tblConstructionPhase	NumDays	220.00	0.00

tblConstructionPhase	NumDays	220.00	0.00
tblConstructionPhase	NumDays	3,100.00	0.00
tblConstructionPhase	NumDaysWeek	5.00	6.00
tblFleetMix	HHD	0.04	0.08
tblFleetMix	LDA	0.59	0.46
tblFleetMix	LDT1	0.04	0.46
tblFleetMix	LDT2	0.17	0.00
tblFleetMix	LHD1	0.02	0.00
tblFleetMix	LHD2	6.0000e-003	0.00
tblFleetMix	MCY	5.4970e-003	0.00
tblFleetMix	MDV	0.11	0.00
tblFleetMix	MH	9.8800e-004	0.00
tblFleetMix	MHD	0.02	0.00
tblFleetMix	OBUS	3.8800e-003	0.00
tblFleetMix	SBUS	1.0270e-003	0.00
tblFleetMix	UBUS	1.8010e-003	0.00
tblGrading	AcresOfGrading	0.00	116.00
tblLandUse	LotAcreage	0.00	116.00
tblOffRoadEquipment	HorsePower	158.00	400.00
tblOffRoadEquipment	HorsePower	247.00	474.00
tblOffRoadEquipment	HorsePower	247.00	215.00
tblOffRoadEquipment	HorsePower	247.00	359.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	2.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	4.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	4.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	3.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	0.00	2.00
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	PhaseName		Grading
tblOffRoadEquipment	UsageHours	6.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	7.00
tblOffRoadEquipment	UsageHours	8.00	7.00
tblOffRoadEquipment	UsageHours	8.00	0.00

tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	7.00
tblOffRoadEquipment	UsageHours	8.00	7.00
tblOffRoadEquipment	UsageHours	8.00	7.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	7.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOffRoadEquipment	UsageHours	8.00	0.00
tblOperationalOffRoadEquipment	OperHoursPerDay	8.00	10.00
tblOperationalOffRoadEquipment	OperOffRoadEquipmentNumber	0.00	4.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	294
tblTripsAndVMT	VendorTripLength	7.30	14.00
tblTripsAndVMT	VendorTripNumber	0.00	4.00
tblTripsAndVMT	WorkerTripLength	10.80	14.00
tblTripsAndVMT	WorkerTripNumber	40.00	20.00
tblVehicleTrips	CC_TL	7.30	14.00
tblVehicleTrips	CC_TTP	0.00	100.00
tblVehicleTrips	PR_TP	0.00	100.00
tblVehicleTrips	ST_TR	0.00	13.00
tblVehicleTrips	WD_TR	0.00	13.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.6343	6.3141	4.8641	0.01	1.218	0.2698	1.4878	0.6372	0.2482	0.8854	0	883.6663	883.6663	0.2785	0	890.6281
Maximum	**0.6343**	**6.3141**	**4.8641**	**0.01**	**1.218**	**0.2698**	**1.4878**	**0.6372**	**0.2482**	**0.8854**	**0**	**883.6663**	**883.6663**	**0.2785**	**0**	**890.6281**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2021	0.1275	0.5675	4.9112	0.01	1.218	0.0162	1.2342	0.6372	0.0162	0.6534	0	883.6653	883.6653	0.2785	0	890.6271
Maximum	**0.1275**	**0.5675**	**4.9112**	**0.01**	**1.218**	**0.0162**	**1.2342**	**0.6372**	**0.0162**	**0.6534**	**0**	**883.6653**	**883.6653**	**0.2785**	**0**	**890.6271**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**79.90**	**91.01**	**-0.97**	**0.00**	**0.00**	**94.00**	**17.04**	**0.00**	**93.48**	**26.20**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	4-1-2021	6-30-2021	3.7630	0.3758
2	7-1-2021	9-30-2021	3.1841	0.3180
		Highest	3.7630	0.3758

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0	0	1.00E-05	0		0	0		0	0	0	2.00E-05	2.00E-05	0	0	2.00E-05
Energy	0	0	0	0		0	0		0	0	0	0	0	0	0	0
Mobile	4.51E-03	0.0376	0.0715	2.50E-04	0.021	2.20E-04	0.0212	5.60E-03	2.00E-04	5.80E-03	0	23.145	23.145	9.10E-04	0	23.1676
Offroad	0.1446	1.4003	1.9927	3.05E-03		0.0671	0.0671		0.0617	0.0617	0	268.2844	268.2844	0.0868	0	270.4536
Waste						0	0		0	0	0	0	0	0	0	0
Water						0	0		0	0	0	0	0	0	0	0
Total	**0.1491**	**1.4379**	**2.0642**	**3.3000e-003**	**0.0210**	**0.0673**	**0.0883**	**5.6000e-003**	**0.0619**	**0.0675**	**0.0000**	**291.4294**	**291.4294**	**0.0877**	**0.0000**	**293.6212**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Energy	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mobile	4.5100e-003	0.0376	0.0715	2.5000e-004	0.0210	2.2000e-004	0.0212	5.6000e-003	2.0000e-004	5.8000e-003	0.0000	23.1450	23.1450	9.1000e-004	0.0000	23.1676
Offroad	0.1446	1.4003	1.9927	3.0500e-003		0.0671	0.0671		0.0617	0.0617	0.0000	268.2844	268.2844	0.0868	0.0000	270.4536
Waste						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Water						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.1491**	**1.4379**	**2.0642**	**3.3000e-003**	**0.0210**	**0.0673**	**0.0883**	**5.6000e-003**	**0.0619**	**0.0675**	**0.0000**	**291.4294**	**291.4294**	**0.0877**	**0.0000**	**293.6212**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/6/2021	1/5/2021	5	0	
2	Demolition	Demolition	4/1/2021	3/31/2021	5	0	
3	Grading	Grading	4/1/2021	9/15/2021	6	144	
4	Architectural Coating	Architectural Coating	5/22/2021	5/21/2021	5	0	
5	Paving	Paving	7/19/2021	7/18/2021	5	0	
6	Building Construction	Building Construction	8/31/2021	8/30/2021	5	0	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 116

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	0	0.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	0	0.00	97	0.37

Demolition	Concrete/Industrial Saws	0	0.00	81	0.73
Demolition	Excavators	0	0.00	158	0.38
Demolition	Rubber Tired Dozers	0	0.00	247	0.40
Grading	Excavators	1	7.00	158	0.38
Grading	Excavators	2	7.00	400	0.38
Grading	Graders	0	0.00	187	0.41
Grading	Off-Highway Tractors	4	7.00	124	0.44
Grading	Off-Highway Trucks	3	7.00	402	0.38
Grading	Rubber Tired Dozers	2	7.00	474	0.40
Grading	Rubber Tired Dozers	1	7.00	215	0.40
Grading	Rubber Tired Dozers	1	7.00	359	0.40
Grading	Rubber Tired Loaders	2	7.00	203	0.36
Grading	Scrapers	0	0.00	367	0.48
Grading	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Architectural Coating	Air Compressors	0	0.00	78	0.48
Paving	Pavers	0	0.00	130	0.42
Paving	Paving Equipment	0	0.00	132	0.36
Paving	Rollers	0	0.00	80	0.38
Building Construction	Cranes	0	0.00	231	0.29
Building Construction	Forklifts	0	0.00	89	0.20
Building Construction	Generator Sets	0	0.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	0	0.00	97	0.37
Building Construction	Welders	0	0.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Site Preparation	0	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Demolition	0	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	16	20.00	4.00	0.00	14.00	14.00	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	0	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	0	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	0	0.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Site Preparation - 2021

Phase not used

3.3 Demolition - 2021

Phase not used

3.4 Grading - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.1997	0.0000	1.1997	0.6323	0.0000	0.6323	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.6265	6.2653	4.8058	9.7700e-003		0.2696	0.2696		0.2480	0.2480	0.0000	858.4994	858.4994	0.2777	0.0000	865.4408
Total	**0.6265**	**6.2653**	**4.8058**	**9.7700e-003**	**1.1997**	**0.2696**	**1.4692**	**0.6323**	**0.2480**	**0.8803**	**0.0000**	**858.4994**	**858.4994**	**0.2777**	**0.0000**	**865.4408**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.5000e-003	0.0443	0.0116	1.3000e-004	3.6100e-003	1.3000e-004	3.7400e-003	1.0400e-003	1.2000e-004	1.1700e-003	0.0000	12.9517	12.9517	5.1000e-004	0.0000	12.9643
Worker	6.2500e-003	4.5200e-003	0.0467	1.4000e-004	0.0148	1.0000e-004	0.0148	3.9200e-003	9.0000e-005	4.0100e-003	0.0000	12.2152	12.2152	3.1000e-004	0.0000	12.2229
Total	**7.7500e-003**	**0.0488**	**0.0583**	**2.7000e-004**	**0.0184**	**2.3000e-004**	**0.0186**	**4.9600e-003**	**2.1000e-004**	**5.1800e-003**	**0.0000**	**25.1669**	**25.1669**	**8.2000e-004**	**0.0000**	**25.1872**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					1.1997	0.0000	1.1997	0.6323	0.0000	0.6323	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1197	0.5187	4.8529	9.7700e-003		0.0160	0.0160		0.0160	0.0160	0.0000	858.4984	858.4984	0.2777	0.0000	865.4398
Total	**0.1197**	**0.5187**	**4.8529**	**9.7700e-003**	**1.1997**	**0.0160**	**1.2156**	**0.6323**	**0.0160**	**0.6482**	**0.0000**	**858.4984**	**858.4984**	**0.2777**	**0.0000**	**865.4398**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.5000e-003	0.0443	0.0116	1.3000e-004	3.6100e-003	1.3000e-004	3.7400e-003	1.0400e-003	1.2000e-004	1.1700e-003	0.0000	12.9517	12.9517	5.1000e-004	0.0000	12.9643
Worker	6.2500e-003	4.5200e-003	0.0467	1.4000e-004	0.0148	1.0000e-004	0.0148	3.9200e-003	9.0000e-005	4.0100e-003	0.0000	12.2152	12.2152	3.1000e-004	0.0000	12.2229
Total	**7.7500e-003**	**0.0488**	**0.0583**	**2.7000e-004**	**0.0184**	**2.3000e-004**	**0.0186**	**4.9600e-003**	**2.1000e-004**	**5.1800e-003**	**0.0000**	**25.1669**	**25.1669**	**8.2000e-004**	**0.0000**	**25.1872**

3.5 Architectural Coating - 2021

Phase not used

3.6 Paving - 2021

Phase not used

3.7 Building Construction - 2021

Phase not used

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	4.5100e-003	0.0376	0.0715	2.5000e-004	0.0210	2.2000e-004	0.0212	5.6000e-003	2.0000e-004	5.8000e-003	0.0000	23.1450	23.1450	9.1000e-004	0.0000	23.1676
Unmitigated	4.5100e-003	0.0376	0.0715	2.5000e-004	0.0210	2.2000e-004	0.0212	5.6000e-003	2.0000e-004	5.8000e-003	0.0000	23.1450	23.1450	9.1000e-004	0.0000	23.1676

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
User Defined Recreational	13.00	13.00	0.00	56,784	56,784
Total	13.00	13.00	0.00	56,784	56,784

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
User Defined Recreational	9.50	14.00	7.30	0.00	100.00	0.00	100	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
User Defined Recreational	0.461538	0.461538	0.000000	0.000000	0.000000	0.000000	0.000000	0.076923	0.000000	0.000000	0.000000	0.000000	0.000000

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Mitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NaturalGas Unmitigated	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Unmitigated	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	1.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	2.0000e-005	2.0000e-005	0.0000	0.0000	2.0000e-005
Total	**0.0000**	**0.0000**	**1.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**2.0000e-005**	**2.0000e-005**	**0.0000**	**0.0000**	**2.0000e-005**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			

User Defined Recreational	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0000	0.0000	0.0000	0.0000
Unmitigated	0.0000	0.0000	0.0000	0.0000

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
User Defined Recreational	0	0.0000	0.0000	0.0000	0.0000
Total		**0.0000**	**0.0000**	**0.0000**	**0.0000**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type
Off-Highway Tractors	4	10.00	260	124	0.44	Diesel

UnMitigated/Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Equipment Type	tons/yr										MT/yr					
Off-Highway Tractors	0.1446	1.4003	1.9927	3.0500e-003		0.0671	0.0671		0.0617	0.0617	0.0000	268.2844	268.2844	0.0868	0.0000	270.4536
Total	**0.1446**	**1.4003**	**1.9927**	**3.0500e-003**		**0.0671**	**0.0671**		**0.0617**	**0.0617**	**0.0000**	**268.2844**	**268.2844**	**0.0868**	**0.0000**	**270.4536**

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

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memorandum

date	March 8, 2020
to	Jennifer Aranda, Senior Managing Associate
from	Jyothi Iyer, Air Quality Specialist
subject	Stagecoach North Vineyard Conversion Erosion Control Plan Carbon Stock and Sequestration Analysis

Introduction

This analysis has been prepared as part of the greenhouse gas (GHG) analysis for the Environmental Impact Report (EIR) to evaluate impacts of implementing the Stagecoach North Vineyard Conversion Erosion Control Plan Application (ECPA) Project (#P18-00446-ECPA).

This analysis includes an assessment of the carbon stock and carbon sequestration of the existing land use types that would be lost as a result of land conversion from the Stagecoach North Soda Canyon Vineyard Conversion Erosion Control Plan Application Project (proposed project). The analysis also includes an assessment of the carbon stock and sequestration that would be gained as a result of converting existing land uses into vineyards.

Analysis

The analysis includes the following sources and sinks of carbon and GHG emissions:

1. One-time emissions associated with carbon stocks and storage lost or released when site vegetation is removed. This includes above-ground carbon, such as woody debris and downed wood, and below-ground carbon, such as in the soil. Soil carbon is released when soil is ripped in preparation for vineyard development and planting. For the purpose of this analysis it is assumed that half of the removed vegetation would be burned and the other half would be chipped/mulched.
2. Annual emissions associated with carbon sequestration lost when site vegetation is removed.
3. One-time emission sinks associated with carbon stocks and storage gained when the new vineyards are planted, including above-ground and below-ground carbon.
4. Annual emission sinks associated with carbon sequestration gained through the growth and maintenance of the new vineyards.

A number of different sources were consulted to estimate the carbon stocks and carbon sequestration of all land types associated with the project. These sources include the following:

- **Napa County Draft Climate Action Plan Appendix A (2016).**[1] The Napa County Draft Climate Action Plan (CAP) was used to estimate carbon storage for grasslands and scrublands, along with carbon sequestration for all land use types.
- **California Oak Foundation: An Inventory of Carbon and California Oaks (2008)**.[2] This report was used to estimate above- and below-ground carbon storage for oaks.
- **Williams et. al. 2011, Assessment of carbon in woody plants and soil across a vineyard-woodland landscape.**[3] This paper was used to determine above- and below-ground carbon storage for vineyards.

The carbon storage and sequestration factors used in the analysis are presented below in **Table 1.** The table includes factors for all land use types associated with the project and presents the source of each factor.

TABLE 1
CARBON STOCKS / STORAGE AND ANNUAL SEQUESTRATION FACTORS

Vegetation / Land Use Type	Carbon Storage / Stock per Acre (MT C/acre)				Carbon Sequestration (MT C/year)
	Wood / Trees	Soil	Litter / duff / understory	Total	
Existing Land Use Types					
Agriculture [a]	-	-	-	2.2	0.081
California Annual Grassland Alliance [a]	-	-	-	2.6	0.0
Chamise Alliance [a]	-	-	-	2.6	0.0
Coast Live Oak Alliance [b]	22.3	11.3	25.9	59.5	2.017
Mixed Manzanita – (Interior Live Oak - California Bay - Chamise) West County NFD Alliance [a]	-	-	-	34.9	2.017
Schlerophyllous Shrubland Formation [a]	-	-	-	12.8	0.0
Scrub Interior Live Oak-Scrub Oak (California Bay-Flowering Ash-Birch Leaf Mountain Mahogany-Toyon-California Buckeye) Mesic East County NFD Super Alliance [a]	-	-	-	34.9	2.017
New Land Use Types					
Vineyard [d]	1.2	34.0	0.0	35.2	0.016
Roads / other [c]	0.0	0.0	0.0	0.0	0.0

NOTES:

[a] Values are from the 2012 Napa CAP, Appendix A, Table 16. For agriculture, grasslands and scrublands, only a total carbon storage value was available.

[b] Carbon storage values are from California Oaks Foundation (2008), Tables 4 and 5. Carbon sequestration values are from the 2012 Napa CAP, Appendix A, Table 16.

[c] It was assumed that these land types have no carbon storage or annual carbon sequestration.

[d] Carbon storage values are from Williams (2011), Table 1. Carbon sequestration values are from the 2012 Napa CAP, Appendix A, Table 16.

1 Ascent Environmental, 2016. *Napa County Climate Action Plan: Appendix A Technical Memo #1 - Greenhouse Gas Emissions Inventory and Forecasts*. Table 16. Available at: https://www.countyofnapa.org/DocumentCenter/View/297/Appendix-A-Revised-Final-Tech-Memo-1-PDF. Accessed January 2019.

2 California Oak Foundation, 2008. *An Inventory of Carbon and California Oaks*. Tables 4 and 5. Available at: http://californiaoaks.org/wp-content/uploads/2016/04/CarbonResourcesFinal.pdf. Accessed January 2019.

3 Williams, J. N., D. Hollander, A T. O'Geen, L. A. Thrupp, R. Hanifin, K. Steenwerth, G. McGourty, L. E. Jackson (2011). Assessment of carbon in woody plants and soil across a vineyard-woodland landscape. *Carbon Balance and Management*, 2011; 6: 11. doi: 10.1186/1750-0680-6-11. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3287142/.

ABBREVIATIONS:
MT = metric tons
C = carbon
NFD = no formal description
- = value not available

SOURCES:
1. Ascent Environmental, 2016. *Napa County Climate Action Plan: Appendix A Technical Memo #1 - Greenhouse Gas Emissions Inventory and Forecasts*. Table 16. Available at: https://www.countyofnapa.org/DocumentCenter/View/297/Appendix-A-Revised-Final-Tech-Memo-1-PDF. Accessed January 2019.
2. California Oak Foundation, 2008. *An Inventory of Carbon and California Oaks*. Tables 4 and 5. Available at: http://californiaoaks.org/wp-content/uploads/2016/04/CarbonResourcesFinal.pdf. Accessed January 2019.
3. Williams, J. N., D. Hollander, A T. O'Geen, L. A. Thrupp, R. Hanifin, K. Steenwerth, G. McGourty, L. E. Jackson (2011). Assessment of carbon in woody plants and soil across a vineyard-woodland landscape. *Carbon Balance and Management*, 2011; 6: 11. doi: 10.1186/1750-0680-6-11. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3287142/.

These carbon stock and sequestration factors are utilized in this assessment because they provide the most conservative estimate of potential emissions from vegetation removed from the project site. As such, the County considers the anticipated potential emissions resulting from the proposed project that are disclosed in this analysis to reasonably reflect proposed conditions and therefore are considered appropriate and adequate for project impact assessment. Emissions associated with loss of sequestration due to land use change (i.e., the conversions of grassland and oak woodlands to vineyard) have been calculated based the sources identified above, which indicates that grasslands and scrublands sequester a negligible quantity of carbon dioxide (CO_2) acre per year (essentially zero), and oak woodland sequesters approximately 2.0 metric tons carbon (MT C) per acre per year.

Grapevines are photosynthetic plants and therefore have value in terms of carbon capture. Additionally, the use of cover crops, which are also photosynthetic plants, tends to result in less soil CO_2 loss from vineyard soils. Carbon sequestration loss would be somewhat offset by the proposed vineyard, which would likely act as a sink for atmospheric CO_2, depending on the longevity of grapevine roots and the quantity of carbon stored in deep roots. In addition to vines, the sequestration of atmospheric carbon is also achieved by the soil between vine rows through cover-cropping which has not been quantified in this analysis.

It is worth noting that the quantitative estimate of carbon stocks and sequestration presented in this analysis requires many assumptions about what would happen during the next 30-100 years onsite under "project" and "no project" conditions (e.g., the life expectancy of the proposed vineyard and existing site vegetation, incidences of disease and fire, etc.).

Table 2 presents the estimated carbon stocks/storage at the project site for existing land uses. These represent one-time emissions resulting from vegetation removal and soil preparation associated with the conversion of approximately 116 acres of agriculture, grassland, oak woodlands, and scrublands to vineyard and access roads. As mentioned above, for the purpose of this analysis it is assumed that half of the removed vegetation would be burned and the other half would be chipped/mulched. Because there is not yet a universally accepted scientific methodology or modeling method to calculate GHG emissions due to vegetation conversion and soil disturbance, the carbon stock factors collected from the sources identified above are utilized to determine potential project site carbon stocks and associated emissions. As shown in Table 2, total existing project site carbon stocks are estimated to be approximately 2,258 MT C or approximately 8,280 metric tons of carbon dioxide equivalent ($MTCO_2e$).[4]

[4] The Carbon Dioxide Equivalent (CO_2e) is the commonly reported unit of GHG emissions to represent total emissions from all the different greenhouse gases, based on CO_2 as the reference gas for climate change. Carbon is converted to CO_2e by multiplying the carbon amount by 44/12 (or 3.67), which is the ratio of the atomic mass of a carbon dioxide molecule to the atomic mass of a carbon atom.

TABLE 2
ESTIMATED PROJECT SITE CARBON STOCKS / STORAGE – EXISTING [A]

Vegetation / Land Use Type	Project Acreage	Carbon Storage / Stock per Acre (MT C/acre) [b]	Total Carbon Storage (MT C) [c]	Total Carbon Storage ($MTCO_2e$) [d]
Agriculture	0.3	2.2	0.6	2.1
California Annual Grassland Alliance	0.3	2.6	0.7	2.5
Chamise Alliance	40.3	2.6	104.9	384.5
Coast Live Oak Alliance	0.0	59.5	0.0	0.0
Mixed Manzanita – (Interior Live Oak - California Bay - Chamise) West County NFD Alliance	44.7	34.9	1,559.8	5719.3
Schlerophyllous Shrubland Formation	21.6	12.8	276.6	1,014.3
Scrub Interior Live Oak-Scrub Oak (California Bay-Flowering Ash-Birch Leaf Mountain Mahogany-Toyon-California Buckeye) Mesic East County NFD Super Alliance	9.0	34.9	315.6	1,157.1
Total	**116.2**	**-**	**2,258.1**	**8,280**

NOTES:

[a] Values may not sum exactly due to rounding

[b] Values from Table 1

[c] Project acreage multiplied by carbon storage / stock per acre

[d] MT C is converted to $MTCO_2e$ by multiplying MT C by 44/12 (or 3.67), which is the ratio of the atomic mass of a carbon dioxide molecule to the atomic mass of a carbon atom.

ABBREVIATIONS:
MT = metric tons
C = carbon
$MTCO_2e$ = metric tons carbon dioxide equivalent

Table 3 presents the estimated annual carbon sequestration at the project site for existing land uses. This represents lost carbon sequestration resulting from vegetation removal and soil preparation associated with the project's land use conversion. As for carbon storage factors above, because there is not yet a universally accepted scientific methodology or modeling method to calculate GHG emissions due to vegetation conversion and soil disturbance, the carbon sequestration factors collected from the sources identified above are utilized to determine the potential loss in annual carbon sequestration at the project site. As shown in Table 3, it is anticipated that the annual emissions associated with existing carbon sequestration at the project site is approximately 152 MT C per year or 557.3 $MTCO_2e$ per year.

TABLE 3
ESTIMATED PROJECT SITE CARBON SEQUESTRATION – EXISTING [A]

Vegetation / Land Use Type	Project Acreage	Annual Carbon Sequestration per Acre (MT C/acre) [b]	Annual Carbon Sequestration (MT C) [c]	Annual Carbon Sequestration ($MTCO_2e$) [d]
Agriculture	0.3	0.081	0.0	0.1
California Annual Grassland Alliance	0.3	0.0	0.0	0.0
Chamise Alliance	40.3	0.0	0.0	0.0
Coast Live Oak Alliance	0.0	2.017	0.0	0.0
Mixed Manzanita – (Interior Live Oak - California Bay - Chamise) West County NFD Alliance	44.7	2.017	90.1	330.5

Vegetation / Land Use Type	Project Acreage	Annual Carbon Sequestration per Acre (MT C/acre) [b]	Annual Carbon Sequestration (MT C) [c]	Annual Carbon Sequestration ($MTCO_2e$) [d]
Schlerophyllous Shrubland Formation	21.6	0.0	43.6	159.8
Scrub Interior Live Oak-Scrub Oak (California Bay-Flowering Ash-Birch Leaf Mountain Mahogany-Toyon-California Buckeye) Mesic East County NFD Super Alliance	9.0	2.017	18.2	66.9
Total	**116.2**	**-**	**152.0**	**557.3**

NOTES:

[a] Values may not sum exactly due to rounding

[b] Values from Table 1

[c] Project acreage multiplied by carbon storage / stock per acre

[d] MT C is converted to MTCO2e by multiplying MT C by 44/12 (or 3.67), which is the ratio of the atomic mass of a carbon dioxide molecule to the atomic mass of a carbon atom.

ABBREVIATIONS:
MT = metric tons
C = carbon
$MTCO_2e$ = metric tons carbon dioxide equivalent

Table 4 presents the future estimated carbon stocks/storage at the project site for new land uses, including the vineyards. This represents new carbon storage associated with the new vineyards' biomass. As shown in Table 4, total project-related carbon stocks are estimated to be approximately 3,218 MT C or approximately 11,800 $MTCO_2e$.

TABLE 4
ESTIMATED PROJECT SITE CARBON STOCKS / STORAGE – PROJECT [A]

Vegetation / Land Use Type	Project Acreage	Carbon Storage / Stock per Acre (MT C/acre) [b]	Total Carbon Storage (MT C) [c]	Total Carbon Storage ($MTCO_2e$) [d]
Vineyard	91.3	35.2	3,218.2	11,800
Roads / other	24.9	0.0	0.0	0.0
Total	**116.2**	**0.0**	**3,218.2**	**11,800**

NOTES:

[a] Values may not sum exactly due to rounding

[b] Values from Table 1

[c] Project acreage of individual vegetation/land use types multiplied by carbon storage / stock per acre

[d] MT C is converted to MTCO2e by multiplying MT C by 44/12 (or 3.67), which is the ratio of the atomic mass of a carbon dioxide molecule to the atomic mass of a carbon atom.

ABBREVIATIONS:
MT = metric tons
C = carbon
$MTCO_2e$ = metric tons carbon dioxide equivalent

Table 5 presents the estimated annual carbon sequestration at the project site for new land uses. This represents gained carbon sequestration from photosynthesis by the new vineyards. As shown in Table 5, it is anticipated that the annual emissions associated with new carbon sequestration at the project site is approximately 1.5 MT C per year or 5.4 $MTCO_2e$ per year.

TABLE 5
ESTIMATED PROJECT SITE CARBON SEQUESTRATION – PROJECT [A]

Vegetation / Land Use Type	Project Acreage	Annual Carbon Sequestration per Acre (MT C/acre) [b]	Annual Carbon Sequestration (MT C) [c]	Annual Carbon Sequestration ($MTCO_2e$) [d]
Vineyard	91.3	0.016	1.5	5.4
Roads / other	24.9	0.0	0.0	0.0
Total	**116.2**	**-**	**1.5**	**5.4**

NOTES:

[a] Values may not sum exactly due to rounding

[b] Values from Table 1

[c] Project acreage multiplied by carbon storage / stock per acre

[d] MT C is converted to $MTCO_2e$ by multiplying MT C by 44/12 (or 3.67), which is the ratio of the atomic mass of a carbon dioxide molecule to the atomic mass of a carbon atom.

ABBREVIATIONS:
MT = metric tons
C = carbon
$MTCO_2e$ = metric tons carbon dioxide equivalent

Based on the above estimates, **Table 6** presents overall project-related GHG emissions. This table shows the total one-time carbon storage loss associated with converting existing land uses into vineyards along with the 30-year project lifetime carbon sequestration loss of this conversion, which is 15,148 $MTCO_2e$. The table also shows the total one-time carbon storage gain associated with the new vineyards along with the 30-year project lifetime carbon sequestration gain of the new vineyards, which is 14,607 $MTCO_2e$. Accordingly, the proposed project could result in a one-time emissions sink of up to 6,713 $MTCO_2e$ (7,697 minus 14,411) and annual on-going emissions associated with loss of sequestration estimated to be 242 MT CO_{2e} per year (248 minus 7), for a total 30-year lifetime project emission of 541 $MTCO_2e$ or 148 MT C. In other words, it is anticipated that the annual emissions associated with changes in carbon stock/storage and sequestration as a result of project-related land use changes would be approximately 5 MT C per year or 18 $MTCO_2e$ per year.

TABLE 6
ESTIMATED OVERALL PROJECT-RELATED GHG EMISSIONS

Vegetation / Land Use Type	Total $MTCO_2e$
Carbon Loss - existing land use removal	
Carbon Storage[a]	4,140
Carbon Sequestration (annual)	557
30-year lifetime emissions	20,859
Carbon Gains - new land use types [a]	
Carbon Storage	-11,800
Carbon Sequestration (annual)	-5
30-year lifetime emissions	-11,961
Total Project Lifetime Emissions	**8,899**
Total Project Annual Emissions	**297**

NOTES:

[a] Emissions are reported as negative because they represent a GHG emissions sink

ABBREVIATIONS:
GHG = greenhouse gas emissions
$MTCO_2e$ = metric tons carbon dioxide equivalent

References

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Stagecoach Soda Canyon - Carbon Sequestration Analysis EIR Tables

Updated: 3/10/2020

1 Carbon Stock / Sequestration Factors

Vegetation / Land Use Type	Carbon Storage / Stock per Acre (MT C/acre)				Carbon Sequestration (MT C/year)
	Wood/Trees	Soil	Litter / duff / understory	Total	
Existing Land Use Types					
Agriculture	0.0	0.0	0.0	2.2	0.081
California Annual Grasslands Alliance	0.0	0.0	0.0	2.6	0
Chamise Alliance	0.0	0.0	0.0	2.6	0
Coast Live Oak Alliance	22.3	11.3	25.9	59.5	2.017
Mixed Manzanita - (Interior Live Oak -California Bay - Chamise) West County NFD Alliance	0.0	0.0	0.0	34.9	2.017
Sclerophyllous Shrubland Formation	0.0	0.0	0.0	12.8	0
Scrub Interior Live Oak - Scrub Oak - (California Bay - Flowering Ash - Birch Leaf Mountain Mahogany - Toyon - California Buckeye) Mesic East County NFD Super Alliance	0.0	0.0	0.0	34.9	2.017
New Land Use Types					
Vineyard	1.2	34.0	0.0	35.2	0.016
Roads / other	0.0	0.0	0.0	0.0	0.000

2 Estimated Project Site Carbon Stocks/Storage

Vegetation / Land Use Type	Project Acreage	Carbon Storage / Stock per Acre (MT C/acre)	Total Carbon Storage (MT C)	Total Carbon Storage ($MTCO_2e$)
Agriculture	0.3	2.2	0.6	2.1
California Annual Grasslands Alliance	0.3	2.6	0.7	2.5
Chamise Alliance	40.3	2.6	104.9	384.5
Coast Live Oak Alliance	0.0	59.5	0.0	0.0
Mixed Manzanita - (Interior Live Oak -California Bay - Chamise) West County NFD Alliance	44.7	34.9	1,559.8	5,719.3
Sclerophyllous Shrubland Formation	21.6	12.8	276.6	1,014.3
Scrub Interior Live Oak - Scrub Oak - (California Bay - Flowering Ash - Birch Leaf Mountain Mahogany - Toyon - California Buckeye) Mesic East County NFD Super Alliance	9.0	34.9	315.6	1,157.1
Total	**116.2**		**2,258.1**	**8,279.7**

3 Estimated Project Site Carbon Sequestration

Vegetation / Land Use Type	Project Acreage	Annual Carbon Sequestration per Acre (MT C/acre)	Annual Carbon Sequestration (MT C)	Annual Carbon Sequestration ($MTCO_2e$)
Agriculture	0.3	0.1	0.0	0.1
California Annual Grasslands Alliance	0.3	0.0	0.0	0.0
Chamise Alliance	40.3	0.0	0.0	0.0
Coast Live Oak Alliance	0.0	0.0	0.0	0.0
Mixed Manzanita - (Interior Live Oak -California Bay - Chamise) West County NFD Alliance	44.7	2.0	90.1	330.5
Sclerophyllous Shrubland Formation	21.6	2.0	43.6	159.8
Scrub Interior Live Oak - Scrub Oak - (California Bay - Flowering Ash - Birch Leaf Mountain Mahogany - Toyon - California Buckeye) Mesic East County NFD Super Alliance	9.0	2.0	18.2	66.9
Total	**116.2**		**152.0**	**557.3**

4 Estimated Project Carbon Stocks/Storage - Gained

Vegetation / Land Use Type	Project Acreage	Carbon Storage / Stock per Acre (MT C/acre)	Total Carbon Storage (MT C)	Total Carbon Storage ($MTCO_2e$)
Vineyard	91.3	35.2	3,218.2	11,799.9
Access Roads / other	24.9	0.0	0.0	0.0
Total	**116.2**	**0.0**	**3,218.2**	**11,799.9**

5 Estimated Project Site Carbon Sequestration - Gained

Vegetation / Land Use Type	Project Acreage	Carbon Storage / Stock per Acre (MT C/acre)	Total Carbon Storage (MT C)	Total Carbon Storage ($MTCO_2e$)
Vineyard	91.3	0.016	1.5	5.4
Other	24.9	0.000	0.0	0.0
Total	**116.2**	**0.000**	**1.5**	**5.4**

6 Estimated Overall Project-related GHG Emissions

Vegetation Type/Carbon Storage	MTCO2e		
Carbon Loss - existing land use removal			
Carbon Storage	4,140		
Carbon Squestration (annual)	557		
30-year lifetime emissions	20,859		
Carbon Gains - new land use types			
Carbon Storage	-11,800	-7,660	-255
Carbon Squestration (annual)	-5	552	552
30-year lifetime emissions	-11,961		
Total Project Lifetime Emissions	**8,899**	2,427	
Total Project Annual Emissions	**297**	81	297

APPENDIX D
BIOLOGICAL RESOURCES REPORT

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memorandum

date	September 16, 2019
to	Brian Bordona and Don Barrella
cc	
from	Kelly Bayne
subject	Stagecoach North ECPA #P18-00446 Biological Resources Memorandum

This memorandum (memo) provides biological resources information for the Stagecoach North Vineyard Project (project), located in Napa County, California. LSA (2018) prepared a Biological Resources Survey Report (2018 Report) for the project. This memo provides supplemental information to the 2018 Report, consistent with the Napa County's Guidelines for Preparing Biological Resources Reconnaissance Surveys (2016a) and Guidelines for Preparing Special-Status Plant Studies (2016b). The memo includes a brief project description; updated agency lists of potentially occurring special-status species; plants and wildlife observed within the project site; presence or absence of wildlife movement corridors; bat habitat, raptor foraging habitat, and oak woodland habitat; photographs of representative biological communities; a discussion of biological communities within the evaluation area (a 1-mile radius around the project site) within Napa County; and a discussion of impacts as they relate to percent loss in the evaluation area and Napa County. The biological resources documented within this memo and the 2018 Report will be discussed in the biological resources section of the Environmental Impact Report for the project.

Project Description

Gallo Vineyards Inc. (Applicant) filed an erosion control plan (ECP) application (ECPA #P18-00446) with the Napa County Conservation, Development and Planning Department (County) on December 20, 2018 for the proposed vegetation removal and earthmoving activities on slopes greater than 5 percent in connection with the development of approximately 91.3 net acres of new vineyard within 116.2 gross acres (i.e., development area) within an approximately 170.2-acre parcel (i.e., project site). A total of 17 vineyard blocks are proposed. The acres of the proposed vineyard blocks and their associated clearing limits are described in **Table 1** below.

TABLE 1
ACRES OF PROPOSED VINEYARD BLOCKS

Block	Proposed Clearing Limits (Gross Acres)	Proposed Block Boundaries (Net Acres)
V1	10.5	9.0
V2	8.8	7.0
V3	6.4	5.3
V4	5.7	3.8
V6	5.4	4.0
W7	2.8	1.6
W8	5.3	4.0
X10	3.6	2.5
X11	1.1	0.5
X12	13.3	11.2
Y14	13.7	11.8
Y15	4.6	3.6
Y16	17.6	14.1
Z17	0.7	0.3
Z18	6.3	4.9
Z19	3.8	2.7
Z20	6.3	5.0
Avenues and Rock Disposal Areas	0.3	N/A
Total	116.2	91.3

Source: PPI Engineering 2019

Methodology

Prior to conducting the 2019 fieldwork, Environmental Science Associates (ESA) reviewed the 2018 Report, Napa County's Guidelines for Preparing Biological Resources Reconnaissance Surveys (2016a), and the Guidelines for Preparing Special-Status Plant Studies (2016b). LSA's (2018) shapefile data associated with the biological communities and special-status plants within the project site was uploaded into a global positioning system (GPS) for use with conducting the field survey.

ESA Senior Biologists/Botanists Chuck Hughes and Kelly Bayne conducted botanical inventories and general biological surveys on May 14 and 15, 2019 that focused on ground-truthing the special-status plants and biological communities mapped by LSA (2018). ESA used the GPS and field maps to navigate to the mapped plants and biological communities. In addition, ESA surveyed within 500 feet of the project site using binoculars. Updated agency lists are provided in **Attachment 1** (CDFW, 2019, CNPS, 2019, and USFWS, 2019).

Natural habitat types within the development area and project site are based on the 2018 Report based on site conditions mapped by LSA during fieldwork. Natural habitat types within the evaluation area and Napa County were mapped based on Napa County's 2005 land cover data.

Results and Analysis

Wildlife Movement Corridors

The project site lacks wildlife corridors. The ephemeral drainages within the project site are narrow and surrounded by dense vegetation. This is consistent with the findings in the 2018 Report.

Bat Habitat

The project site does not provide suitable trees for roosting bats nor does it provide high quality bat foraging habitat. The majority of the project site consists of dense, shrubby vegetation with small diameter trees aside from the disturbed areas associated with the graded roads. No large trees that contain cavities occur within the project site. This is consistent with the findings in the 2018 Report.

Raptor Foraging Habitat

While the 2018 Report does not contain a separate section for raptor foraging habitat, foraging habitat is discussed for the potentially occurring special-status raptors. The project site provides low quality foraging habitat because it is densely vegetated with limited to no ground visibility aside from the disturbed areas associated with the graded road. Further, although the project site contains small patches of grassland, the acreages are small and isolated from other patches of grassland, thereby providing minimal opportunities for raptors to forage.

Oak Woodland Habitat

The project site contains little to no mature oak woodland habitat. While a variety of oak alliances occur within the project site, none contain mature trees and all are densely interspersed with other tree species and shrubs. This is consistent with the findings in the 2018 Report.

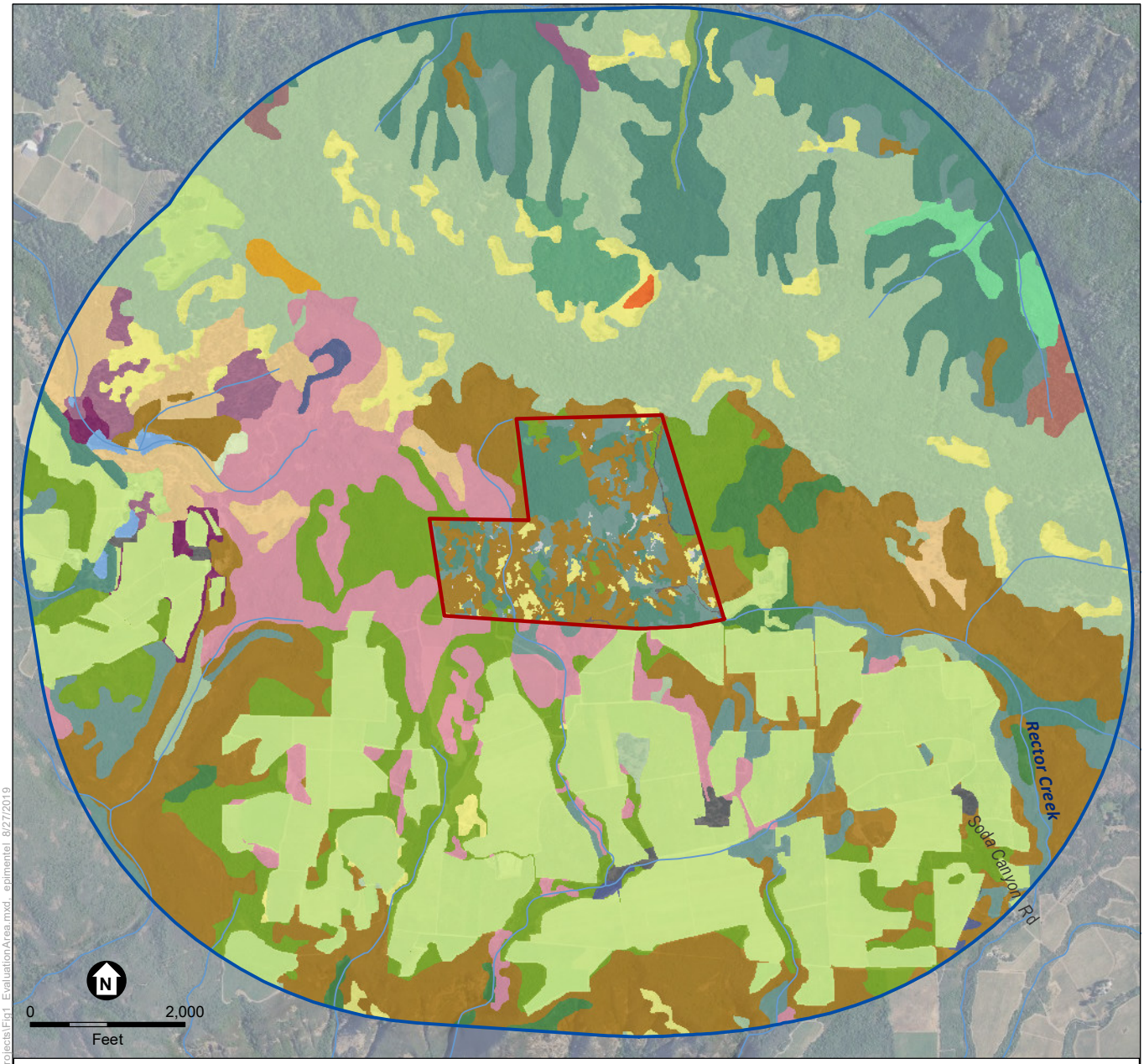
Wildlife and Plants Observed

Wildlife observed during the May 2019 biological surveys include scrub jay (*Aphelocoma californica*), common raven (*Corvus corax*), oak titmouse (*Baeolophus inornatus*), western bluebird (*Sialia mexicana*), California quail (*Callipepla californica*), American robin (*Turdus migratorius*), mourning dove (*Zenaida macroura*), European starling (*Sturnus vulgaris*), turkey vulture (*Cathartes aura*), Anna's hummingbird (*Calypte anna*), Acorn woodpecker (*Melanerpes formicivorus*), lesser goldfinch (*Spinus psaltria*), northern flicker (*Colaptes auratus*), black-tailed jackrabbit (*Lepus californicus*), mule deer (*Odocoileus hemionus*), Pacific treefrog (*Pseudacris regilla*), and western fence lizard (*Sceloporus occidentalis*).

A comprehensive list of plants observed during the May 2019 botanical inventories are provided in **Attachment 2**. Representative photographs of the biological communities within the project site are provided in **Attachment 3**.

Biological Setting within the Evaluation Area

The evaluation area includes natural habitats within 1 mile of the project site. Natural habitats are grouped by oak woodland, annual grassland, chamise/scrub, human-altered/other landforms, and riparian and water. Some biological alliances containing oaks are categorized under chamise/scrub because their characteristics are more closely related to the chamise/scrub habitat. Natural habitats within the evaluation area are depicted in **Figure 1**. The acreages of vegetation alliances within the development area, the project site, the evaluation area, and Napa County are provided in **Table 2**.



Project Site
1-mile Evaluation Area

Land Cover Type

- (Carex spp. - Juncus spp - Wet Meadow Grasses) NFD Super Alliance
- Agriculture
- Black Oak Alliance
- Blue Oak Alliance
- California Annual Grasslands Alliance
- California Bay - Madrone - Coast Live Oak - (Black Oak Big - Leaf Maple) NFD Super Alliance
- Canyon Live Oak Alliance
- Chamise - Wedgeleaf Ceanothus Alliance
- Chamise Alliance
- Coast Live Oak - Blue Oak - (Foothill Pine) NFD Association
- Coast Live Oak Alliance
- Leather Oak - California Bay - Rhamnus spp. Mesic Serpentine NFD Alliance
- Mixed Manzanita - (Interior Live Oak -California Bay - Chamise) West County NFD Alliance
- Mixed Oak Alliance
- Sclerophyllous Shrubland Formation
- Scrub Interior Live Oak - Scrub Oak - (California Bay - Flowering Ash - Birch Leaf Mountain Mahogany - Toyon - California Buckeye) Mesic East County NFD Super Alliance
- Upland Annual Grasslands and Forbs Formation
- White Alder (Mixed Willow - California Bay - Big Leaf Maple) Riparian Forest NFD Association
- White Leaf Manzanita - Leather Oak - (Chamise - Ceanothus spp.) Xeric Serpentine NFD Super Alliance
- Water
- Rock Outcrop
- Urban or Built-up
- Vacant
- Unknown

Path: U:\GIS\GIS\Projects\19xxxx\D190106 Stagecoach North\03 MXDs Projects\Fig1 EvaluationArea.mxd epimentel 8/27/2019

SOURCE: Napa County, 2018; LSA, 2018; PPI Engineering, 2019; ESA, 2019

Stagecoach North Vineyard Conversion #P18-00446-ECPA

Figure 1
Evaluation Area

TABLE 2
TERRESTRIAL BIOLOGICAL COMMUNITIES BY ACREAGES IN THE DEVELOPMENT AREA, PROJECT SITE, EVALUATION AREA, AND NAPA COUNTY

Terrestrial Biological Community	Acreage[1] Within Development Area[2]	Acreage Within Project Site[2]	Acreage within Evaluation Area[3]	Acreage Within Napa County[5]
Mixed Oak Woodland				
Black Oak Alliance (*Quercus kelloggii* Forest Alliance)[4]	0.75	0.77	29.92	2,509.19
Blue Oak Alliance	--	--	32.30	43,603.94
California Bay-Madrone-Coast Live Oak-(Black Oak, Big-Leaf Maple) NFD Super Alliance (*Umbellularia californica* Forest Alliance)	31.63	50.24	344.48	18,114.77
Canyon Live Oak Alliance	--	--	7.03	658.30
Coast Live Oak-Blue Oak-(Foothill Pine) NFD Association	--	--	94.27	26,087.47
Coast Live Oak Alliance	--	--	46.24	12,824.12
Mixed Oak Alliance	--	--	776.80	28,303.08
Mixed Oak Woodland Total	***32.38***	***51.01***	***1,331.04***	***132,100.87***
Annual Grassland				
California Annual Grasslands Alliance	6.56	8.82	122.06	36,218.28
Upland Annual Grasslands and Forbs Formation	--	--	2.26	9,991.89
Annual Grassland Total	***6.56***	***8.82***	***124.32***	***46,210.17***
Chamise/Scrub				
Chamise-Wedgeleaf Ceanothus Alliance	--	--	23.61	7,090.74
Chamise Alliance (*Adenostoma fasciculatum* Shrubland Alliance)	48.85	71.59	599.09	30,559.71
Leather Oak-California Bay-Rhamnus ssp. Mesic Serpentine NFD Alliance	--	--	4.13	4,390.70
Mixed Manzanita-(Interior Live Oak-California Bay-Chamise) West County NFD Alliance (*Arcostaphylos glandulosa* and *Arctostaphylos manzanita* Provisional Shrubland Alliance)	3.76	5.73	283.06	7,880.85
Sclerophyllous Shrubland Formation	--	--	224.21	3,091.36
Scrub Interior Live Oak-Scrub Oak-(California Bay-Flowering Ash-Birch Leaf Mountain Mahogany-Toyon-California Buckeye) Mesic East County NFD Super Alliance (*Sclerophyllous Quercus* spp. Alliance)	22.55	29.86	160.21	10,934.15
White Leaf Manzanita-Leather Oak-(Chamise - Ceanothus spp.) Xeric Serpentine NFD Super Alliance	--	--	12.98	7,983.30
Chamise/Scrub Total	***75.16***	***107.18***	***1,307.29***	***71,930.81***

TABLE 2
TERRESTRIAL BIOLOGICAL COMMUNITIES BY ACREAGES IN THE DEVELOPMENT AREA, PROJECT SITE, EVALUATION AREA, AND NAPA COUNTY

Terrestrial Biological Community	Acreage[1] Within Development Area[2]	Acreage Within Project Site[2]	Acreage within Evaluation Area[3]	Acreage Within Napa County[5]
Human-Altered/Other				
Agriculture	--	--	759.01	70,018.95
Unknown	--	--	7.05	1,144.49
Urban or Built-up (Roads and Graded Areas)	1.02	1.52	10.53	28,772.92
Vacant	--	--	9.51	1,201.21
Rock Outcrop	1.60	1.60	1.60	1,671.63
Human-Altered Total	***2.62***	***3.12***	***787.70***	***102,809.20***
Riparian and Water				
(Carex spp.-Juncus spp.-Wet Meadow Grasses) NFD Super Alliance	--		2.07	271.95
White Alder (Mixed Willow-California Bay-Big Leaf Maple) Riparian Forest NFD Association	--		4.23	966.68
Water	--		7.03	31,610.09
Riparian and Water Total	***--***	***--***	***13.33***	**32,848.72**
Biological Community Total	**116.2**	**170.13**	**3,563.68**	**385,899.77**

NOTES:
1. GIS calculations do not reflect exact acreage of development area due to rounding.
2. The biological communities within the development area and project site are based on ground level habitat mapping, as documented within LSA's 2018 Report.
3. The biological communities within the evaluation area were calculated as follows: Napa County's (2005) vegetation alliance was used to obtain biological communities within a 1-mile radius around the project site. The biological communities within the project site that were mapped by Napa County (2005) were clipped out and omitted from the acreages. LSA's (2018) biological communities within the project site were added to the acreages within the evaluation area.
4. All biological communities in parentheses are the land cover types identified within the 2018 Report, which correspond with Napa County's 2005 data.
5. The evaluation area and the Napa County acreages were obtained from Napa County's 2005 GIS data.

SOURCE: LSA, 2018, ESA, 2019, Napa County, 2005

Oak woodland occurs within the evaluation area. Vegetation alliances associated with oak woodland include: black oak alliance, blue oak alliance, California bay-madrone-coast live oak-(black oak big-leaf maple) NFD super alliance, canyon live oak alliance, coast live oak alliance, coast live oak-blue oak-(foothill pine) NFD association, and mixed oak alliance.

Annual grassland occurs in scattered areas throughout the evaluation area. Vegetation alliances associated with this natural community include California annual grasslands alliance and upland annual grasslands and forbs formation.

Chamise/scrub occurs throughout the evaluation area. Vegetation alliances generally associated within this natural community include: chamise-wedgeleaf ceanothus alliance, chamise alliance, mixed manzanita-(interior live oak-California bay-chamise) west county NFD alliance, leather oak-California bay-*Rhamnus* ssp. mesic serpentine NFD alliance, sclerophyllous shrubland formation, scrub interior live oak-scrub oak-(California bay-flowering ash-birch leaf mountain mahogany-toyon-California buckeye) mesic East County NFD super alliance, and white leaf manzanita-leather oak-(chamise-ceanothus spp.) xeric serpentine NFD super alliance.

Other human-altered habitat types and other land types within the evaluation area include: agriculture, unknown, urban or built-up, vacant, and rock outcrop.

Riparian vegetation alliances include *Carex* ssp.-*Juncus* spp. wet meadow grasses NFD super alliance and white alder (mixed willow-California bay-big leaf maple) riparian forest NFD Association. Water includes wetlands, drainages (streams), and aquatic habitat (reservoirs/lakes/marsh).

Biological Community Impact Analysis

The proposed project would impact a total of approximately 115.12 acres within the project site (note that GIS calculations do not reflect the exact acreage of the development area due to rounding). **Table 3** identifies the total acreage by biological community within the development area, the evaluation area, and Napa County, and provides the percent of the biological community that would be removed as a result of the project.

TABLE 3
PROJECT IMPACTS BY BIOLOGICAL COMMUNITY

Biological Communities	Total Acreage within Development Area	Total Acreage within Evaluation Area	Percent of Total Impacted within Evaluation Area	Total Acreage within Napa County	Percent of Total Impacted within Napa County
Black Oak Alliance	0.75	29.92	2.51	2,509.19	0.03
Scrub Interior Live Oak-Scrub Oak-(California Bay-Flowering Ash-Birch Leaf Mountain Mahogany-Toyon-California Buckeye) Mesic East County NFD Super Alliance	22.55	160.21	14.08	10,934.15	0.21
California Annual Grasslands Alliance	6.56	122.06	5.37	36,218.28	0.02
Chamise Alliance	48.85	599.09	8.15	30,559.71	0.16
Mixed Manzanita-(Interior Live Oak-California Bay-Chamise) West County NFD Alliance	3.76	283.06	1.33	7,880.85	0.05
California Bay - Madrone - Coast Live Oak - (Black Oak, Big-Leaf Maple) NFD Super Alliance	31.63	344.48	9.18	18,114.77	0.17
Rock Outcrop	1.60	1.60	100	1,671.63	0.10
Urban or Built-up	1.02	10.53	9.69	28,772.92	0.004
Total	**115.12**	**1,550.95**	**--**	**136,661.50**	**--**

NOTE:
1. GIS calculations do not reflect exact acreage of development area due to rounding.

SOURCE: Napa County 2005; ESA, 2019

As shown in Table 3, the percent loss of biological community within Napa County as a result of the project is negligible. Each of the biological communities that would be impacted within the project site would amount to less than 0.3 percent of loss within Napa County.

References

California Department of Fish and Wildlife (CDFW). 2019. California Natural Diversity Database (CNDDB) search for the Yountville U.S. Geological Survey 7.5-minute topographic quadrangle and surrounding 8 quadrangles. Updated August 20, 2019.

California Native Plant Society (CNPS). 2019. Inventory of Rare and Endangered Plants (online edition, v8-01a) query for the Yountville U.S. Geological Survey 7.5-minute topographic quadrangle and surrounding 8 quadrangles. Updated August 20, 2019.

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Napa County Planning, Building & Environmental Services. 2016a. Guidelines for Preparing Biological Resources Reconnaissance Surveys. August 2016.

_____. 2016b. Guidelines for Preparing Special-Status Plant Studies. August 2016.

U.S. Fish and Wildlife Service (USFWS). 2019. List of Threatened and Endangered Species that may Occur in your Proposed Project Location, and/or may be Affected by your Proposed Project. Consultation Code: 08ESMF00-2018-SLI-01678. March 26, 2018. Updated August 20, 2019.

Attachment 1
Agency Lists

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE RareFind

Query Summary:
Quad IS (Yountville (3812243) OR St. Helena (3812254) OR Chiles Valley (3812253) OR Lake Berryessa (3812252) OR Rutherford (3812244) OR Capell Valley (3812242) OR Sonoma (3812234) OR Napa (3812233) OR Mt. George (3812232))

Print Close

CNDDB Element Query Results

Scientific Name	Common Name	Taxonomic Group	Element Code	Total Occs	Returned Occs	Federal Status	State Status	Global Rank	State Rank	CA Rare Plant Rank	Other Status	Habitats
Agelaius tricolor	tricolored blackbird	Birds	ABPBXB0020	955	1	None	Threatened	G2G3	S1S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_EN-Endangered, NABCI_RWL-Red Watch List, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Marsh & swamp, Swamp, Wetland
Agrostis hendersonii	Henderson's bent grass	Monocots	PMPOA040K0	26	1	None	None	G2Q	S2	3.2	null	Valley & foothill grassland, Vernal pool, Wetland
Allium peninsulare var. franciscanum	Franciscan onion	Monocots	PMLIL021R1	25	2	None	None	G5T2	S2	1B.2	null	Cismontane woodland, Ultramafic, Valley & foothill grassland
Amorpha californica var. napensis	Napa false indigo	Dicots	PDFAB08012	76	19	None	None	G4T2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden	Broadleaved upland forest, Chaparral, Cismontane woodland
Amsinckia lunaris	bent-flowered fiddleneck	Dicots	PDBOR01070	93	1	None	None	G3	S3	1B.2	BLM_S-Sensitive	Cismontane woodland, Coastal bluff scrub, Valley & foothill grassland
Antrozous pallidus	pallid bat	Mammals	AMACC10010	420	19	None	None	G5	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland
Aquila chrysaetos	golden eagle	Birds	ABNKC22010	321	1	None	None	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-	Broadleaved upland forest, Cismontane woodland, Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland

											Fully Protected, CDFW_WL-Watch List, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	
Arctostaphylos stanfordiana ssp. decumbens	Rincon Ridge manzanita	Dicots	PDERI041G4	12	1	None	None	G3T1	S1	1B.1	null	Chaparral, Cismontane woodland
Ardea alba	great egret	Birds	ABNGA04040	43	1	None	None	G5	S4	null	CDF_S-Sensitive, IUCN_LC-Least Concern	Brackish marsh, Estuary, Freshwater marsh, Marsh & swamp, Riparian forest, Wetland
Ardea herodias	great blue heron	Birds	ABNGA04010	155	1	None	None	G5	S4	null	CDF_S-Sensitive, IUCN_LC-Least Concern	Brackish marsh, Estuary, Freshwater marsh, Marsh & swamp, Riparian forest, Wetland
Astragalus claranus	Clara Hunt's milk-vetch	Dicots	PDFAB0F240	6	3	Endangered	Threatened	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Chaparral, Cismontane woodland, Valley & foothill grassland
Astragalus tener var. tener	alkali milk-vetch	Dicots	PDFAB0F8R1	65	1	None	None	G2T1	S1	1B.2	null	Alkali playa, Valley & foothill grassland, Vernal pool, Wetland
Balsamorhiza macrolepis	big-scale balsamroot	Dicots	PDAST11061	51	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, USFS_S-Sensitive	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland
Blennosperma bakeri	Sonoma sunshine	Dicots	PDAST1A010	24	2	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Valley & foothill grassland, Vernal pool, Wetland
Bombus caliginosus	obscure bumble bee	Insects	IIHYM24380	181	5	None	None	G4?	S1S2	null	IUCN_VU-Vulnerable	null
Bombus occidentalis	western bumble bee	Insects	IIHYM24250	282	2	None	None	G2G3	S1	null	USFS_S-Sensitive, XERCES_IM-Imperiled	null
Brodiaea leptandra	narrow-anthered brodiaea	Monocots	PMLIL0C022	39	20	None	None	G3?	S3?	1B.2	null	Broadleaved upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Valley & foothill grassland
Buteo swainsoni	Swainson's hawk	Birds	ABNKC19070	2510	2	None	Threatened	G5	S3	null	BLM_S-Sensitive, IUCN_LC-Least Concern, USFWS_BCC-Birds of Conservation Concern	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland
Calasellus californicus	An isopod	Crustaceans	ICMAL34010	3	1	None	None	G2	S2	null	null	Aquatic
Castilleja ambigua var. meadii	Mead's owls-clover	Dicots	PDSCR0D404	3	3	None	None	G4T1	S1	1B.1	null	Meadow & seep, Vernal pool, Wetland
Ceanothus	Rincon Ridge	Dicots	PDRHA04220	33	5	None	None	G1	S1	1B.1	BLM_S-	Chaparral, Cismontane woodland, Closed-cone coniferous

confusus	ceanothus										Sensitive	forest, Ultramafic
Ceanothus divergens	Calistoga ceanothus	Dicots	PDRHA04240	26	6	None	None	G2	S2	1B.2	BLM_S-Sensitive	Chaparral, Cismontane woodland, Ultramafic
Ceanothus purpureus	holly-leaved ceanothus	Dicots	PDRHA04160	43	38	None	None	G2	S2	1B.2	null	Chaparral, Cismontane woodland
Ceanothus sonomensis	Sonoma ceanothus	Dicots	PDRHA04420	30	15	None	None	G2	S2	1B.2	null	Chaparral, Ultramafic
Corynorhinus townsendii	Townsend's big-eared bat	Mammals	AMACC08010	635	2	None	None	G3G4	S2	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, USFS_S-Sensitive, WBWG_H-High Priority	Broadleaved upland forest, Chaparral, Chenopod scrub, Great Basin grassland, Great Basin scrub, Joshua tree woodland, Lower montane coniferous forest, Meadow & seep, Mojavean desert scrub, Riparian forest, Riparian woodland, Sonoran desert scrub, Sonoran thorn woodland, Upper montane coniferous forest, Valley & foothill grassland
Coturnicops noveboracensis	yellow rail	Birds	ABNME01010	45	1	None	None	G4	S1S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_RWL-Red Watch List, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Freshwater marsh, Meadow & seep
Cryptantha dissita	serpentine cryptantha	Dicots	PDBOR0A0H2	10	1	None	None	G2	S2	1B.2	BLM_S-Sensitive	Chaparral, Ultramafic
Cypseloides niger	black swift	Birds	ABNUA01010	46	1	None	None	G4	S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, NABCI_YWL-Yellow Watch List, USFWS_BCC-Birds of Conservation Concern	null
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	Insects	IICOL48011	271	1	Threatened	None	G3T2	S2	null	null	Riparian scrub
Dicamptodon ensatus	California giant salamander	Amphibians	AAAAH01020	234	7	None	None	G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened	Aquatic, Meadow & seep, North coast coniferous forest, Riparian forest

Downingia pusilla	dwarf downingia	Dicots	PDCAM060C0	132	10	None	None	GU	S2	2B.2	null	Valley & foothill grassland, Vernal pool, Wetland
Elanus leucurus	white-tailed kite	Birds	ABNKC06010	180	3	None	None	G5	S3S4	null	BLM_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern	Cismontane woodland, Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland
Emys marmorata	western pond turtle	Reptiles	ARAAD02030	1376	17	None	None	G3G4	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable, USFS_S-Sensitive	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Erethizon dorsatum	North American porcupine	Mammals	AMAFJ01010	508	1	None	None	G5	S3	null	IUCN_LC-Least Concern	Broadleaved upland forest, Cismontane woodland, Closed-cone coniferous forest, Lower montane coniferous forest, North coast coniferous forest, Upper montane coniferous forest
Erigeron greenei	Greene's narrow-leaved daisy	Dicots	PDAST3M5G0	20	11	None	None	G3	S3	1B.2	null	Chaparral, Ultramafic
Eryngium jepsonii	Jepson's coyote-thistle	Dicots	PDAPI0Z130	19	2	None	None	G2	S2	1B.2	null	Valley & foothill grassland, Vernal pool
Extriplex joaquinana	San Joaquin spearscale	Dicots	PDCHE041F3	127	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden	Alkali playa, Chenopod scrub, Meadow & seep, Valley & foothill grassland
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	Birds	ABPBX1201A	112	2	None	None	G5T3	S3	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Marsh & swamp
Haliaeetus leucocephalus	bald eagle	Birds	ABNKC10010	327	2	Delisted	Endangered	G5	S3	null	BLM_S-Sensitive, CDF_S-Sensitive, CDFW_FP-Fully Protected, IUCN_LC-Least Concern, USFS_S-Sensitive, USFWS_BCC-Birds of Conservation Concern	Lower montane coniferous forest, Oldgrowth
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	Dicots	PDAST4R065	52	2	None	None	G5T2	S2	1B.2	null	Valley & foothill grassland
Hesperolinon	Brewer's	Dicots	PDLIN01030	29	3	None	None	G2	S2	1B.2	BLM_S-	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill

breweri	western flax										Sensitive	grassland
Hesperolinon sharsmithiae	Sharsmith's western flax	Dicots	PDLIN010E0	32	16	None	None	G2Q	S2	1B.2	BLM_S-Sensitive	Chaparral, Ultramafic
Horkelia tenuiloba	thin-lobed horkelia	Dicots	PDROS0W0E0	27	1	None	None	G2	S2	1B.2	BLM_S-Sensitive, SB_RSABG-Rancho Santa Ana Botanic Garden	Broadleaved upland forest, Chaparral, Valley & foothill grassland
Juglans hindsii	Northern California black walnut	Dicots	PDJUG02040	5	2	None	None	G5	S5	CBR	SB_USDA-US Dept of Agriculture	Riparian forest, Riparian woodland
Lasiurus blossevillii	western red bat	Mammals	AMACC05060	128	1	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern, WBWG_H-High Priority	Cismontane woodland, Lower montane coniferous forest, Riparian forest, Riparian woodland
Lasthenia conjugens	Contra Costa goldfields	Dicots	PDAST5L040	36	3	Endangered	None	G1	S1	1B.1	SB_UCBBG-UC Berkeley Botanical Garden	Alkali playa, Cismontane woodland, Valley & foothill grassland, Vernal pool, Wetland
Lathyrus jepsonii var. jepsonii	Delta tule pea	Dicots	PDFAB250D2	133	2	None	None	G5T2	S2	1B.2	SB_BerrySB-Berry Seed Bank, SB_RSABG-Rancho Santa Ana Botanic Garden	Freshwater marsh, Marsh & swamp, Wetland
Layia septentrionalis	Colusa layia	Dicots	PDAST5N0F0	57	3	None	None	G2	S2	1B.2	BLM_S-Sensitive	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland
Leptosiphon jepsonii	Jepson's leptosiphon	Dicots	PDPLM09140	37	13	None	None	G2G3	S2S3	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland
Lilaeopsis masonii	Mason's lilaeopsis	Dicots	PDAPI19030	197	1	None	Rare	G2	S2	1B.1	null	Freshwater marsh, Marsh & swamp, Riparian scrub, Wetland
Limnanthes vinculans	Sebastopol meadowfoam	Dicots	PDLIM02090	46	1	Endangered	Endangered	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Meadow & seep, Valley & foothill grassland, Vernal pool, Wetland
Lupinus sericatus	Cobb Mountain lupine	Dicots	PDFAB2B3J0	46	8	None	None	G2?	S2?	1B.2	BLM_S-Sensitive	Broadleaved upland forest, Chaparral, Cismontane woodland, Lower montane coniferous forest, Ultramafic
Melospiza melodia samuelis	San Pablo song sparrow	Birds	ABPBXA301W	41	1	None	None	G5T2	S2	null	CDFW_SSC-Species of Special Concern, USFWS_BCC-Birds of Conservation Concern	Salt marsh
Myotis evotis	long-eared myotis	Mammals	AMACC01070	139	1	None	None	G5	S3	null	BLM_S-Sensitive, IUCN_LC-	null

											Least Concern, WBWG_M-Medium Priority	
Myotis yumanensis	Yuma myotis	Mammals	AMACC01020	265	1	None	None	G5	S4	null	BLM_S-Sensitive, IUCN_LC-Least Concern, WBWG_LM-Low-Medium Priority	Lower montane coniferous forest, Riparian forest, Riparian woodland, Upper montane coniferous forest
Navarretia leucocephala ssp. bakeri	Baker's navarretia	Dicots	PDPLM0C0E1	58	1	None	None	G4T2	S2	1B.1	BLM_S-Sensitive	Cismontane woodland, Lower montane coniferous forest, Meadow & seep, Valley & foothill grassland, Vernal pool, Wetland
Navarretia leucocephala ssp. pauciflora	few-flowered navarretia	Dicots	PDPLM0C0E4	10	2	Endangered	Threatened	G4T1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Vernal pool, Wetland
Navarretia rosulata	Marin County navarretia	Dicots	PDPLM0C0Z0	15	1	None	None	G2	S2	1B.2	null	Chaparral, Closed-cone coniferous forest, Ultramafic
Northern Vernal Pool	Northern Vernal Pool	Herbaceous	CTT44100CA	20	5	None	None	G2	S2.1	null	null	Vernal pool, Wetland
Nycticorax nycticorax	black-crowned night heron	Birds	ABNGA11010	37	1	None	None	G5	S4	null	IUCN_LC-Least Concern	Marsh & swamp, Riparian forest, Riparian woodland, Wetland
Oncorhynchus mykiss irideus pop. 8	steelhead - central California coast DPS	Fish	AFCHA0209G	44	2	Threatened	None	G5T2T3Q	S2S3	null	AFS_TH-Threatened	Aquatic, Sacramento/San Joaquin flowing waters
Pandion haliaetus	osprey	Birds	ABNKC01010	500	3	None	None	G5	S4	null	CDF_S-Sensitive, CDFW_WL-Watch List, IUCN_LC-Least Concern	Riparian forest
Penstemon newberryi var. sonomensis	Sonoma beardtongue	Dicots	PDSCR1L483	11	2	None	None	G4T2	S2	1B.3	null	Chaparral
Phalacrocorax auritus	double-crested cormorant	Birds	ABNFD01020	39	1	None	None	G5	S4	null	CDFW_WL-Watch List, IUCN_LC-Least Concern	Riparian forest, Riparian scrub, Riparian woodland
Progne subis	purple martin	Birds	ABPAU01010	71	3	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Broadleaved upland forest, Lower montane coniferous forest
Rana boylii	foothill yellow-legged frog	Amphibians	AAABH01050	2411	29	None	Candidate Threatened	G3	S3	null	BLM_S-Sensitive, CDFW_SSC-Species of Special Concern, IUCN_NT-Near Threatened, USFS_S-Sensitive	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow & seep, Riparian forest, Riparian woodland, Sacramento/San Joaquin flowing waters

Rana draytonii	California red-legged frog	Amphibians	AAABH01022	1526	3	Threatened	None	G2G3	S2S3	null	CDFW_SSC-Species of Special Concern, IUCN_VU-Vulnerable	Aquatic, Artificial flowing waters, Artificial standing waters, Freshwater marsh, Marsh & swamp, Riparian forest, Riparian scrub, Riparian woodland, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland
Rhynchospora californica	California beaked-rush	Monocots	PMCYP0N060	9	1	None	None	G1	S1	1B.1	BLM_S-Sensitive	Freshwater marsh, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Wetland
Riparia riparia	bank swallow	Birds	ABPAU08010	298	1	None	Threatened	G5	S2	null	BLM_S-Sensitive, IUCN_LC-Least Concern	Riparian scrub, Riparian woodland
Sagittaria sanfordii	Sanford's arrowhead	Monocots	PMALI040Q0	126	1	None	None	G3	S3	1B.2	BLM_S-Sensitive	Marsh & swamp, Wetland
Sidalcea hickmanii ssp. napensis	Napa checkerbloom	Dicots	PDMAL110A6	2	1	None	None	G3T1	S1	1B.1	null	Chaparral
Sidalcea keckii	Keck's checkerbloom	Dicots	PDMAL110D0	16	1	Endangered	None	G2	S2	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden	Cismontane woodland, Ultramafic, Valley & foothill grassland
Sidalcea oregana ssp. hydrophila	marsh checkerbloom	Dicots	PDMAL110K2	35	1	None	None	G5T2	S2	1B.2	null	Meadow & seep, Riparian forest, Wetland
Spirinchus thaleichthys	longfin smelt	Fish	AFCHB03010	46	1	Candidate	Threatened	G5	S1	null	null	Aquatic, Estuary
Streptanthus hesperidis	green jewelflower	Dicots	PDBRA2G510	19	5	None	None	G2	S2	1B.2	null	Chaparral, Cismontane woodland, Ultramafic
Symphyotrichum lentum	Suisun Marsh aster	Dicots	PDASTE8470	175	1	None	None	G2	S2	1B.2	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture	Brackish marsh, Freshwater marsh, Marsh & swamp, Wetland
Syncaris pacifica	California freshwater shrimp	Crustaceans	ICMAL27010	20	3	Endangered	Endangered	G2	S2	null	IUCN_EN-Endangered	Aquatic, Sacramento/San Joaquin flowing waters
Taricha rivularis	red-bellied newt	Amphibians	AAAAF02020	136	1	None	None	G4	S2	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Broadleaved upland forest, North coast coniferous forest, Redwood, Riparian forest, Riparian woodland
Taxidea taxus	American badger	Mammals	AMAJF04010	590	2	None	None	G5	S3	null	CDFW_SSC-Species of Special Concern, IUCN_LC-Least Concern	Alkali marsh, Alkali playa, Alpine, Alpine dwarf scrub, Bog & fen, Brackish marsh, Broadleaved upland forest, Chaparral, Chenopod scrub, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub, Desert dunes, Desert wash, Freshwater marsh, Great Basin grassland, Great Basin scrub, Interior dunes, Ione formation, Joshua tree woodland, Limestone, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Mojavean desert scrub, Montane dwarf scrub, North coast coniferous forest, Oldgrowth, Pavement plain, Redwood, Riparian forest, Riparian scrub, Riparian woodland, Salt marsh, Sonoran desert scrub, Sonoran thorn woodland, Ultramafic, Upper montane coniferous forest, Upper Sonoran scrub, Valley & foothill grassland
Trichostema	Napa	Dicots	PDLAM220H0	19	17	None	None	G1G2	S1S2	1B.2	null	Chaparral, Cismontane woodland, Lower montane coniferous

ruygtii	bluecurls											forest, Valley & foothill grassland, Vernal pool, Wetland
Trifolium amoenum	two-fork clover	Dicots	PDFAB40040	26	1	Endangered	None	G1	S1	1B.1	SB_RSABG-Rancho Santa Ana Botanic Garden, SB_USDA-US Dept of Agriculture	Coastal bluff scrub, Ultramafic, Valley & foothill grassland
Trifolium hydrophilum	saline clover	Dicots	PDFAB400R5	49	1	None	None	G2	S2	1B.2	null	Marsh & swamp, Valley & foothill grassland, Vernal pool, Wetland
Viburnum ellipticum	oval-leaved viburnum	Dicots	PDCPR07080	38	4	None	None	G4G5	S3?	2B.3	null	Chaparral, Cismontane woodland, Lower montane coniferous forest

CNPS California Native Plant Society

Inventory of Rare and Endangered Plants

*The database used to provide updates to the Online Inventory is under construction. View updates and changes made since May 2019 here.

Plant List

83 matches found. *Click on scientific name for details*

Search Criteria

Found in Quads 3812254, 3812253, 3812252, 3812244, 3812243, 3812242, 3812234 3812233 and 3812232;

Modify Search Criteria Export to Excel Modify Columns Modify Sort Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Agrostis hendersonii	Henderson's bent grass	Poaceae	annual herb	Apr-Jun	3.2	S2	G2Q
Allium peninsulare var. franciscanum	Franciscan onion	Alliaceae	perennial bulbiferous herb	(Apr)May-Jun	1B.2	S2	G5T2
Amorpha californica var. napensis	Napa false indigo	Fabaceae	perennial deciduous shrub	Apr-Jul	1B.2	S2	G4T2
Amsinckia lunaris	bent-flowered fiddleneck	Boraginaceae	annual herb	Mar-Jun	1B.2	S3	G3
Antirrhinum virga	twig-like snapdragon	Plantaginaceae	perennial herb	Jun-Jul	4.3	S3?	G3?
Arabis modesta	modest rockcress	Brassicaceae	perennial herb	Mar-Jul	4.3	S3	G3
Arctostaphylos bakeri ssp. bakeri	Baker's manzanita	Ericaceae	perennial evergreen shrub	Feb-Apr	1B.1	S1	G2T1
Arctostaphylos stanfordiana ssp. decumbens	Rincon Ridge manzanita	Ericaceae	perennial evergreen shrub	Feb-Apr(May)	1B.1	S1	G3T1
Astragalus breweri	Brewer's milk-vetch	Fabaceae	annual herb	Apr-Jun	4.2	S3	G3
Astragalus claranus	Clara Hunt's milk-vetch	Fabaceae	annual herb	Mar-May	1B.1	S1	G1
Astragalus clevelandii	Cleveland's milk-vetch	Fabaceae	perennial herb	Jun-Sep	4.3	S4	G4
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	Mar-Jun	1B.2	S1	G2T1
Balsamorhiza macrolepis	big-scale balsamroot	Asteraceae	perennial herb	Mar-Jun	1B.2	S2	G2

Blennosperma bakeri	Sonoma sunshine	Asteraceae	annual herb	Mar-May	1B.1	S1	G1
Brodiaea leptandra	narrow-anthered brodiaea	Themidaceae	perennial bulbiferous herb	May-Jul	1B.2	S3?	G3?
Calamagrostis ophitidis	serpentine reed grass	Poaceae	perennial herb	Apr-Jul	4.3	S3	G3
Calandrinia breweri	Brewer's calandrinia	Montiaceae	annual herb	(Jan)Mar-Jun	4.2	S4	G4
Calochortus pulchellus	Mt. Diablo fairy-lantern	Liliaceae	perennial bulbiferous herb	Apr-Jun	1B.2	S2	G2
Calycadenia micrantha	small-flowered calycadenia	Asteraceae	annual herb	Jun-Sep	1B.2	S2	G2
Calystegia collina ssp. oxyphylla	Mt. Saint Helena morning-glory	Convolvulaceae	perennial rhizomatous herb	Apr-Jun	4.2	S3	G4T3
Castilleja ambigua var. ambigua	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	Mar-Aug	4.2	S3S4	G4T4
Castilleja ambigua var. meadii	Mead's owl's-clover	Orobanchaceae	annual herb (hemiparasitic)	Apr-May	1B.1	S1	G4T1
Ceanothus confusus	Rincon Ridge ceanothus	Rhamnaceae	perennial evergreen shrub	Feb-Jun	1B.1	S1	G1
Ceanothus divergens	Calistoga ceanothus	Rhamnaceae	perennial evergreen shrub	Feb-Apr	1B.2	S2	G2
Ceanothus purpureus	holly-leaved ceanothus	Rhamnaceae	perennial evergreen shrub	Feb-Jun	1B.2	S2	G2
Ceanothus sonomensis	Sonoma ceanothus	Rhamnaceae	perennial evergreen shrub	Feb-Apr	1B.2	S2	G2
Centromadia parryi ssp. rudis	Parry's rough tarplant	Asteraceae	annual herb	May-Oct	4.2	S3	G3T3
Chorizanthe valida	Sonoma spineflower	Polygonaceae	annual herb	Jun-Aug	1B.1	S1	G1
Clarkia breweri	Brewer's clarkia	Onagraceae	annual herb	Apr-Jun	4.2	S4	G4
Clarkia gracilis ssp. tracyi	Tracy's clarkia	Onagraceae	annual herb	Apr-Jul	4.2	S3	G5T3
Collomia diversifolia	serpentine collomia	Polemoniaceae	annual herb	May-Jun	4.3	S4	G4
Cordylanthus tenuis ssp. brunneus	serpentine bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	Jul-Aug	4.3	S3	G4G5T3
Cryptantha dissita	serpentine cryptantha	Boraginaceae	annual herb	Apr-Jun	1B.2	S2	G2
Delphinium uliginosum	swamp larkspur	Ranunculaceae	perennial herb	May-Jun	4.2	S3	G3
Downingia pusilla	dwarf downingia	Campanulaceae	annual herb	Mar-May	2B.2	S2	GU
Erigeron biolettii	streamside daisy	Asteraceae	perennial herb	Jun-Oct	3	S3?	G3?
Erigeron greenei	Greene's narrow-leaved daisy	Asteraceae	perennial herb	May-Sep	1B.2	S3	G3
Eryngium jepsonii	Jepson's coyote thistle	Apiaceae	perennial herb	Apr-Aug	1B.2	S2?	G2?
Extriplex joaquinana	San Joaquin spearscale	Chenopodiaceae	annual herb	Apr-Oct	1B.2	S2	G2
Gilia capitata ssp. tomentosa	woolly-headed gilia	Polemoniaceae	annual herb	May-Jul	1B.1	S1	G5T1
Harmonia nutans	nodding harmonia	Asteraceae	annual herb	Mar-May	4.3	S3	G3
Hemizonia congesta ssp. congesta	congested-headed hayfield tarplant	Asteraceae	annual herb	Apr-Nov	1B.2	S2	G5T2

Hesperolinon bicarpellatum	two-carpellate western flax	Linaceae	annual herb	May-Jul	1B.2	S2	G2
Hesperolinon breweri	Brewer's western flax	Linaceae	annual herb	May-Jul	1B.2	S2	G2
Hesperolinon sharsmithiae	Sharsmith's western flax	Linaceae	annual herb	May-Jul	1B.2	S2	G2Q
Horkelia tenuiloba	thin-lobed horkelia	Rosaceae	perennial herb	May-Jul(Aug)	1B.2	S2	G2
Juglans hindsii	Northern California black walnut	Juglandaceae	perennial deciduous tree	Apr-May	1B.1	S1	G1
Lasthenia conjugens	Contra Costa goldfields	Asteraceae	annual herb	Mar-Jun	1B.1	S1	G1
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	May-Jul(Aug-Sep)	1B.2	S2	G5T2
Layia septentrionalis	Colusa layia	Asteraceae	annual herb	Apr-May	1B.2	S2	G2
Leptosiphon acicularis	bristly leptosiphon	Polemoniaceae	annual herb	Apr-Jul	4.2	S4?	G4?
Leptosiphon jepsonii	Jepson's leptosiphon	Polemoniaceae	annual herb	Mar-May	1B.2	S2S3	G2G3
Leptosiphon latisectus	broad-lobed leptosiphon	Polemoniaceae	annual herb	Apr-Jun	4.3	S4	G4
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	Apr-Nov	1B.1	S2	G2
Lilium rubescens	redwood lily	Liliaceae	perennial bulbiferous herb	Apr-Aug(Sep)	4.2	S3	G3
Limnanthes vinculans	Sebastopol meadowfoam	Limnanthaceae	annual herb	Apr-May	1B.1	S1	G1
Lomatium repostum	Napa lomatium	Apiaceae	perennial herb	Mar-Jun	4.3	S3	G3
Lupinus sericatus	Cobb Mountain lupine	Fabaceae	perennial herb	Mar-Jun	1B.2	S2?	G2?
Malacothamnus helleri	Heller's bush-mallow	Malvaceae	perennial deciduous shrub	May-Jul	3.3	S3	G3Q
Micropus amphibolus	Mt. Diablo cottonweed	Asteraceae	annual herb	Mar-May	3.2	S3S4	G3G4
Monardella viridis	green monardella	Lamiaceae	perennial rhizomatous herb	Jun-Sep	4.3	S3	G3
Navarretia cotulifolia	cotula navarretia	Polemoniaceae	annual herb	May-Jun	4.2	S4	G4
Navarretia heterandra	Tehama navarretia	Polemoniaceae	annual herb	Apr-Jun	4.3	S4	G4
Navarretia leucocephala ssp. bakeri	Baker's navarretia	Polemoniaceae	annual herb	Apr-Jul	1B.1	S2	G4T2
Navarretia leucocephala ssp. pauciflora	few-flowered navarretia	Polemoniaceae	annual herb	May-Jun	1B.1	S1	G4T1
Navarretia rosulata	Marin County navarretia	Polemoniaceae	annual herb	May-Jul	1B.2	S2	G2
Penstemon newberryi var. sonomensis	Sonoma beardtongue	Plantaginaceae	perennial herb	Apr-Aug	1B.3	S2	G4T2
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb (aquatic)	Feb-May	4.2	S3	G4
Rhynchospora californica	California beaked-rush	Cyperaceae	perennial rhizomatous herb	May-Jul	1B.1	S1	G1
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	1B.2	S3	G3

Senecio clevelandii var. clevelandii	Cleveland's ragwort	Asteraceae	perennial herb	Jun-Jul	4.3	S3	G4?T3Q
Sidalcea hickmanii ssp. napensis	Napa checkerbloom	Malvaceae	perennial herb	Apr-Jun	1B.1	S1	G3T1
Sidalcea hickmanii ssp. viridis	Marin checkerbloom	Malvaceae	perennial herb	May-Jun	1B.1	SH	G3TH
Sidalcea keckii	Keck's checkerbloom	Malvaceae	annual herb	Apr-May(Jun)	1B.1	S2	G2
Sidalcea oregana ssp. hydrophila	marsh checkerbloom	Malvaceae	perennial herb	(Jun)Jul-Aug	1B.2	S2	G5T2
Streptanthus hesperidis	green jewelflower	Brassicaceae	annual herb	May-Jul	1B.2	S2	G2
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	(Apr)May-Nov	1B.2	S2	G2
Toxicoscordion fontanum	marsh zigadenus	Melanthiaceae	perennial bulbiferous herb	Apr-Jul	4.2	S3	G3
Trichostema ruygtii	Napa bluecurls	Lamiaceae	annual herb	Jun-Oct	1B.2	S1S2	G1G2
Trifolium amoenum	two-fork clover	Fabaceae	annual herb	Apr-Jun	1B.1	S1	G1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	Apr-Jun	1B.2	S2	G2
Triteleia lugens	dark-mouthed triteleia	Themidaceae	perennial bulbiferous herb	Apr-Jun	4.3	S4?	G4?
Viburnum ellipticum	oval-leaved viburnum	Adoxaceae	perennial deciduous shrub	May-Jun	2B.3	S3?	G4G5

Suggested Citation

California Native Plant Society, Rare Plant Program. 2019. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 20 August 2019].

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:
Consultation Code: 08ESMF00-2019-SLI-2814
Event Code: 08ESMF00-2019-E-08989
Project Name: Stagecoach North

August 20, 2019

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2019-SLI-2814

Event Code: 08ESMF00-2019-E-08989

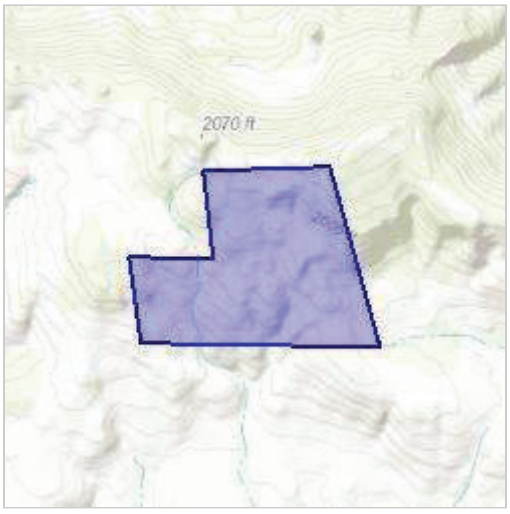
Project Name: Stagecoach North

Project Type: AGRICULTURE

Project Description: Vineyard

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/38.46835593065136N122.30958288780451W



Counties: Napa, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Crustaceans

NAME	STATUS
California Freshwater Shrimp *Syncaris pacifica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered

Flowering Plants

NAME	STATUS
Contra Costa Goldfields *Lasthenia conjugens* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7058	Endangered
Few-flowered Navarretia *Navarretia leucocephala ssp. pauciflora (=N. pauciflora)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8242	Endangered
Sebastopol Meadowfoam *Limnanthes vinculans* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/404	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Attachment 2
Observed Plants

OBSERVED PLANTS

Family	Scientific Name	Common Name
Agavaceae	*Chlorogalum pomeridianum* var. *pomeridianum*	Soap plant
Alliaceae	*Allium peninsulare* var. *franciscanum*	Franciscan onion
	Allium sp.	Onion
Anacardiaceae	*Toxicodendron diversilobum*	Poison oak
Apiaceae	*Lomatium dasycarpum* ssp. *dasycarpum*	Wooly-fruited lomatium
	Lomatium repostum	Napa lomatium
	Perideridia kelloggii	Kellogg's yampah
	Sanicula bipinnatifida	Purple sanicle
	Sanicula crassicaulis	Sanicle
	Torilis arvensis	Hedge parsley
	Yabea microcarpa	Yabea
Asteraceae	*Achillea millefolium*	Yarrow
	Baccharis pilularis	Coyote brush
	Calycadenia micrantha	Calycadenia
	Cirsium occidentale	Thistle
	Centaurea melitensis	Tocalote
	Grindelia sp.	
	Eriophyllum lanatum	Woolly sunflower
	Harmonia nutans	Nodding harmonia
	Hypochaeris radicata	Rough cat's-ear
	Logfia gallica	Daggerleaf cottonrose
	Madia sp.	Tarplant
	Micropus californicus	Cottontop
	Senecio aronicoides	Rayless ragwort
Boraginaceae	*Eriodictyon californicum*	California yerba santa
Campanulaceae	*Heterocodon rariflorum*	Few flowered heterocodon
Caprifoliaceae	*Lonicera* sp.	honeysuckle
Convolvulaceae	*Calystegia* sp.	Morning glory
Ericaceae	*Arbutus menziesii*	Pacific Madrone
	Arctostaphylos sp.	Manzanita
Fabaceae	*Pickeringia montana* var. *montana*	Chaparral pea
	Trifolium dubium	Little hop clover
	Trifolium hirtum	Rose clover
Fagaceae	*Quercus durata* var. *durata*	Leather oak
	Quercus kelloggii	California black oak
	Quercus sp.	Live oak
Hypericaceae	*Hypericum concinnum*	Gold-wire
Iridaceae	*Sisyrinchium bellum*	Bule-eyed grass
Juncaceae	*Juncus bufonius*	Common toad rush

Family	Scientific Name	Common Name
Lamiaceae	*Clinopodium douglasii*	Yerba buena
	Monardella viridis	Green monardella
	Salvia sonomensis	Sonoma sage
Lauraceae	*Umbellularia californica*	California bay
Linaceae	*Hesperolinon bicarpellatum*	Two-carpellate western flax
Liliaceae	*Calochortus amabilis*	Diogenes' lantern
	Fritillaria recurva	Scarlet fritillary
Myrsinaceae	*Lysimachia arvensis*	Scarlet pimpernel
Onagraceae	*Clarkia purpurea* ssp. *quadrivulnera*	Four-spot
Orchidaceae	*Piperia* sp.	Piperia
Orobanchaceae	*Castilleja foliolosa*	Woolly paintbrush
Phrymaceae	*Diplacus aurantiacus*	Sticky monkeyflower
	Erythranthe guttata	Yellow monkey flower
Pinaceae	*Pinus attenuata*	Knobcone pine
Poaceae	*Aira caryophyllea*	Shiver grass
	Brachypodium distachyon	False brome
	Bromus diandrus	Ripgut brome
	Bromus hordeaceus	Soft brome
	Bromus madritensis ssp. *rubens*	Red brome
	Cynosurus echinatus	Hedgehog dogtail
	Festuca bromoides	Brome fescue
	Festuca microstachys	Small fescue
	Gastridium phleoides	Nit grass
	Melica sp.	Oniongrass
	Stipa sp.	Needlegrass
Polemoniaceae	*Leptosiphon* sp.	Leptosiphon
Polygalaceae	*Polygala californica*	California milkwort
Pteridaceae	*Pellaea* sp.	Coffee fern
	Pentagramma triangularis	Golden back fern
Rhamnaceae	*Frangula californica* ssp. *tomentella*	Coffee berry
	Ceanothus cuneatus var. *cuneatus*	Buckbrush
	Ceanothus foliosus var. *foliosus*	Wavyleaf ceanothus
	Ceanothus purpureus	Holly-leaved ceanothus
Rosaceae	*Adenostoma fasciculatum*	Chamise
	Heteromeles arbutifolia	Toyon
Rubiaceae	*Galium porrigens*	Climbing bedstraw
Tecophilaceae	*Odontostomum hartwegii*	Odontostomum
Themidaceae	*Dichelostemma capitatum*	Blue dicks
Violaceae	*Viola* sp.	Violet

Attachment 3
Project Site Photographs



Photograph 1
View north of California bay forest (*Umbellularia californica* Forest Alliance) within the project site.



Photograph 2
View northwest of California annual grassland Alliance within the project site.



Photograph 3
View northwest of chamise chaparral (*Adenostoma fasciculatum* Shrubland Alliance).



Photograph 4
View west of disturbed area associated with a graded road.



Photograph 5
Representative photograph of an ephemeral drainage within the project site.



Photograph 6
View northwest of *Quercus wislizeni* (shrub) Shrubland Alliance.



Photograph 7
View of Eastwood Manzanita Chaparral (*Arctostaphylos glandulosa* Scrubland Alliance) and *Arctostaphylos manzanita* Provisional Shrubland Alliance.

CARLSBAD
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LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

MEMORANDUM

DATE: October 8, 2018

TO: Annalee Sanborn, PPI Engineering Inc.
2800 Jefferson Street, Napa, CA 94558

FROM: Eric Lichtwardt and Bernhard Warzecha, LSA

SUBJECT: Estimate of Number of Trees on Stagecoach North Project Site

Per your request, LSA estimated the number of trees within the boundaries of the Stagecoach North Vineyard Development Project Site (project site; Figure 1). Based on the methods, assumptions, and parameters described below, LSA estimates that approximately 2,790 trees are present on the project site. The distribution of trees is highly variable on site, and generally correlates with the vegetation communities mapped by LSA during previous field surveys on the project site and provided in *Biological Resources* (*Revised*)*, Stagecoach North Vineyard Project* (*APN 032-010-086-000*)*, Napa County, California* submitted to PPI Engineering in December 2016.

METHODS

The methods implemented by LSA for the purpose of this study include direct measurements and counts of trees within sample plots, combined with the analysis of high-resolution aerial imagery generated by an unmanned aerial vehicle (UAV or drone), a process typically referred to as remote sensing. The final tree count estimate is a result of a synthesis of both the direct counts and measurements on the ground, and images and elevation data generated through remote sensing. A detailed description for each method can be found below.

Definition of a Tree

For the purpose of the tree count estimate presented here, a tree is defined as any live woody plant with a stem diameter at breast height (DBH) of 5 inches or more. If multiple stems are present at breast height, the DBH of all stems are summed. A “potential tree” is a signal generated by remote sensing that is interpreted as a tree as defined above.

Ground Surveys

Five half-acre-square ground survey sample plots were placed within representative areas of each of the plant communities on the project site. Plant communities sampled include woody plant communities dominated by California bay tree (*Umbellularia californica*), chamise (*Adenostoma fasciculatum*), various oak (*Quercus* spp.), and manzanita species (*Arctostaphylos* spp.).

A team of surveyors used a high-accuracy Trimble X1 GPS unit to survey the five sample plots, including counting and mapping of all trees within the sample plots. Surveyors determined the

accumulated DBH of all trees encountered, and collected other relevant general data of the tree community, including number of stems per tree, clustering, and general functional groups or taxonomy.

Remote Sensing

LSA GIS specialist and FAA certified drone pilot Greg Gallaugher flew a drone (DJI Phantom 4 Pro v2.0 quadcopter) over the Stagecoach North property on August 28, 2018. Map Pilot for DJI flight control software was used for flight planning and to control the drone as it flew a back-and-forth pattern over the property taking photos with the onboard 20MP camera pointing straight down.

Flights were conducted at approximately 350 feet above ground level with 75 percent overlap between images (frontlap and sidelap). Pix4Dmapper software was used to process the 788 images to create a point cloud, an orthoimagery mosaic, a digital surface model (DSM), a digital terrain model (DTM), and an elevation contour shapefile. A DSM is a raster representation of the 3D surface (including tops of vegetation and structures), and a DTM is an estimated raster representation of the bare earth surface. Ground control was provided by five Propeller AeroPoint GPS-based ground control points, which collected data for 2.5 hours. The post-processed accuracy of the ground control points ranged from 1.4 to 11.5 millimeters horizontally and vertically. The resolution or ground sample distance (distance between pixel centers on the ground) of the resulting orthomosaic and DSM was 1.3 inches.

Potential trees were identified and mapped by LSA senior biologist Bernhard Warzecha based on a combination of the following data:

- High-resolution aerial imagery
- Remotely sensed vegetation heights
- Direct (on-ground) tree mapping and counting within sample plots

Combining Manual Counts and Remote Sensing

In order to account for the potential error rate for areas with a high degree of tree canopy clustering or overlap, all areas with similar conditions were identified. These areas include approximately 40 acres. For these areas, an additional number of trees was added to the tree count to account for the error rate determined between the direct tree counts and the aerial interpreted tree count. For all other areas, no procedure for error correction was needed because of the high accuracy in identifying trees based on the high-resolution aerial imagery.

RESULTS

The results of the manually counted tree surveys when compared to counts derived by analyzing aerial imagery are presented in Table A.

Table A: Tree Counts

Sample Plot	Degree of Canopy Clustering/Overlap	Manual Count	Count based on Aerial Imagery	Percent Difference/Potential Error Rate
East, predominantly forested	High	40	33	18
North, predominantly forested	High	33	29	12
Southwest, predominantly forested	Medium	36	37	3
Southeast, predominantly chaparral	None	1	1	0
West, predominantly chaparral	None	2	2	0

Remotely counted trees included 1,736 trees for 40 acres identified as having a high degree of canopy clustering or overlap. In order to account for the lower detection probability of 85 percent for these areas, an additional 260 (15 percent[1] of 1,736) trees were added to the tree count estimate. The tree count estimate for all other areas includes 793 trees, for a total estimate of 2,790 trees on the project site.

Potential locations of counted trees are shown on Figure 1. Note that mapping of trees is based on an aerial interpretation including error correction and is thus suitable for estimating tree numbers only. The mapped potential trees shown on Figure 1 are not necessarily accurate enough for any smaller-scale spatial planning applications, e.g., the potential tree map is not accurate enough for determining impacts to specific trees.

Most trees on site consist of a cluster of stems, often growing out of basal burls. The survey identified individual trees consisting of clusters of 15 or more stems, adding up to a multi-stem DBH of 30 inches or more. A large number of these trees do not have a single stem that is greater than 5 inches DBH, but because the DBH of multiple stems from a single root is additive, such trees fall under the definition of a tree and are included in the counts.

Trees within Proposed Clearing Areas

Based on our estimated tree count there are 1,481 trees within the proposed clearing areas on the project site (Figure 2). Of these 1,481 trees, 1,035 occur within areas identified as having a high degree of canopy clustering or canopy overlap. Applying the 15 percent correction factor (as discussed above) to these areas with a high degree of canopy clustering results in an additional 155 estimated trees, bringing the total estimated trees within the proposed clearing areas to 1,636.

DISCUSSION AND CONCLUSION

LSA's tree estimate presented here is based on a synthesis of analyzing high-resolution aerial imagery, and manual (direct) counting and mapping of trees within designated ground control plots.

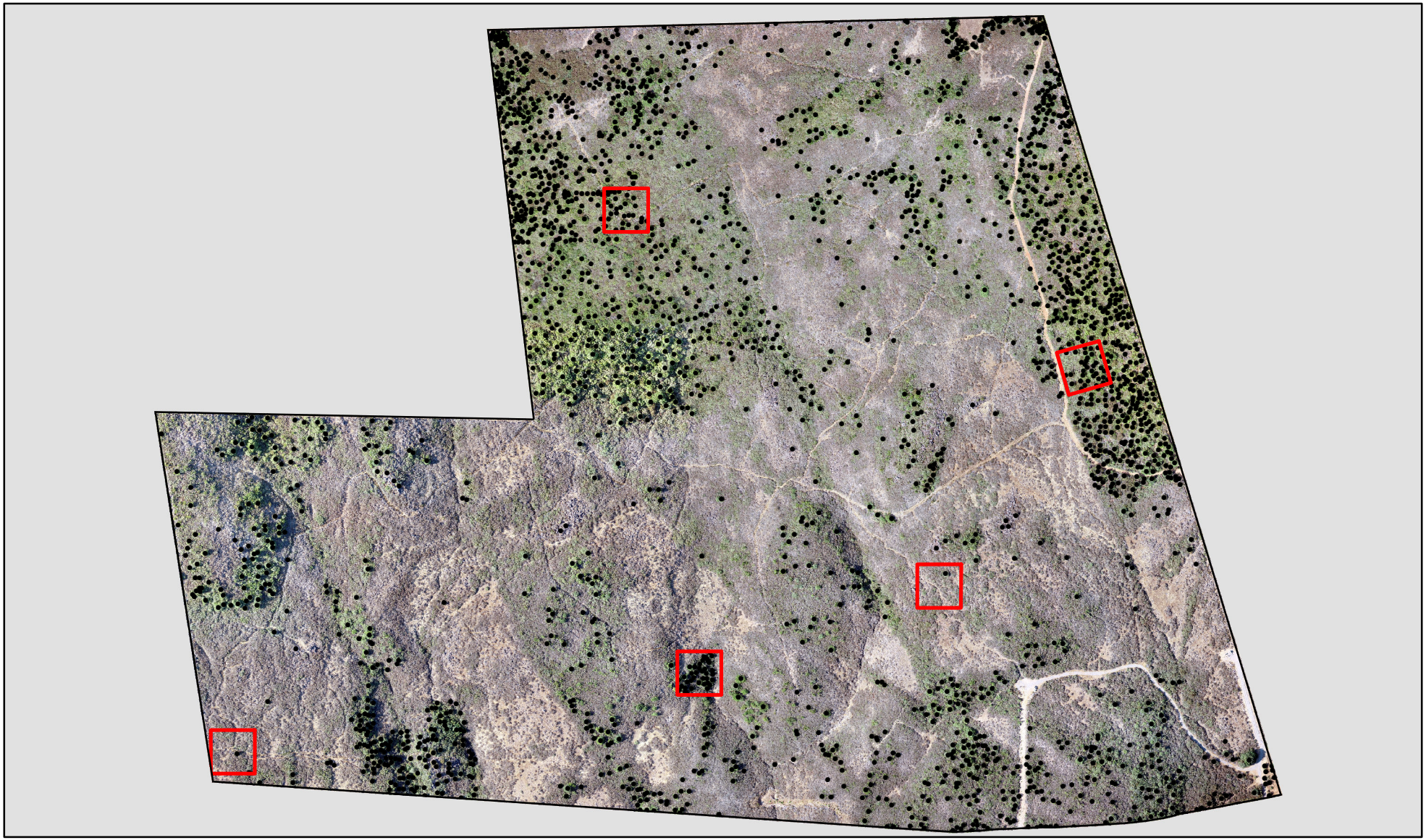
[1] The correction factor applies only to areas with a high degree of canopy clustering or overlap. The average error rate for these areas is 18%+12%/2=15%.

The comparison between the number of trees derived from aerial imagery versus manually counted trees within the ground control plots reveals a potential error rate for certain conditions when interpreting aerial imagery, specifically, the detection probability of the aerial imagery counts are lower than the direct counts.

The potential error rate/detection probability is dependent on how densely tree canopies of individual trees of the same species are clustered or overlap. For example, the estimated number of trees for the densely clustered forested sample plots North and East underestimate the number of trees by an approximate average of 15 percent. However, the potential average error rate for medium to sparsely clustered forested sample plots is close to zero. For the purpose of this tree estimate, LSA applied a correction factor of 15 percent for all areas with densely clustered trees canopies. It is LSA's professional opinion that the estimate of number of trees derived from aerial photo interpretation and direct tree counts results in a reasonable estimation of the true number of trees on the property.

The location of counted potential trees is based on an interpretation of aerial photos ground-truthed by direct tree counts and is therefore suitable for estimating tree numbers. The mapped potential tree locations shown on Figure 1, however, are not accurate enough for smaller-scale spatial planning applications such as determining impacts to individual trees.

Enclosures: Figure 1: Estimated Tree Count
Figure 2: Trees within Proposed Clearing Areas



LSA

FIGURE 1

LEGEND

- Project Site
- Ground-Truthing Sample Plot
- Potential Location of Tree from Aerial Interpretation

0 250 500

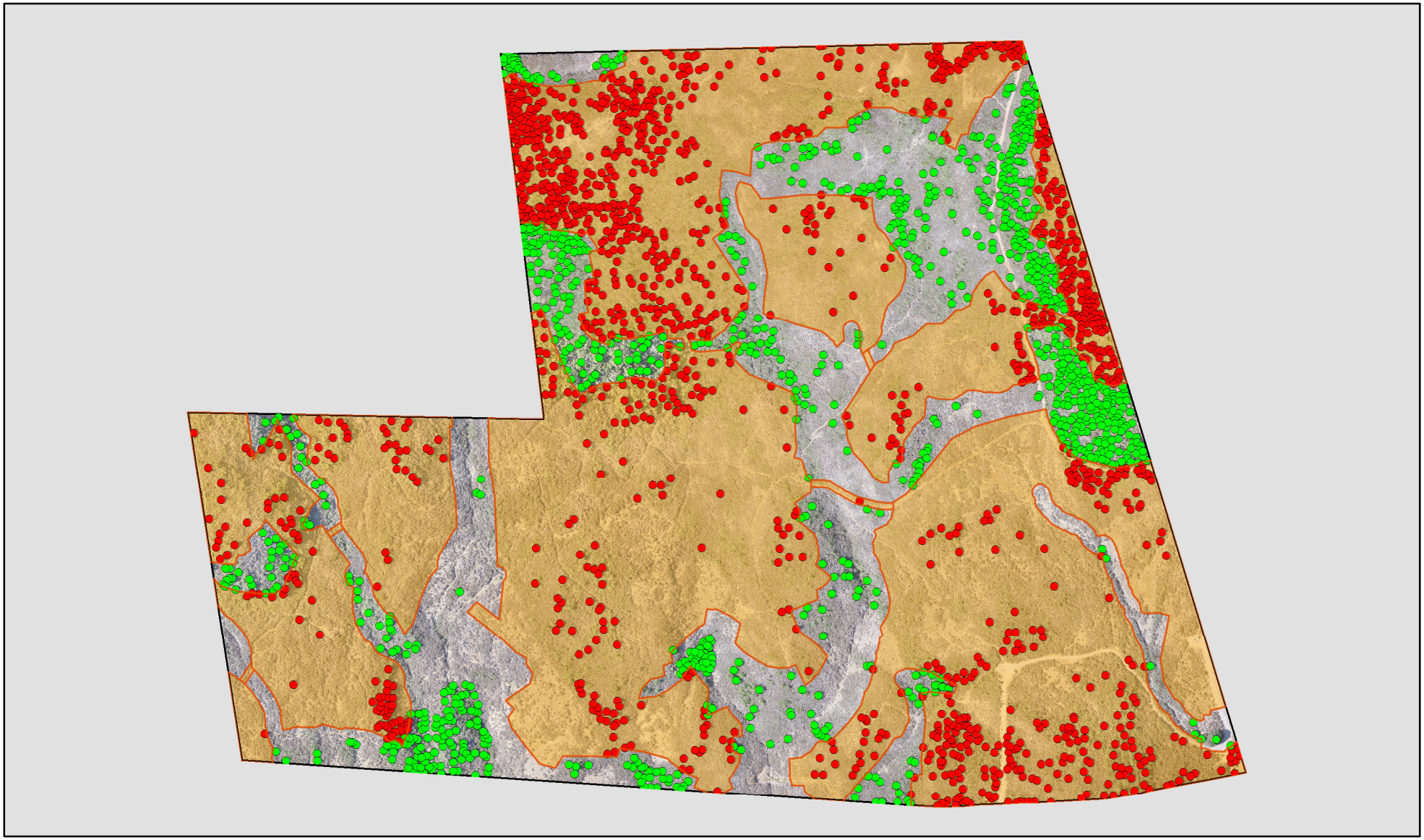
FEET

Stagecoach North

Estimated Tree Count

SOURCE: Use Upper and Lower Case Fonts (MM/YY)

I:\PPI1801\GIS\Maps\Tree Mapping\Figure 1 Tree Count.mxd (9/6/2018)



LSA

LEGEND

Project Site

Proposed Clearing Limits

Potential Location of Tree from Aerial Interpretation

Location within Clearing Limit

Location outside Clearing Limit

N

0 250 500

FEET

SOURCE: PPI Engineering (09/2018); LSA (08/2018).

I:\PPI1801\GIS\Maps\Tree Mapping Memo\Figure 2_Trees within Proposed Clearing Areas.mxd (10/8/2018)

FIGURE 2

Stagecoach North

Trees within Proposed Clearing Areas

BIOLOGICAL RESOURCES SURVEY

(2018 UPDATE)

STAGECOACH NORTH VINEYARD PROJECT

(APN 032-010-086-000)

NAPA COUNTY, CALIFORNIA



LSA

November 2018

BIOLOGICAL RESOURCES SURVEY

(2018 UPDATE)

STAGECOACH NORTH VINEYARD PROJECT

(APN 032-010-086-000)

NAPA COUNTY, CALIFORNIA

Submitted to:

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Project No. PPI1801

LSA

November 2018

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INTRODUCTION

This report presents the results of the LSA Associates, Inc. (LSA) Biological Resources Survey of the Stagecoach North Vineyard Project (Assessor's Parcel Number 032-010-086-000), hereafter referred to as the project. This report was prepared to address sensitive biological resources that could be impacted by proposed vineyard development on the project site, including sensitive biotic communities and/or waters of the United States, potential wildlife movement corridors, and special-status plant and animal species. This report was prepared according to Attachment B, Guidelines for Preparing Biological Resources Reconnaissance Surveys, and Attachment C, Guidelines for Preparing Special-status Plant Studies from the Napa County Planning, Building & Environmental Services Department (County).

This report is an update of a report originally completed in December 2016. The 2016 report provided an evaluation of the biological resources on the project site and the impacts to these resources from a proposed vineyard project; however, the proposed project was put on hold and the project site was later sold to a new owner. In 2018, the new owner decided to move forward with the proposed vineyard project, and this report provides an update of the 2016 report.

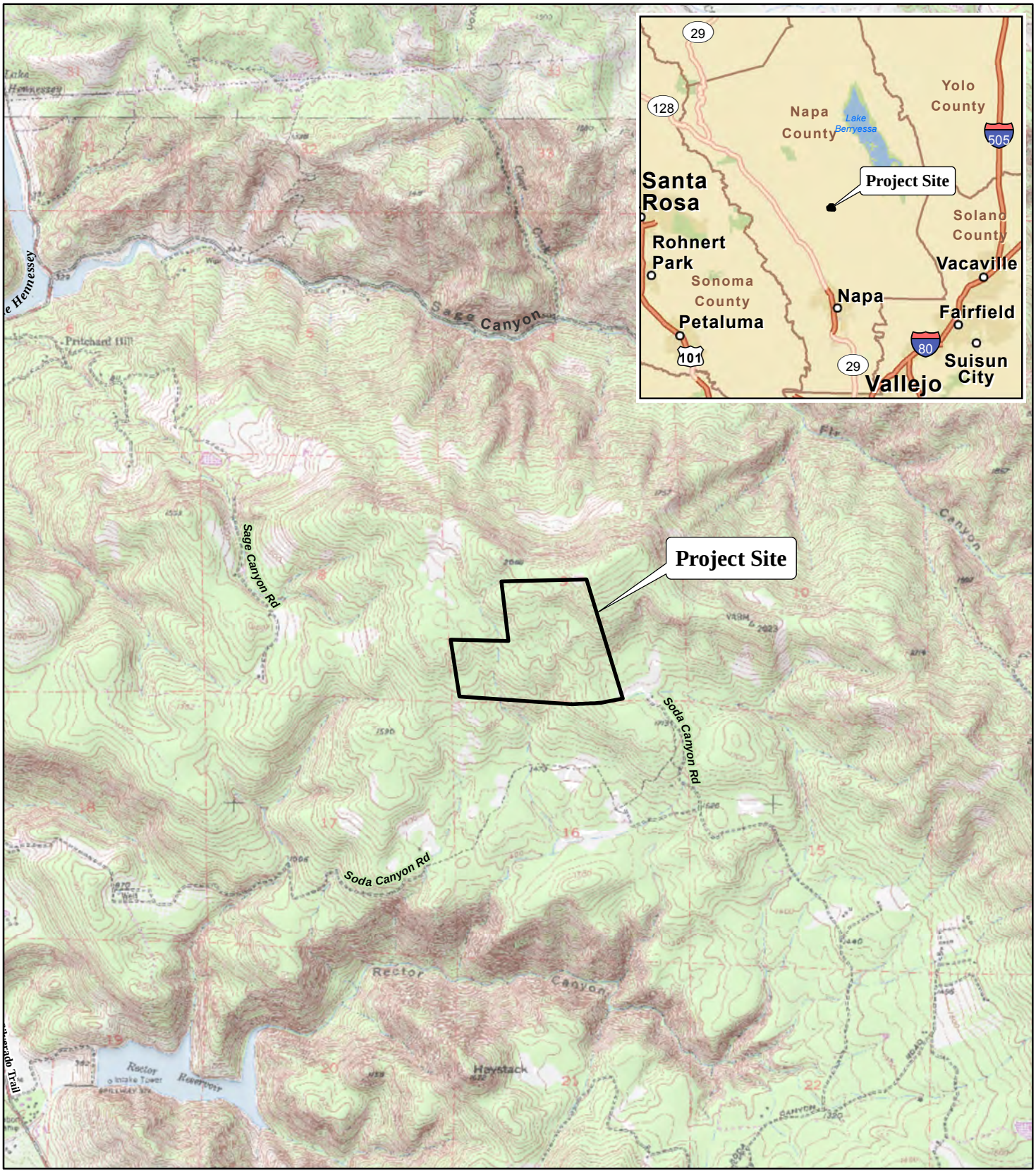
PROJECT LOCATION

The project site is located in the mountains flanking the eastern side of the Napa Valley approximately 5.3 miles northeast of Yountville, Napa County, California (Figure 1). The project site is situated within section 9 T.7.N, R.4.W, on the U.S. Geological Survey (USGS) 7.5-minute Yountville quadrangle and is within the Napa County Eastern Mountains Evaluation Area as identified on Map 4-1 in the Napa County Baseline Data Report (NCCDPD 2005). The project site is approximately 170.29 acres in size with elevations that vary from approximately 1,600 feet to 2,100 feet (487 meters to 640 meters) above mean sea level and is within the Rector Reservoir watershed. Access to the project site is via Soda Canyon Road off Silverado Trail.

SOILS AND GEOLOGY

The geology on the project site consists of extensive outcrops derived from basalt lava flows of the Pliocene Sonoma Volcanics (USGS 2007). The soils on the site are very shallow and rocky and include small rock outcrops as well as areas with exposed bedrock and scattered small rocks and boulders.

The soils are classified as Guenoc-Rock outcrop complex, 30 to 75 percent slopes (0.4 percent of project area); Hambright rock-outcrop complex, 30 to 75 percent slopes (30.7 percent of project area); Rock outcrop-Hambright complex, 50 to 75 percent slopes (68.5 percent of project area); and Sobrante loam, 5 to 30 percent slopes (0.4 percent of project area) (USDA 2015).



LSA

FIGURE 1

N

0 1500 3000

FEET

Stagecoach North
Napa County, California

Regional Location

SOURCE: USGS 7.5-minute Topo Quads - *Chiles Valley, Calif.* (1993) and *Yountville, Calif.* (1968).

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 1_Regional Location.mxd (10/25/2018)

METHODS

Prior to conducting fieldwork, LSA compiled a list of the special-status plant and animal species that could occur in the project area based on the following sources: an official United States Fish and Wildlife Service (USFWS) species list; records in the California Natural Diversity Database (CNDDB) (CDFW 2018) (Appendix A); the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (8th edition) (electronic version) (CNPS 2018); and the Napa County Baseline Data Report (NCCDPD 2005) (Appendix A). LSA's in-house knowledge of special-status plant and animal species occurrences and distribution in Napa County was also a source of information for this report. The CNDDB search for special-status animal species occurrences included an area within a 2-mile radius of the project site. The 2-mile search radius encompasses all habitats that were potentially present on the project site historically.

The list of special-status plants was developed by a search of these databases to include occurrences of special-status vascular plants, lichens, bryophytes, and fungi recorded for the Yountville, St. Helena, Chiles Valley, Capell Valley, Mount George, Lake Berryessa, Rutherford, Sonoma, and Napa USGS 7.5-minute quadrangles; however some species not known to occur in Napa County (CNPS 2018) were excluded.

LSA wildlife biologist Eric Lichtwardt and LSA botanist Tim Milliken conducted an initial reconnaissance-level biological survey on the project site on March 5, 2015; the survey included approximately 15 person-hours. Much of the project site supports impenetrable chaparral/California bay forest, but a number of trails had been recently cleared on the project site, including a complete trail around the project site perimeter. Most of the project site was thus accessible on foot over these recently cleared trails, including the entire perimeter of the project site. The perimeter trail allowed visual inspection of off-site areas within approximately 500 feet of the project site. Plants and vertebrate animals (wildlife) observed within and adjacent to the project area were recorded in field notes (species observed are listed in Appendix B). Binoculars (10x42) were used to aid in the identification of wildlife and to visually survey inaccessible habitat. Digital cameras were used to document vegetation cover and rare plants.

LSA botanists/biologists Tim Milliken, Bernhard Warzecha, and/or Chris DiVittorio conducted focused rare plant surveys on the following dates: March 5 and 6; April 6, 8, and 22; May 8 and 20; June 17; and August 8, 2015. During the rare plant surveys, the project site was systematically covered on foot over trails and in other accessible areas, and locations of rare plants were recorded with sub-meter accuracy global positioning system (GPS) units. California Native Species Field Survey Forms were filled out for all rare plant species observed on the project site.

Additionally, LSA biologist Bernhard Warzecha and LSA botanist Tim Milliken surveyed the entire project site and mapped occurrences of holly-leaved ceanothus (*Ceanothus purpureus*) and land cover types, including vegetation types based on the Manual of California Vegetation (MCV) map of the County (NCCDPD 2005), in conjunction with the more recent second edition of the MCV (Sawyer et al. 2009). These surveys were conducted on March 16, 18, 23, 24, 25, and 29, 2016; and on April 1, 4, and 5, 2016; nine total survey days. During these days, holly-leaved ceanothus was in bloom and readily identifiable.

In order to map holly-leaved ceanothus and vegetation types, the project site was subdivided into mapping units (polygons) based on topography, land cover categories, vegetation types, and densities of holly-leaved ceanothus. Polygons were delineated using recent, high-resolution aerial imagery (Google, April 2015), in combination with visual cues on the ground, including breaks in topography, changes in land cover, vegetation types, streams, trails, and different densities of holly-leaved ceanothus. A minimum mapping unit of 0.05 acres was initially targeted, and some vegetation polygons were mapped as small as 0.02 acres. This smaller mapping unit was helpful to capture the patchy character of the vegetation types, specifically small but dense clusters of holly-leaved ceanothus. The minimum mapping unit for rock outcrops is even smaller, starting at 138 square feet (0.003 acres). The average area of all mapped polygons is 0.35 acres.

After delineating the polygon in the field, each polygon was traversed and visually assessed from one or several vantage points above the shrub canopy cover. Vantage points were selected within the polygon and/or from one or several adjacent elevated vantage points, whichever method resulted in better visibility and results. To ensure that all areas were visible from at least one elevated point above the shrub canopy, each surveyor used a 6-foot stepladder and binoculars to visually assess vegetation and specifically holly-leaved ceanothus occurrences in each polygon. The ubiquitous presence of tall rock outcrops in combination with the use of the 6-foot ladders enabled surveyors to get a "bird's-eye" view of the surrounding vegetation.

The vegetation types for each polygon were mapped to alliance level by identifying the dominant and co-dominant species, following the membership rules as defined in the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009), in conjunction with the vegetation types based on the MCV map of the County (NCCDPD 2005). The mapped vegetation types are based on Sawyer et al. (2009) and correspond directly to the vegetation types used for the MCV map of the County (NCCDPD 2005, based on Thorne et al. 2004).

In order to survey dense woodland where closed canopy cover was above 10 feet, a slightly modified protocol was implemented. Dense woodlands taller than 10 feet with a closed canopy were surveyed from the perimeter and the woodlands were traversed using existing trails and gaps. Woodlands were spot checked for changes in vegetation community and the potential presence of holly-leaved ceanothus. Closed canopy woodlands are not suitable habitat for *Ceanothus* species for several reasons, including interspecific competition for light in combination with other factors, including allelopathy from California bay laurel (*Umbellularia californica*) litter. Additionally, Sawyer et al. (2009) are not considering *Ceanothus* species to be co-dominant within the *Umbellularia californica* Forest Alliance.

After determining the vegetation type, the number of detectable holly-leaved ceanothus individuals was determined and recorded for each polygon. Areas with high densities of holly-leaved ceanothus (clusters) were mapped as separate polygons.

Two maps depicting the results were generated from the collected field data using geographic information system (GIS) software. The vegetation types, land cover types, and potential waters of the United States map for the project site grouped polygons based on the identified land cover and vegetation types using color-coding. For the holly-leaved ceanothus densities map, the holly-leaved ceanothus density was calculated for each polygon by dividing the holly-leaved ceanothus count of

each polygon by the area of each polygon. Densities, as individual observation counts per acre, were then placed into the following density categories: (1) No observations; (2) >0 to 25 observations per acre; (3) >25 to 50 observations per acre; (4) >50 to 75 observations per acre; (5) >75 to 100 observations per acre; and (6) >100 to 255 observations per acre.

To estimate numbers of two-carpellate western flax and green monardella, LSA surveyed potential habitat on site to locate and quantify populations of the target species. Potential habitat included naturally occurring openings in the chamise/grassland matrix as well as old and newly constructed trails. A population estimate was derived from the average density of observed stands using the following protocol: for each of the target species, LSA determined the area of occupied habitat by multiplying linear feet by the average swath width of one foot. Then, the observed minimum and maximum density of individuals for each target species was determined. The final population estimate was then calculated by multiplying the area of occupied habitat with the calculated average density.

Mr. Warzecha mapped potential waters of the United States on the project site on the following dates: April 6 and 8, 2015.

The scientific and vernacular nomenclature used for the plant and animal species in this report are from the following standard sources: plants, Baldwin et al. (2012) and updates through September 2018 listed on the Jepson Herbarium eflora website (http://ucjeps.berkeley.edu/eflora/); amphibians and reptiles, AmphibiaWeb (2018) and Crother (2017); birds, American Ornithologists' Union (1998) and supplements; and mammals, Bradley et al. (2014). To the extent feasible, vegetation cover within the project site was identified according to Sawyer et al. (2009).

Field Surveys for 2018 Report Update

As part of the work to update the biological resources survey, LSA biologist Eric Lichtwardt conducted wildlife surveys on the project site on March 25 and June 5, 2018, and LSA botanist Tim Milliken conducted protocol rare plant surveys on March 28 and 29, April 18 and 19, May 17, and June 5, 2018.

REGULATORY CONTEXT

This section provides a summary of federal and State laws, and/or local regulations that apply to the biological resources that occur on the project site.

APPLICABLE FEDERAL LAWS AND REGULATIONS

Endangered Species Act (ESA)

The USFWS has jurisdiction over species that are listed as threatened or endangered under the federal ESA. The ESA protects listed wildlife species from harm or "take." The term "take" is broadly defined as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct." An activity is defined as a "take" even if it is unintentional or accidental. An endangered plant or wildlife species is one that is considered in danger of becoming extinct throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered within the foreseeable future. In addition to endangered and threatened species, which are legally protected under the federal ESA, the USFWS has a list of proposed and candidate species. Proposed species are those for which a proposed rule to list them as endangered or threatened has been published in the Federal Record. A candidate species is one for which the USFWS currently has enough information to support a proposal to list it as a threatened or endangered species. These latter species are not afforded legal protection under the federal ESA. Nonetheless, project-related impacts to federally listed, proposed, and candidate species or their habitats are considered "significant" under California Environmental Quality Act Guidelines (discussed below).

Critical habitat is defined under the ESA as specific geographic areas within a listed species range that contain features considered essential for the conservation of the listed species. Designated critical habitat for a given species may not necessarily be currently occupied by that species if it is within the historical range of the species and supports habitat deemed by the USFWS to be important for the recovery of the species. Critical habitat designation applies only to federal actions or actions funded or permitted by federal agencies. If a federal action or an action allowed by federal funding or a federal permit has the potential to adversely affect critical habitat for a listed species, the responsible federal agency is required to consult with the USFWS or National Marine Fisheries Service (NMFS).

Clean Water Act

The U.S. Army Corps of Engineers (Corps) is responsible under Section 404 of the Clean Water Act to regulate the discharge of fill material into waters of the United States. Waters of the United States and their lateral limits are defined in 33 Code of Federal Regulations (CFR) Part 328.3(a) and include streams that are tributaries to navigable waters and their adjacent wetlands. The lateral limits of jurisdiction for a non-tidal stream are measured at the line of the Ordinary High Water Mark (OHWM) (33 CFR Part 328.3(e)) or the limit of adjacent wetlands (33 CFR Part 328.3(b)). Any permanent extension of the limits of an existing water of the United States, whether natural or manmade, results in a similar extension of Corps jurisdiction (33 CFR Part 328.5).

Waters of the United States fall into two broad categories, wetlands and other waters. Wetlands include marshes, wet meadows, seep areas, floodplains, basins, and other areas experiencing extended seasonal soil saturation. Seasonally or intermittently inundated features, such as seasonal pools, ephemeral streams, and tidal marshes, are categorized as wetlands if they have hydric soils and support wetland plant communities. For wetlands to be under the jurisdiction of the Clean Water Act they must have hydrophytic vegetation, hydric soils, and wetland hydrology.

Seasonally inundated water bodies or watercourses that do not exhibit wetland characteristics are classified as other waters of the United States. Other waters include unvegetated water bodies and watercourses such as rivers, streams, lakes, springs, ponds, coastal waters, and estuaries.

Waters and wetlands that cannot trace a continuous hydrological connection to a navigable water of the United States are not tributary to waters of the United States. These are termed "isolated waters or wetlands." Isolated wetlands or other waters are jurisdictional when their destruction or degradation can affect interstate or foreign commerce (33 CFR Part 328.3(a)). The Corps may or may not take jurisdiction over isolated wetlands depending on the circumstances.

In general, a Corps permit must be obtained before placing fill or grading in jurisdictional wetlands or other waters of the United States. The Corps will be required to consult with the USFWS and/or NMFS under Section 7 of the ESA if the action subject to Clean Water Act permitting could result in take of federally listed species.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (16 United States Code 703) prohibits the taking, hunting, killing, selling, purchasing, etc. of migratory birds, parts of migratory birds, or their eggs and nests. In addition, it contains a clause that prohibits baiting or poisoning of these birds. As used in this act, the term "take" is defined as meaning, "to pursue, hunt, shoot, capture, collect, kill, or attempt to pursue, hunt, shoot, capture, collect, or kill, unless the context otherwise requires." Most of the native bird species that occur in the region of the project site are covered by this act.

APPLICABLE STATE AND LOCAL LAWS AND REGULATIONS

California Endangered Species Act

The California Department of Fish and Wildlife (CDFW) has jurisdiction over State-listed threatened, rare (plants only), and endangered plant and animal species under the California Endangered Species Act. In addition, its provisions protect species proposed for listing under the State Act.

California Fully Protected and Protected Species

California fully protected and protected species may not be taken or possessed without a permit from the Fish and Game Commission and/or the CDFW. These permits do not allow "incidental take" and are more restrictive than the take allowed under Section 2081 for the California Endangered Species Act. Information on fully protected species can be found in the Fish and Game Code (birds at Section 3511, mammals at Section 4700, reptiles and amphibians at Section 5050, and fish at Section 5515). Information on protected (as opposed to fully protected) amphibians can be found in Chapter 5, Section 41; and protected (as opposed to fully protected) reptiles at Chapter 5, Section 42.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) applies to "projects" that are proposed to be undertaken or those requiring approval by State or local government agencies. Projects are defined as actions that have the potential to have physical impact on the environment. Under Section 15380 of CEQA, a species not included on any formal list "shall nevertheless be considered rare or endangered if the species can be shown by a local agency to meet the criteria" for listing. With sufficient documentation, a species could be shown to meet the definition of rare or endangered under CEQA and be considered a "de facto" endangered species. The CDFW maintains a list of species of special concern, defined as species that appear to be vulnerable to extinction because of declining populations, limited ranges, and/or continuing threats. Species of special concern are not afforded legal protection under the California Endangered Species Act, but impacts to these species are typically considered significant under CEQA.

Section 401 Water Quality Certification

Pursuant to Section 401 of the federal Clean Water Act, projects that require a permit from the Corps under Section 404 must also obtain Water Quality Certification from the California Regional Water Quality Control Board (RWQCB). This regulatory program is administered by one of nine Regional Boards depending on project location. The RWQCB has adopted a policy requiring mitigation for any unavoidable loss of wetland, streambed, or other State jurisdictional waters.

If a project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to Waters of the State, the RWQCB has the option to regulate the dredge and fill activities under its state authority in the form of Waste Discharge Requirements (WDR). The San Francisco Bay RWQCB, which has jurisdiction over projects in the Napa River watershed, recently adopted the General Permit for Vineyard Properties in the Napa River and Sonoma Creek Watersheds to comply with the WDRs for sediment and nutrient discharge from vineyards.

California Fish and Game Code

Sections 3503, 3503.5, and 3513. The California Fish and Game Code (cited sections) protect the nests and eggs of most birds, including raptors (Falconiformes and Strigiformes) and the bird species protected under the Migratory Bird Treaty Act.

Section 1600. The CDFW also administers the issuance of Streambed Alteration Agreements under Fish and Game Code Section 1600. Lake and Streambed Alteration Agreements are required when project activities would substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated as such by the CDFW.

California Department of Fish and Wildlife

The CDFW also maintains lists of "species of special concern." These species are broadly defined as plants and animals that are of concern to the CDFW because of population declines and restricted distributions, and/or they are associated with habitats that are declining in California. The California Native Plant Society, in conjunction with the CDFW, maintains lists of special-status plants for California. Lists of special animals are maintained by the CDFW (CDFW 2015) and are defined by the

CDFW as "a species, subspecies, or distinct population of an animal native to California that meet one or more of the following (not necessarily mutually exclusive) criteria:

- *Is extirpated from the State or, in the case of birds, its primary seasonal or breeding role;*
- *Is listed as Federally-,but not State-, threatened or endangered; meets the State definition of threatened or endangered but has not formerly been listed;*
- *Is experiencing, or formerly experienced, serious (noncyclical) population declines or range retractions (not reversed) that, if continued or resumed, could qualify it as State threatened or endangered status;* and
- *Has naturally small population exhibiting high susceptibility to risk from any factor(s) that, if realized, could lead to declines that would qualify it for State threatened or endangered status. (Comrack et al. 2008*)

The species of special concern category is a CDFW administrative designation; it does not carry any legal status. However, project-related impacts to species of special concern are considered "significant" under CEQA Guidelines, and projects with unavoidable significant impacts to special concern species must provide mitigation.

Napa County

Napa County General Plan (2008)

The Napa County General Plan contains the following policies relevant to the biological issues on the project site:

General Plan Policy CON-2: Maintain or enhance the existing level of biodiversity, encouraging its enhancement where appropriate.

General Plan Policy CON-3: Protect the continued presence of state and federally protected rare, threatened and endangered species and their habitat.

General Plan Policy CON-4: Conserve, protect, and improve plant, wildlife, and fishery habitat for all native species.

General Plan Policy CON-5: Protect connectivity and continuous habitat areas for wildlife movement.

General Plan Policy CON-13: Residential, commercial, industrial and recreational projects, wineries and new vineyards, and water development projects shall avoid impacts to fisheries and wildlife habitat to the maximum extent feasible. Where impacts cannot be avoided, projects shall include effective management plans.

This policy goes on to specify several provisions to conserve wildlife habitat including supplemental planting, habitat replacement, habitat enhancement, and developer responsibility for mitigation planning and implementation under agency oversight.

General Plan Policy CON-14: To offset possible losses of fishery and wildlife habitat due to discretionary development projects, developers shall be responsible for mitigation when avoidance of impacts is determined to be infeasible. Such mitigation measures may include providing and permanently maintaining similar quality and quantity habitat within Napa County, enhancing existing habitat areas, or paying in-kind funds to an approved wildlife habitat improvement and acquisition fund. Replacement habitat may occur either on-site or at approved off-site locations, but preference shall be given to on-site replacement.

General Plan Policy CON-16: The County shall require a biological resources evaluation for discretionary projects in areas identified to contain or potentially contain special-status species based upon data provided in the Baseline Data Report (BDR), California Natural Diversity Database (CNDDB), or other technical materials. This evaluation shall be conducted prior to the approval of any earthmoving activities. The County shall also encourage the development of programs to protect special-status species and disseminate updated information to state and federal resource agencies.

General Plan Policy CON-17: Preserve and protect native grasslands, serpentine grasslands, mixed serpentine chaparral, and other sensitive biotic communities and habitats of limited distribution. The County, in its discretion, shall require mitigation that results in the following standards:

a) Prevent removal or disturbance of sensitive natural plant communities that contain special-status plant species or provide critical habitat to special-status animal species.

b) In other areas, avoid disturbances to or removal of sensitive natural plant communities and mitigate potentially significant impacts where avoidance is infeasible.

c) Promote protection from overgrazing and other destructive activities.

d) Encourage scientific study and require monitoring and active management where biotic communities and habitats of limited distribution or sensitive natural plant communities are threatened by the spread of invasive non-native species.

e) Require no net loss of sensitive biotic communities and habitats of limited distribution through avoidance, restoration, or replacement where feasible. Where avoidance, restoration, or replacement is not feasible, preserve like habitat at a 2:1 ratio or greater within Napa County to avoid significant cumulative loss of valuable habitats.

General Plan Policy CON-18: To reduce impacts on habitat conservation and connectivity:

a) In sensitive domestic water supply drainages where new development is required to retain between 40 and 60 percent of the existing vegetation on-site, the vegetation selected for retention should be in areas designed to maximize habitat value and connectivity.

b) Outside of sensitive domestic water supply drainages, streamlined permitting procedures should be instituted for new vineyard projects that voluntarily retain valuable habitat and connectivity, including generous setbacks from streams and buffers around ecologically sensitive areas.

c) Preservation of habitat and connectivity of adequate size, quality, and configuration to support special-status species should be required within the project site. The size of habitat and connectivity to be preserved shall be determined based on the specific needs of the species.

d) The County shall require discretionary projects to retain movement corridors of adequate size and habitat quality to allow for continued wildlife use based on the needs of the species occupying the habitat.

e) The County shall require new vineyard development to be designed to minimize the reduction of wildlife movement to the maximum extent feasible. The County shall require the removal or reconfiguration of existing wildlife exclusion fencing to reduce existing significant impacts to wildlife movement, particularly in riparian areas, where a nexus exists between the proposed project and the existing fencing.

f) The County shall disseminate information about impacts that fencing has on wildlife movement in wild land areas of the County and encourage property owners to use permeable fencing.

g) The County shall develop a program to improve and continually update its database of biological information, including identifying threats to wildlife habitat and barriers to wildlife movement.

h) Support public acquisition, conservation easements, in-lieu fees where on-site mitigation is infeasible, and/or other measures to ensure long-term protection of wildlife movement areas.

General Plan Policy CON-19: The County shall encourage the preservation of critical habitat areas and habitat connectivity through the use of conservation easements or other methods as well as through continued implementation of the Napa County Conservation Regulations associated with vegetation retention and setbacks from waterways.

General Plan Policy CON-24: Maintain and improve oak woodland habitat to provide for slope stabilization, soil protection, species diversity, and wildlife habitat through the following measures:

a) Preserve, to the maximum extent feasible, oak trees and other significant vegetation that occur near the heads of drainages or depressions to maintain diversity of vegetation type and wildlife habitat as part of agricultural projects.

b) Comply with the Oak Woodlands Preservation Act (PRC Section 21083.4) regarding oak woodland preservation to conserve the integrity and diversity of oak woodlands, and retain, to the maximum extent feasible, existing oak woodland and chaparral communities and other significant vegetation as part of residential, commercial, and industrial approvals.

c) Provide replacement or preservation of lost oak woodland and native vegetation at a 2:1 ratio when retention of existing vegetation is found to be infeasible. Removal of oak species limited in distribution shall be avoided to the maximum extent feasible.

d) Support hardwood cutting criteria that require retention of adequate stands of oak trees sufficient for wildlife, slope stabilization, soil protection, and soil production be left standing.

e) Maintain, to the maximum extent feasible, a mixture of oak species which is needed to ensure acorn production. Black, canyon, live, and brewer oaks as well as blue, white, scrub, and live oaks are common associations.

f) Encourage and support the County Agricultural Commission's enforcement of state and federal regulations concerning Sudden Oak Death and similar future threats to woodlands.

General Plan Policy CON-26: Consistent with longstanding practice in Napa County, natural vegetation retention areas along perennial and intermittent streams shall vary in width with steepness of the terrain, the nature of the undercover, and type of soil. The design and management of natural vegetation areas shall consider habitat and water quality needs, including the needs of native fish and wildlife and flood protection where appropriate. Site-specific setbacks shall be established in coordination with Regional Water Quality Control Boards, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration National Marine Fisheries Service, and other coordinating resource agencies that identify essential stream and stream reaches necessary for the health of populations of native fisheries and other sensitive aquatic organisms within the County's watersheds.

Where avoidance of impacts to riparian habitat is infeasible along stream reaches, appropriate measures will be undertaken to ensure that protection, restoration, and enhancement activities will occur within these identified stream reaches that support or could support native fisheries and other sensitive aquatic organisms to ensure a no net loss of aquatic habitat functions and values within the County's watersheds.

General Plan Policy CON-27: The County shall enforce compliance and continued implementation of the intermittent and perennial stream setback requirements set forth in existing stream setback regulations, provide education and information regarding the importance of stream setbacks and the active management and enhancement/restoration of native vegetation within setbacks, and develop incentives to encourage greater stream setbacks where appropriate.

Incentives shall include streamlined permitting for vineyard proposals on slopes between 5 and 30 percent and flexibility regarding yard and road setbacks for other proposals.

General Plan Policy CON-28: To offset possible additional losses of riparian woodland due to discretionary development projects and conversions, developers shall provide and maintain similar quality and quantity of replacement habitat or in-kind funds to an approved wildlife habitat improvement and acquisition fund in Napa County. While on-site replacement, wherever possible, is preferred, replacement habitat may be either on-site or off-site as approved by the County.

General Plan Policy CON-30: All public and private projects shall be required to avoid impacts to wetlands to the maximum extent feasible. If avoidance is not feasible, projects shall achieve no net loss of wetlands, consistent with State and federal regulations.

Napa County Code

The Napa County Municipal Code contains an ordinance relevant to the biological resources of the project site.

Conservation Regulations (County Code Chapter 18.108): Napa County Conservation Regulations (County Code Chapter 18.108) address protection of the County's streams and waterways. It requires setbacks from streams (width depends on slope) from development and may require revegetation within the setbacks on a case-by-case basis. The project is in compliance with this ordinance because all stream setbacks have been maintained by project design, and habitat restoration and installation of stream crossings are permitted uses within stream setbacks.

California Native Plant Society

The California Native Plant Society in conjunction with the CDFW has developed a rare plant ranking system for special-status plants. Special-status plants in California are assigned to one of five "California Rare Plant Ranks" (CRPR) by a collaborative group of over 300 botanists in government, academia, non-governmental organizations, and the private sector. The five CRPR are:

- Rare Plant Rank 1A – presumed extinct in California.
- Rare Plant Rank 1B – rare, threatened, or endangered in California and elsewhere.
- Rare Plant Rank 2 – rare, threatened, or endangered in California but more common elsewhere.
- Rare Plant Rank 3 – a review list of plants about which more information is needed.
- Rare Plant Rank 4 – a watch list of plants of limited distribution.

All of the plant species listed as CRPR 1A, 1B, and 2 meet the requirements of Section 1901, Chapter 10 (Native Plant Protection Act) or Sections 2062 and 2067 (California Endangered Species Act) of the California Fish and Game Code, and are eligible for State listing. Therefore, plants appearing on Lists 1A, 1B, or 2 are considered to meet CEQA's Section 15380 criteria and effects to these species are considered "significant" in this report.

CRPR 1 and 2 species are generally considered under CEQA because they meet CEQA's definition of "rare or endangered." Impacts to List 3 and 4 species are generally not considered significant under CEQA unless local jurisdictions (e.g., Napa County) request that they be addressed or specific information on their status and/or distribution supports their consideration for a given project.

RESULTS AND ANALYSIS

BIOLOGICAL SETTING

Plants and Animals

The observed vascular plant flora on the project site includes 191 species composed of 152 native (80 percent) and 39 alien (i.e., non-native; introduced purposely or accidentally into an area) (20 percent) species (Appendix B).

The observed wildlife (vertebrate fauna) on the project site includes one species of amphibian, three species of reptiles, 29 species of birds, and six species of mammals (Appendix B). There are undoubtedly a number of other species of vertebrates (particularly amphibians, reptiles, migratory birds, and small mammals) that occur on the project site that were not observed during the surveys due to their secretive behavior, natural low population densities, infrequent or transient occurrence on the property, seasonal occurrence in the region, or other factors.

Vegetation and Other Cover Types

This section describes the vegetation and other land cover types (habitats) including the natural communities observed on the project site. These descriptions are based upon the classification system in the second edition of *A Manual of California Vegetation* (Sawyer et al. 2009) and cross-referenced with Thorne et al. (2004) for Napa County (Table A). Vegetation on the project site consists of a mosaic of vegetation types and/or land covers that are typical of the adjacent landscape along the south-facing slopes of the ridge north of Rector Canyon and south of Sage Canyon. The vegetation types and other land cover types on the project site include chamise chaparral, grassland, California black oak forest, California bay forest, intermixed scrub oak communities (including canyon live oak, leather oak, interior live oak, and scrub oak), and rock outcrops (Figure 2). A network of cleared trails (including a perimeter trail) and several dirt roads are the only human modified areas on the project site (Figure 2); these areas are approximately 1.52 acres in size.

Table A: Vegetation Crosswalk

Vegetation Types Observed on the Project Site (Figure 2)	Associated NCBDR/Napa County MCV Vegetation Types (Thorne et al. 2004)	Associated Vegetation Types (Sawyer et al. 2009)
Adenostoma fasciculatum Shrubland Alliance	Chamise Alliance (*Adenostoma fasciculatum*)	*Adenostoma fasciculatum* Shrubland Alliance
Eastwood Manzanita Chaparral (*Arctostaphylos glandulosa* Alliance and *Arctostaphylos manzanita* Provisional Shrubland Alliance	Eastwood manzanita series (*Arctostaphylos glandulosa* Alliance not treated)	*Arctostaphylos glandulosa* Shrubland Alliance and *Arctostaphylos manzanita* Provisional Shrubland Alliance
California Annual Grasslands Alliance	California Annual Grasslands Alliance	Not treated at this classification level
Quercus kelloggii Forest Alliance	Black Oak Alliance (*Quercus kelloggii*)	*Quercus kelloggii* Forest Alliance
Quercus chrysolepis (shrub) Shrubland Alliance, *Quercus berberidifolia* Shrubland Alliance and *Quercus durata* Shrubland Alliance, *Quercus wislizeni* (shrub) Shrubland Alliance (sclerophyllous *Quercus* spp. Shrubland Alliance)	Canyon Live Oak Alliance (*Quercus chrysolepis*) and Scrub Interior Live Oak–Scrub Oak–(California Bay–California Ash–Birch Leaf Mountain Mahogany–Toyon–California Buckeye) Mesic East County NFD Super Alliance (*Quercus wislizenii* var. *frutenscens–Quercus berberidifolia–(Umbellularia californica–Fraxinus dipetala–Cercocarpus betuloides–Heteromeles arbutifolia–Aesculus californica*)	*Quercus chrysolepis* (shrub) Shrubland Alliance, *Quercus berberidifolia* Shrubland Alliance, *Quercus durata* Shrubland Alliance and *Quercus wislizeni* (shrub) Shrubland Alliance
Umbellularia californica Forest Alliance	California Bay–Madrone–Coast Live Oak–(Black Oak–Big Leaf Maple) NFD Super Alliance (*Umbellularia californica–Arbutus menziesii–Quercus agrifolia*) (*Quercus kelloggii–Acer macrophyllum*)	*Umbellularia californica* Forest Alliance

LSA

LEGEND

Property Boundary

Potential Waters of the United States

Land Cover Types

Umbellularia californica Forest Alliance	50.24 ac
Quercus kelloggii Forest Alliance	0.77 ac
Adenostoma fasciculatum Shrubland Alliance	71.59 ac
Sclerophyllous Quercus spp. Alliance	29.86 ac
California Annual Grassland Alliance	8.82 ac
Arctostaphylos glandulosa and *A. manzanita* Provisional Shrubland Alliance	5.73 ac
Rock Outcropping	1.60 ac
Roads and Graded Areas	1.52 ac

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SOURCE: USDA NAIP (2014).

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 2_Land Cover Types and Potential Waters of the US.mxd (10/26/2018)

FIGURE 2

Stagecoach North
Napa County, California

Land Cover Types and
Potential Waters of the United States

Chamise Chaparral (*Adenostoma fasciculatum* Shrubland Alliance)

Chamise (*Adenostoma fasciculatum*) is a widely distributed shrub in chaparral communities in California and is the dominant species throughout much of the project site (Figure 2). Chamise chaparral and smaller areas of grassland form a mosaic on the project site and because of the complex intermingling of chaparral and grassland these vegetation types were not mapped separately. The chamise chaparral/grassland mosaic covers approximately 71.59 acres of the project site. Co-dominant shrubs with chamise include common manzanita (*Arctostaphylos manzanita* subsp. *manzanita*), wavyleaf ceanothus (*Ceanothus foliosus* var. *foliosus*), holly-leaved ceanothus (*C. purpureus*), blue buckbrush (*C. cuneatus* var. *cuneatus*), chaparral clematis (*Clematis lasiantha*), yerba santa (*Eriodictyon californicum*), hoary coffee berry (*Frangula californica* subsp. *tomentella*), Fremont's silk-tassel (*Garrya fremontii*), toyon (*Heteromeles arbutifolia*), chaparral honeysuckle (*Lonicera interrupta*), bush monkey flower (*Mimulus aurantiacus*), chaparral pea (*Pickeringia montana* var. *montana*), scrub oak (*Quercus berberidifolia*), and poison oak (*Toxicodendron diversilobum*).

Holly-leaved ceanothus is of special interest because it is a rare plant; however, it is a common co-dominant shrub on the project site mostly throughout chamise chaparral. Holly-leaved ceanothus also occurs within areas that are dominated by a mix of oak species in their shrub form, mainly the shrub form of canyon live oak (*Quercus chrysolepis*).

Openings within the chaparral vary between rocky ground with little plant cover to a diverse groundcover comprised of annual and perennial herbs, grasses, and bulbs that include narrow leaved onion (*Allium amplectens*), soap root (*Chlorogalum pomeridianum*), two-carpellate western flax (*Hesperolinon bicarpellatum*), variable linanthus (*Leptosiphon parviflorus*), green monardella (*Monardella viridis*), Hartweg's doll lily (*Odontostomum hartwegii*), bird's-foot fern (*Pellaea mucronata* var. *mucronata*), bunchleaf penstemon (*Penstemon heterophyllus*), California milkwort (*Polygala californica*), and Sonoma sage (*Salvia sonomensis*).

In places, the chaparral intergrades and shares species with adjacent woodlands and grasslands. These vegetation types are discussed in the sections below. As well as being components of the adjacent woodland, California bay (*Umbellularia californica*), Pacific madrone (*Arbutus menziesii*), coast live oak (*Quercus agrifolia*), and interior live oak (*Q. wislizeni*) are present as trees scattered throughout the chamise chaparral.

Chamise chaparral is a fire-adapted vegetation alliance with a fire cycle typically under 100 years, but shrubs can persist for much longer in fire free periods (Sawyer et al. 2009). Many of the annual plants in chamise chaparral occur in openings caused by fire or other habitat disturbance; most of the annual species observed on the project site were along old trails cleared through the chaparral.

Wildlife associated with chamise chaparral includes a diversity of reptiles, birds, and mammals that favor dry shrub dominated habitats; examples observed on the project site include western fence lizard (*Sceloporus occidentalis*), striped racer (*Coluber lateralis*), California quail (*Callipepla californica*), western scrub-jay (*Aphelocoma californica*), Bewick's wren (*Thryomanes bewickii*), wrentit (*Chamaea fasciata*), California thrasher (*Toxostoma redivivum*), and spotted towhee (*Pipilo maculatus*). Various species of small mammals occur in this habitat as well, but are generally more

difficult to observe than diurnal reptiles and birds; species identified by the presence of their sign (scat, nests, burrows, etc.) include common gray fox (*Urocyon cinereoargenteus*), dusky-footed woodrat (*Neotoma fuscipes*), and Botta's pocket gopher (*Thomomys bottae*). Various species of bats likely forage over the chaparral, but suitable habitats for bat maternity or winter roosts (old buildings, large hollow trees, caves, abandoned mines, etc.) are not present on the project site.

Eastwood Manzanita Chaparral (*Arctostaphylos glandulosa* Scrubland Alliance) and *Arctostaphylos manazanita* Provisional Shrubland Alliance

These two vegetation alliances are dominated by Eastwood manzanita and common manzanita. On the project site, this vegetation type varies from relatively pure stands to stands where chamise and scrub oaks are co-dominants. Wildlife using this vegetation type is similar to that using chamise chaparral. This vegetation type covers approximately 5.73 acres on the project site (Figure 2).

Grassland

Grasslands form a complex mosaic in the chamise chaparral and occur in patches of variable size. Approximately 8.82 acres of grassland (with scattered rock outcrops) cover the project site (Figure 2). These patches are not uniformly contiguous, as they are routinely interrupted by stands of chamise chaparral and contain scattered rocks of volcanic origin. The plant species composition of the site's grasslands is often shared as understory components to chaparral and woodland, suggesting that grasslands are an early stage in the recovery of the chaparral following a fire. Grasslands on the project site are mostly dominated by a sparse cover of annual alien species including common wild oats (*Avena fatua*), soft chess (*Bromus hordeaceus*), foxtail chess (*Bromus madritensis*), and bristly dogtail grass (*Cynosurus echinatus*); native grasses also occur, but less frequently than alien species. Native grasses present on the project site include blue wild rye (*Elymus glaucus*), California fescue (*Festuca californica*), June grass (*Koeleria macrantha*), melic grass (*Melica torryeana*), and foothill needlegrass (*Stipa lepida*), but these native species are not dominant to the extent that the grasslands on the site would be considered specific native stands as identified in Sawyer et al. (2009).

Native spring wildflowers also commonly occur in the grasslands. These plants include narrow leaved onion, harvest brodiaea (*Brodiaea elegans*), golden globe lily (*Calochortus amabilis*), rosinweed (*Calycadenia truncata*), soap root, purple clarkia (*Clarkia purpurea*), blue dicks (*Dichelostemma capitatum*), two-carpellate western flax, variable linanthus, wooly fruited lomatium (*Lomatium dasycarpum*), slender cottonweed (*Micropus californicus*), Hartweg's doll lily, foothill plantain (*Plantago erecta*), and California milkwort. The on-site grassland is too patchy and small in total area to attract wildlife species typical of grasslands that are more extensive; however, chaparral species such as California quail and spotted towhee often forage on the ground in grassland along chaparral edges.

California Black Oak Forest (*Quercus kelloggii* Forest Alliance)

Three small stands (total 0.78 acres) of this forest type are present in the northeast and northwest corner of the project site (Figure 2). California black oaks are the tallest trees on the project site. This forest type is more common off the project site to the north where the terrain levels off before descending steeply down the north-facing slope of Sage Canyon. Plant species found in California

black oak woodland on the project site include Pacific hound's tongue (*Cynoglossum grande*), Douglas iris (*Iris douglasiana*), white nemophila (*Nemophila heterophylla*), knobcone pine (*Pinus attenuata*), rusty haired popcorn flower (*Plagiobothrys nothofulvus*), pale starwort (*Stellaria pallida*), and fringe pod (*Thysanocarpus curvipes*). Many of the chaparral and grassland species on the project site also occur within openings in the California black oak woodland.

Wildlife observed in this forest alliance on the project site includes acorn woodpecker (*Melanerpes formicivorus*) and oak titmouse (*Baeolophus inornatus*). A western skink (*Plestiodon skiltonianus*) was also observed under a fallen oak limb in the California black oak forest. Many wildlife species typical of chaparral habitats such as California scrub-jay, common gray fox, dusky-footed woodrat, and Botta's pocket gopher also occur in California black oak woodland.

California Bay Forest (*Umbellularia californica* Forest Alliance)

California bay is the dominant tree in this vegetation alliance and covers approximately 50.24 acres on the project site (Figure 2). California bay woodland can include a variety of other tree species in the canopy layer and on the project site, coast live oak and interior live oak co-occur as canopy species. The dense California bay forest on the project site is almost as impenetrable as the chamise chaparral. Shrubs found within this land cover type include common manzanita, Fremont's silk-tassel, and toyon. The herbaceous understory of California bay forest is typically sparse, yet there is an abundant non-vascular flora (lichens and bryophytes).

The California bay forest on the project site is composed of relatively small shrubby trees (10 to 15 feet high). Shrubby stands such as these are typical of the inner North Coast Ranges (Sawyer et al. 2009); the shrubby stature of the on-site stands is likely the result of fire (the property is thought to have burned in the 1981 Atlas Peak Fire). California bay also occurs on the project site as isolated trees in chamise chaparral; only extensive relatively closed canopy stands of this vegetation are mapped on Figure 2. California bay forest is considered a sensitive natural community by the CDFW (NCCDPD 2005; Sawyer et al. 2009). Wildlife associated with this vegetation type is similar to that in chamise chaparral and oaks.

Quercus chrysolepis (shrub) Shrubland Alliance, *Quercus berberidifolia* Shrubland Alliance, *Quercus durata* Shrubland Alliance and *Quercus wislizeni* (shrub) Shrubland Alliance

This vegetation type is dominated by sclerophyllous oak species in their shrub form, including the shrub form of canyon live oak (*Quercus chrysolepis*), scrub oak (*Quercus berberidifolia*), interior live oak (*Quercus wislizeni*) in its shrub form, and leather oak (*Quercus durata*). Because of the intermixed distribution of each of the shrubby oak species within this vegetation type, as well as intermediate forms and potential hybridization, similar habitats, similar habitat value, similar legal status, and other similar ecological functions, it is advisable for this project to map these shrubby oak species as one vegetation type. For associated vegetation types from the MCV (Thorne et al. 2004, Sawyer et al. 2009) see Table A. Sclerophyllous scrub oak alliances cover approximately 29.87 acres on the project site (Figure 2).

Rock Outcrops

The soils on the project site are derived from the Sonoma Volcanics and are shallow and rocky. Rock outcroppings on the project site are variable in size due to the amount of weathering and vegetation cover, the most prominent rock outcrops cover approximately 1.61 acres on the project site (Figure 2). Low rock outcrops (at or a few feet above the ground level) are extensive across the project site and have similar plant associations. Bird's-foot fern and Bigelow's moss fern (*Selaginella bigelovii*) are the most commonly associated plants that occur within cracks of soil level rock outcrops. There are a few rock outcrops on the project site that rise above the surrounding chamise chaparral (10-15 feet off the ground surface). Coville's lip fern (*Myriopteris covillei)* was found only on these larger rock outcrops. Rock outcrops also support a diverse assemblage of lichens. Most of the accessible large rock outcrops were examined for potential evidence of use by crevice roosting bats, but large deep crevices suitable for bat roosting were not present. Western fence lizards were the most conspicuous wildlife species associated with the rock outcrops on the project site.

SPECIAL-STATUS SPECIES

For the purposes of this assessment, special-status species are defined as follows:

- Species that are listed, formally proposed, or designated as candidates for listing as threatened or endangered under the federal Endangered Species Act (ESA);
- Species that are listed, or designated as candidates for listing, as rare, threatened, or endangered under the California Endangered Species Act (CESA);
- Plant species with a California Rare Plant Rank (CRPR) status of 1A, 1B, and 2 as included in the CNPS Electronic Inventory of Rare and Endangered Plants of California (CNPS 2015);
- Although not necessarily considered rare or endangered (depending on site-specific circumstances), plant species with a CRPR of 3 and 4;
- Animal species designated as Species of Special Concern or Fully Protected by the California Department of Fish and Wildlife (CDFW);
- Species that meet the definition of rare, threatened, or endangered under Section 15380 of the California Environmental Quality Act (CEQA) guidelines; and
- Species that are considered taxa of special concern by relevant local agencies (e.g., Napa County).

Special-Status Plants

The USFWS list, the CNDDB and CNPS searches, and the review of the Napa County Baseline Data Report provided occurrence records for 99 species of special-status plants in the region of the project site (Table B). Twenty-eight of these 99 species are not expected to occur on the project site due to the absence of suitable habitat (i.e., alkaline soils, coastal conditions, moist grasslands, riparian settings, serpentine soils, vernal pools, and wetlands) and/or elevation. The project site provides potential habitat for 74 of the 99 special-status plant species evaluated for the project (Table B). The presence of suitable habitat does not necessarily mean the species is present, only that the existing ecological conditions may support these species.

Table B: Special-Status Plants Evaluated for the Stagecoach North Vineyard Project

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Agrostis hendersonii Henderson's bent-grass	--/--/3.2	Valley and foothill grassland (mesic), vernal pools. Elevation: 70–305 m. Blooms: April–June.	No habitat present.
Allium peninsulare var. *franciscanum* Franciscan onion	--/--/1B	Ecology: Dry hillsides in cismontane woodland, valley and foothill grassland/clay, volcanic, often serpentinite. Elevation: 52–300 m. Blooms: May–June.	**Present.** Six individuals of *Allium peninsulare* var. *franciscanum* were observed in one location on the project site. Another species of *Allium*, the common narrow leaved onion (*Allium amplectens*), was observed throughout the project site.
Amorpha californica var. *napensis* Napa false indigo	--/--/1B	Openings in broadleaved upland forest, chaparral, and cismontane woodland. Elevation: 120–2,000 m. Blooms: April–July.	This species was not observed during appropriately timed surveys.
Amsinckia douglasiana Douglas' fiddleneck	--/--/4.2	Unstable shale sedimentary slopes (Monterey shale) in cismontane woodland and valley and foothill grassland. Elevation: 100–1,600 m. Blooms: March–June.	No habitat present. No *Amsinckia* species were observed on the site. This species was not observed during appropriately timed surveys.
Amsinckia lunaris Bent-flowered fiddleneck	--/--/1B	Gravelly slopes, often serpentine in coastal bluff scrub, valley and foothill grassland; openings in cismontane woodland. Elevation: 3–500 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Antirrhinum virga Dimorphic snapdragon	--/--/4.3	Occurs in rocky openings in chaparral and lower montane coniferous forest, often on serpentine. Elevation: 100–2,015 m. Blooms: June–July.	This species was not observed during appropriately timed surveys.
Arctostaphylos bakeri subsp. *bakeri* Baker's manzanita	--/CR/1B	Serpentine chaparral near coast and borders of broadleaved upland forest. Elevation: 75–300 m. Blooms: February–April.	Suitable habitat not present. *Arctostaphylos manzanita* subsp. *manzanita* and *Arctostaphylos glandulosa* were the only manzanitas observed on the site.
Arctostaphylos manzanita subsp. *elegans* Konocti manzanita	--/--/1B	Chaparral, cismontane woodland, and lower montane coniferous forest. Usually on volcanic soils. Elevation: 395–1,400 m. Blooms: March–May.	This species was not observed during appropriately timed surveys. *Arctostaphylos manzanita* subsp. *manzanita* and *Arctostaphylos glandulosa* were the only manzanitas observed on the site.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Arctostaphylos stanfordiana subsp. *decumbens* Rincon manzanita	--/--/1B	Chaparral (rhyolitic), cismontane woodland. Elevation: 75–370 m. Blooms: February–May.	This species was not observed during appropriately timed surveys. *Arctostaphylos manzanita* subsp. *manzanita* and *Arctostaphylos glandulosa* were the only manzanitas observed on the site.
Astragalus breweri Brewer's milk-vetch	--/--/4.2	In chaparral, cismontane woodland, meadows and seeps, and valley and foothill grassland (open, often gravelly). Often on serpentine and volcanic soils. Elevation: 90–730 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Astragalus claranus Clara Hunt's milk-vetch	FE/CT/1B	Openings in chaparral, Cismontane woodland, valley and foothill grassland in serpentine or rocky clay or volcanic soils. Elevation: 75–275 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.
Astragalus rattanii var. *jepsonianus* Jepson's milk-vetch	--/--/1B	Chaparral, cismontane woodland, and valley and foothill grassland. Often on serpentine. Elevation: 297–700 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Astragalus tener var. *tener* Alkali milk-vetch	--/--/1B.2	Occurs in mesic alkaline and adobe clay soils in valley and foothill grassland, adjacent to vernal pools and alkali playas. Elevation: 1–60 m. Blooms: March–June.	Suitable habitat is not present. This species was not observed during appropriately timed surveys.
Balsamorhiza macrolepis var. *macrolepis* Big-scale balsamroot	--/--/1B	Thin rocky soil, grassy hillsides; foothill woodland, chaparral; sometimes on serpentine. Elevation: 90–1,555 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Blennosperma bakeri Sonoma sunshine	FE/CE/1B	Mesic areas in valley and foothill grassland, vernal pools. Elevation: 10–110 m. Blooms: March–May.	Suitable habitat is not present. This species was not observed during appropriately timed surveys.
Brodiaea leptandra Narrow-flowered California brodiaea	--/--/1B	Broadleaved upland forest, chaparral, and lower montane coniferous forest. Elevation: 110–915 m. Blooms: May–July.	**Present.** Thirty individual plants were observed in three locations near and within streams on the project site.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Calamagrostis ophitidis Serpentine reed grass	--/--/4	Occurs in chaparral, meadows, and valley and foothill grasslands often in serpentine soils. Elevation: 90–1,065 m. Blooms: April–July.	This species was not observed during appropriately timed surveys.
Calochortus pulchellus Mount Diablo fairy-lantern	--/--/1B	Chaparral, cismontane woodland, riparian woodland, valley and foothill grassland, in openings on slopes. Elevation: 30–840 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Calochortus umbellatus Oakland star-tulip	--/--/4.2	Broadleaved upland forest, chaparral, lower montane coniferous forest, and valley and foothill grassland; often on serpentine. Elevation: 100–700 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Calycadenia micrantha Small flowered calycadenia	--/--/1B	Chaparral, volcanic meadows and seeps, valley and foothill grassland/roadsides, rocky talus, scree, sometimes in serpentine and sparsely vegetated areas. Elevation: 5–1,500 m. Blooms: June–September.	**Present.** Six small-flowered calycadenia plants were observed on the project site.
Calystegia collina subsp. *oxyphylla* Mt. Saint Helena morning-glory	--/--/4	Chaparral. Usually on serpentine barrens, slopes, and hillsides. Elevation: 305–685 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Castilleja ambigua var. *ambigua* Johnny-nip	--/--/4	Coastal prairie, coastal scrub, marshes and swamps, valley and foothill grassland, and vernal pool margins. Elevation: 0–435 m. Blooms: March–August.	Suitable habitat is not present. This species was not observed during appropriately timed surveys.
Castilleja ambigua var. *meadii* Mead's owls-clover	--/--/1B	Meadows and seeps, and vernal pools in gravelly, volcanic, clay soils. Elevation: 450–475 m. Blooms: April–May.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Ceanothus confuses Rincon Ridge ceanothus	--/--/1B	Closed-cone coniferous forest, chaparral, woodland; on volcanic or serpentine soils, dry shrubby slopes. Elevation: 75–1,065 m. Blooms: February–June.	This species was not observed during appropriately timed surveys. *Ceanothus cuneatus*, *Ceanothus foliosus*, and *Ceanothus purpureus* are the only *Ceanothus* species observed in the study area during appropriately timed surveys.
Ceanothus divergens Calistoga ceanothus	--/--/1B	Chaparral, cismontane woodland; on rocky, serpentine or volcanic sites. Elevation: 165–950 m. Blooms: February–April.	This species was not observed during appropriately timed surveys. *Ceanothus cuneatus*, *Ceanothus foliosus*, and *Ceanothus purpureus* are the only *Ceanothus* species observed in the study area during appropriately timed surveys.
Ceanothus pinetorum Kern ceanothus	--/--/4.3	Yellow pine forest, lodgepole pine forest, red fir forest; on slopes. Elevation: 1,600–2,745 m. Blooms: May–July.	This species was not observed during appropriately timed surveys. *Ceanothus cuneatus*, *Ceanothus foliosus*, and *Ceanothus purpureus* are the only *Ceanothus* species observed in the study area during appropriately timed surveys.
Ceanothus purpureus Holly-leaved ceanothus	--/--/1B	Chaparral and woodland on rocky volcanic soils. Elevation: 120–640 m. Blooms: February–June.	**Present.** This species occurs in all areas of the project site. LSA collected population data and estimated the density of holly-leaved ceanothus on the project site to be between 37 and 42 individuals per acre with a total of 2,822 individuals on site.
Ceanothus sonomensis Sonoma ceanothus	--/--/1B	Chaparral, in sandy, serpentine or volcanic sites. Elevation: 215–800 m. Blooms: February–April.	This species was not observed during appropriately timed surveys. *Ceanothus cuneatus*, *Ceanothus foliosus*, and *Ceanothus purpureus* are the only *Ceanothus* species observed in the study area during appropriately timed surveys.
Centromadia parryi subsp. *parryi* Pappose tarplant	--/--/1B	Vernally mesic areas in grasslands, meadows and seeps, coastal salt marsh; often on alkaline sites. Elevation: 2–420 m. Blooms: May–November.	Suitable habitat is not present
Chorizanthe valida Sonoma spineflower	--/--/1B	Sandy soils in coastal prairie habitat. Elevation: 10–305 m. Blooms: June–August.	Suitable habitat is not present
Clarkia gracilis subsp. *albicaulis* White-stemmed clarkia	--/--/1B	Chaparral and cismontane foothill woodland; sometimes on serpentine. Elevation: 245–1,085 m. Blooms: May–July.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Clarkia gracilis subsp. *tracyi* Tracy's clarkia	--/--/4	Openings in chaparral; generally on serpentine soils. Elevation: 65–650 m. Blooms: April–July.	This species was not observed during appropriately timed surveys.
Collomia diversifolia Serpentine collomia	--/--/4	Chaparral and cismontane woodland; rocky or gravelly areas on serpentine soils. Elevation: 60–900 m. Blooms: April–July.	Suitable habitat is not present.
Cordylanthus tenuis subsp. *brunneus* Serpentine bird's-beak	--/--/4	Serpentine in closed-cone coniferous forest, chaparral, cismontane woodland. Elevation: 475–915 m. Blooms: July–August.	Suitable habitat is not present.
Cryptantha dissita Serpentine cryptantha	--/--/1B	Chaparral (serpentine). Elevation: 395–580 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Delphinium uliginosum Swamp larkspur	--/--/4	Serpentine seeps in chaparral and valley and foothill grassland. Elevation: 340–610 m. Blooms: May–July.	This species was not observed during appropriately timed surveys.
Downingia pusilla Dwarf downingia	--/--/2	Valley and foothill grassland (mesic), vernal pools. Elevation: 1–455 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.
Erigeron biolettii Streamside daisy	--/--/3	Dry slopes, North Coast coniferous forest, broadleaved upland cismontane woodland, rocks and ledges along rivers. Elevation: 30–1,100 m. Blooms: June–September.	This species was not observed during appropriately timed surveys.
Erigeron greenei Greene's narrow-leaved daisy	--/--/1B	Chaparral, lower montane coniferous forest; serpentine, volcanic soils, and alluvium, usually in shrubby vegetation. Elevation: 80–1,005 m. Blooms: May–September.	This species was not observed during appropriately timed surveys.
Erythronium helenae St. Helena fawn lily	--/--/4	Found in and around shrubs in chaparral, valley and foothill grassland on serpentine. Elevation: 300–1,220 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Extriplex joaquinana San Joaquin spearscale	--/--/1B	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland/alkaline. Elevation: 1–835 m. Blooms: April–October.	No habitat present.
Fritillaria pluriflora Adobe-lily	--/--/1B	Cismontane woodland, valley and foothill grasslands, among shrubs/adobe clay. Elevation: 60–705 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.
Fritillaria purdyi Purdy's fritillary	--/--/4	Chaparral, cismontane woodland, and lower montane coniferous forest; usually on serpentine. Elevation: 175–2,255 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Gilia capitata subsp. *tomentosa* Hairy blue field gilia	--/--/1B	Coastal bluff scrub, valley and foothill grassland (serpentine and rocky outcrops). Elevation: 10–220 m. Blooms: May–July.	This species was not observed during appropriately timed surveys.
Harmonia hallii Hall's harmonia	--/--/1B	Chaparral (serpentine). Elevation: 500–975 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Harmonia nutans Nodding harmonia	--/--/4	Chaparral, cismontane woodland, rocky soils, volcanic substrates. Elevation: 75–975 m. Blooms: April–June.	**Present**. This species was observed on the project site during the 2018 surveys.
Helianthus exilis Serpentine sunflower	--/--/4	Gravelly streamsides and serpentine seeps in chaparral, cismontane woodland (wetland riparian). Elevation: 150–1,525 m. Blooms: June–November.	This species was not observed during appropriately timed surveys.
Hemizonia congesta subsp. *congesta* Hayfield tarweed	--/--/1B	Coastal scrub, valley and foothill grassland; sometimes on roadsides. Elevation: 20–560 m. Blooms: April–October.	This species was not observed during appropriately timed surveys.
Hesperolinon bicarpellatum Two-carpellate western flax	--/--/1B	Chaparral; in serpentine barrens at edge of chaparral. Elevation: 150–820 m. Blooms: May–July.	**Present**. The size of this annual herbaceous plant species varies depending on micro-location (soil depth, exposure, aspect). LSA mapped approximately 4,030 square feet of two-carpellate western flax and estimates approximately 12,094 plants occur on the site.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Hesperolinon breweri Brewer's western flax	--/--/1B	Cismontane woodland, grasslands and chaparral. Often in rocky serpentine soil. Elevation: 30–900 m. Blooms: May–July.	This species was not observed during appropriately timed surveys.
Horkelia tenuiloba Thin-lobed horkelia	--/--/1B	Occurs in mesic openings in sandy soils in broadleaved upland forest, chaparral, and valley and foothill grassland. Elevation: 50–500 m. Blooms: May–August.	This species was not observed during appropriately timed surveys.
Juglans hindsii Northern California black walnut	--/--/1B	Deep alluvial soil in riparian forest and riparian woodland. Few extant native stands remain; widely naturalized. Elevation: 0–395 m. Blooms: April–May.	No habitat present.
Lasthenia conjugens Contra Costa goldfields	FE/--/1B	Valley and foothill grassland and cismontane woodland in vernal pools, swales, and moist depressions (alkaline grasslands). Extirpated from most of its range; extremely endangered. Elevation: 0–470 m. Blooms: March–June.	This species is on the official USFWS species list for the project, but suitable habitat is not present.
Lathyrus jepsonii var. *jepsonii* Delta tule pea	--/--/1B	Freshwater and brackish marsh. Elevation: 0–5 m. Blooms: May–September.	No habitat present.
Layia septentrionalis Colusa layia	--/--/1B	Chaparral, cismontane woodland, valley and foothill grassland. Plant has a high affinity for sandy, serpentine soils. Elevation: 100–1,095 m. Blooms: April–May.	This species was not observed during appropriately timed surveys.
Leptosiphon acicularis Bristly leptosiphon	--/--/4/LR	Chaparral, cismontane woodland, coastal prairie, and grassy slopes in valley and foothill woodlands. Elevation: 55–1,500 m. Blooms: April–July.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Leptosiphon grandiflorus Large-flowered leptosiphon	--/--/4	Usually occurs in open grassy flats, generally in sandy soils within coastal bluff scrub, closed-cone coniferous forest, cismontane woodland, coastal dune, coastal prairie, coastal scrub, and valley and foothill grasslands. Elevation: 5–1,220 m. Blooms: April–August.	This species was not observed during appropriately timed surveys.
Leptosiphon jepsonii Jepson's leptosiphon	--/--/1B	Chaparral, cismontane woodland; on volcanic soil or the periphery of serpentine soils in open to partially shaded grassy slopes. Elevation: 100–500 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.
Leptosiphon latisectus Broad-lobed leptosiphon	--/--/4	Open or partially shaded grassy slopes in chaparral, cismontane woodland, coastal prairie, valley and foothill grassland. Elevation: 55–1,500 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Lessingia hololeuca Wooly-headed lessingia	--/--/3	Often found in dry grassy areas such as fields and roadside ditches in broadleaved upland forest, coastal scrub, chaparral, lower montane coniferous forest, and valley and foothill grassland. Plant has an affinity for alkaline or serpentine soils. Elevation: 15–305 m. Blooms: June–October.	This species was not observed during appropriately timed surveys.
Lilaeopsis masonii Mason's lilaeopsis	--/CR/1B	Tidal zone of freshwater and brackish marshes. Elevation: 0–10 m. Blooms: April–November.	Suitable habitat not present, not observed during appropriately timed surveys.
Lilium pardalinum subsp. *vollmeri* Vollmer's lily	--/--/4	Occurs in meadows, peat bogs/fens, streams, and springs within north coastal coniferous forest, mixed evergreen forest, and wetland-riparian. Elevation: 100–1,200 m. Blooms: July–August.	Suitable habitat not present, not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Lilium pardalinum subsp. *wigginsii* Wiggins' lily	--/--/4	Occurs in wet thickets, meadows, and streams among conifers in yellow pine forest, and wetland-riparian. Elevation: 800–2,000 m. Blooms: June–August.	Suitable habitat not present, not observed during appropriately timed surveys.
Lilium rubescens Chaparral lily	--/--/4	Dry soils in chaparral and gaps in redwood or mixed evergreen forest; sometimes on serpentine soil. Elevation: 30–1,910 m. Blooms: April–August.	This species was not observed during appropriately timed surveys.
Limnanthes vinculans Sebastopol meadowfoam	FE/CE/1B	Mesic meadows, vernal pools, valley and foothill grassland; swales, wet meadows and marshy areas in valley oak savanna. Elevation: 15–305 m. Blooms: April–May.	This species is on the official USFWS species list for the project, but suitable habitat is not present.
Lomatium repostum Napa lomatium	--/--/4	Generally found growing on ultramaphically derived soils (serpentinite) in chaparral and cismontane woodland. Elevation: 90–830 m. Blooms: March–June.	**Present**. Approximately 10 individual plants of this species were observed in two locations on the project site.
Lupinus sericatus Cobb Mountain lupine	--/--/1B	Chaparral, cismontane woodland, lower montane coniferous forest; in stands of knobcone pine-oak woodland, on open wooded slopes. Elevation: 275–1,525 m. Blooms: March–June.	This species was not observed during appropriately timed surveys.
Malacothamnus helleri Heller's bush mallow	--/--/3	Found growing in sandstone soils in chaparral and in gravelly soils in riparian woodland. Elevation: 305–635 m. Blooms: May–July.	This species was not observed during appropriately timed surveys.
Micropus amphiboles Mount Diablo cottonweed	--/--/3	Broadleaved upland forest, chaparral, cismontane woodland, valley and foothill grassland/rocky substrates. Elevation: 50–800 m. Blooms: March–May.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Erythranthe microphylla (formerly *Mimulus microphyllus*) Small-leaved monkeyflower	--/--/4	Meadows and seeps (mesic) within chaparral and yellow pine forest. Elevation: 1,770–2,450 m. Blooms: May–August.	This species was not observed during appropriately timed surveys.
Erythranthe nudata (formerly *Mimulus nudatus*) Bare monkeyflower	--/--/4.3	Occurs in seeps on serpentine outcrops in chaparral, foothill woodland, wetland-riparian. Elevation: 250–700 m. Blooms: May–June.	This species was not observed during appropriately timed surveys.
Monardella viridis subsp. *viridis* Green monardella	--/--/4	Chaparral, foothill woodland, mixed evergreen forest (Ponderosa pine); open rocky slopes, also on serpentine. Elevation: 100–1,010 m. Blooms: June–September.	**Present**. This perennial sub-shrub occurs throughout the project site. LSA estimates that one individual plant covers at least 1.64 feet in diameter. LSA mapped approximately 820 square feet of green monardella. Approximately 2,492 individual green monardella plants occur on the project site.
Navarretia cotulifolia Cotula navarretia	--/--/4	Occurs in moist heavy clay areas (vernal pools) in grasslands and chaparral within foothill woodland, valley grassland, and wetland-riparian. Elevation: 4–1,830 m. Blooms: May–June.	This species was not observed during appropriately timed surveys.
Navarretia jepsonii Jepson's navarretia	--/--/4	Occurs in open, grassy or clay flats in chaparral, valley and foothill grassland, and cismontane woodland; often on serpentine. Elevation: 175–855 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Navarretia leucocephala subsp. *bakeri* Baker's navarretia	--/--/1B	Occurs in meadows, seeps and vernal pools in montane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland. Elevation: 5–1,740 m. Blooms: April–July.	This species is on the official USFWS species list for the project, but suitable habitat is not present.
Navarretia leucocephala subsp. *pauciflora* Few-flowered navarretia	FE/CT/1B	Volcanic ash flow and volcanic substrate vernal pools. Elevation: 400–855 m. Blooms: May–June.	No suitable habitat is present.
Navarretia rosulata Marin County navarretia	--/--/1B	Rocky areas in chaparral and Sargent cypress forest. A strict serpentine endemic. Elevation: 200–635 m. Blooms: May–July.	No suitable habitat is present.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Penstemon newberryi var. *sonomensis* Sonoma beardtongue	--/--/1B	Chaparral; crevices in rock outcrops and talus slopes. Elevation: 700–1,370 m. Blooms: April–August.	This species was not observed during appropriately timed surveys.
Perideridia gairdneri subsp. *gairdneri* Gairdner's yampah	--/--/4	Broadleaved upland forest, chaparral, coastal prairie, valley and foothill grassland, vernal pools, in mesic areas. Elevation: 0–610 m. Blooms: June–October.	This species was not observed during appropriately timed surveys.
Quercus dumosa Scrub oak	--/--/1B	Generally occurs on sandy and clay loam soils near the coast in chaparral, coastal sage scrub, and closed-cone coniferous forest. Elevation: 15–400 m. Blooms: February–May.	This species was not observed during appropriately timed surveys.
Ranunculus lobbii Lobb's aquatic buttercup	--/--/4	Vernal pools, ditches, and ponds in cismontane woodland, North Coast coniferous forest, and valley and foothill grassland. Elevation: 15–470 m. Blooms: February–May.	No habitat present.
Rhynchospora californica California beaked-rush	--/--/1B	Bogs and fens, lower montane coniferous forest, meadows and seeps, and freshwater marshes and swamps. Elevation: 45–1,010 m. Blooms: May–July.	No habitat present.
Ribes victoris Victor's gooseberry	--/--/4	Broadleaved upland forest, chaparral, in wooded slopes in shaded canyons. Elevation: 100–750 m. Blooms: March–April.	This species was not observed during appropriately timed surveys.
Sanford's arrowhead *Sagittaria sanfordii*	--/--/1B	Marshes, swamps, and associated shallow freshwater habitats. Elevation: 0 - 650 meters Blooms: May – October	No habitat present.
Sidalcea hickmanii subsp. *napensis* Napa checkerbloom	--/--/1B	Chaparral (rhyolitic rocky soils). Elevation: 415–610 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Sidalcea hickmanii subsp. *viridis* Marin checkerbloom	--/--/1B	Chaparral in serpentine or volcanic soils; sometimes appears after burns. Elevation: 50–430 m. Blooms: May–June.	This species was not observed during appropriately timed surveys.
Sidalcea keckii Keck's checkerbloom	FE/--/1B	Cismontane woodland and serpentine clay soils in valley and foothill grassland. Elevation: 75–650 m. Blooms: April–June.	No habitat present.
Sidalcea oregana subsp. *hydrophila* Marsh checkerbloom	--/--/1B	Meadows and seeps, riparian forest; wet soil of streambanks, meadows. Elevation: 1,100–2,300 m. Blooms: July–August.	No habitat present.
Smilax jamesii English Peak greenbrier	--/--/1B	Riparian, streambanks, lake-margins/edges, broadleaved upland forest, lower montane coniferous forest, marshes and swamps, North Coast coniferous forest, upper montane coniferous forest. Elevation: 560–2,500 m. Blooms: May–October.	No habitat present.
Streptanthus barbiger Bearded jewelflower	--/--/4	Serpentine barrens and chaparral. Elevation: 200–1,500 m. Blooms: May–August.	No habitat present.
Streptanthus hesperidis *(syn. = S. breweri var. hesperidis)* Green jewelflower	--/--/1B	Chaparral (openings), cismontane woodland (serpentine, rocky). Elevation: 130–760 m. Blooms: May–July.	No habitat present.
Symphyotrichum lentum Suisun Marsh aster	--/--/1B	Marshes and swamps. Elevation: 0–3 m. Blooms: May–November.	No habitat present.
Thermopsis gracilis Slender false lupine	--/--/4	Open sites (roadsides) in chaparral, mixed evergreen forest (Ponderosa pine), foothill woodland, and meadows and seeps. Elevation: 100–1,720 m. Blooms: March–July.	This species was not observed during appropriately timed surveys.

Species	Status* (Federal/ State/CRPR)	Habitat/Blooming Period	Discussion
Toxicoscordion fontanum *Marsh zigadenus*	--/--/4	Vernally moist or marshy areas, often serpentine in chaparral and mixed evergreen forest. Elevation: 15–1,000 m. Blooms: March–August.	This species was not observed during appropriately timed surveys.
Trichostema ruygtii Napa bluecurls	--/--/1B	Cismontane woodland, chaparral, valley and foothill grassland, vernal pools, lower montane coniferous forest, often in sunny areas. Elevation: 30–60 m. Blooms: June–October.	This species was not observed during appropriately timed surveys.
Trifolium amoenum Two-fork clover	FE/--/1B	Valley and foothill grassland, coastal bluff scrub, sometimes on serpentine. Elevation: 5–415 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Trifolium hydrophilum Saline clover	--/--/1B	Marshes and swamps, valley and foothill grassland, vernal pools. Elevation: 0–300 m. Blooms: April–June.	No habitat present.
Triteleia lugens Dark-mouthed triteleia	--/--/4	Broadleaved upland forest, chaparral, lower montane coniferous forest. Elevation: 100–1,000 m. Blooms: April–June.	This species was not observed during appropriately timed surveys.
Viburnum ellipticum Oval-leaved viburnum	--/--/2	Chaparral, cismontane woodland, and lower montane coniferous forest. Elevation: 215–1,400 m. Blooms: May–June.	This species was not observed during appropriately timed surveys.

Status:

FE = Federal-listed endangered
FT = Federal-listed threatened
CE = State-listed endangered
CR = State Rare
CT = State-listed as threatened
1A = California Rare Plant Rank 1A: species considered extinct in California
1B = California Rare Plant Rank 1B: species considered rare or endangered in California and elsewhere
2 = California Rare Plant Rank 2 – rare, threatened, or endangered in California, but more common elsewhere
3 = California Rare Plant Rank 3 – review list, plants for which more information is needed
4 = California Rare Plant Rank 4 – watch list, plants of limited distribution
LR = Locally Rare plant species

Holly-Leaved Ceanothus

Holly-leaved ceanothus (*Ceanothus purpureus*), a shrub in the buckthorn family (Rhamnaceae), is endemic to the inner North Coast Ranges and restricted to rocky volcanic soils. This species occurs primarily in Napa, Sonoma, and Mendocino counties and has a CRPR of 1B. Holly-leaved ceanothus blooms from March through May. This species is in the *Ceanothus* subgenus *Cerastes*; adult plants of species in this subgenus are killed by fire (they do not have the ability to crown sprout) and reproduce only from seeds stored in the soil (Quinn and Keeley 2006). This shrub occurs on the project site in varying densities as a co-dominant in chaparral (Figure 3).

Holly-leaved ceanothus appears to be absent from approximately 60 acres of the project site, consisting mainly of closed canopy woodland. Where holly-leaved ceanothus occurs, its densities range from only scattered, isolated individuals to small but dense patches with densities calculated as high as 254 individual shrubs per acre. Overall, LSA detected a total of 2,822 holly-leaved ceanothus individuals, mainly located in chaparral and sclerophyllous shrubland. There are approximately 76 acres with a calculated density of 0 to 25 individual holly-leaved ceanothus shrubs per acre, 20 acres with a density of 25 to 50 individuals per acre, 7 acres with a density of 50 to 75 individuals per acre, 5 acres with a density of 75 to 100 individuals per acre, and 3.7 acres with a density of 100 to 254 observations per acre (Figure 3).

Franciscan Onion

Franciscan onion (*Allium peninsulare* var. *franciscanum*) is a perennial herb (bulb) in the onion family (Alliaceae); this species has a CRPR of 1B. Six individuals of this species were observed at a single location on the project site (Figure 4). Franciscan onion blooms from May to June. Another onion species, the narrow-leaved onion (*Allium amplectens*), was also observed throughout the project site.

Narrow-Flowered California Brodiaea

Narrow-flowered California brodiaea (*Brodiaea leptandra*) is a perennial herb in the brodiaea family (Themidaceae); this species has a CRPR of 1B. Thirty individual plants were observed in three separate locations on the project site (Figure 4). Narrow-flowered California brodiaea blooms from May to July. This species occurs in sunny sites with rocky volcanic soils, often on creek sides, and in wooded or brushy areas. Harvest brodiaea (*Brodiaea elegans* ssp. *elegans*), a more common species, also occurs on the project site. Narrow-flowered California brodiaea has pale lilac to white flowers, and a stem greater than about 19.5 inches tall.

Small-Flowered Calycadenia

Small-flowered calycadenia (*Calycadenia micrantha*) is an annual herb in the sunflower family (Asteraceae); this species has a CRPR of 1B. Small-flowered calycadenia blooms from June to September and occupies rocky sparsely vegetated habitats. Six individuals were observed on the project site at a single location (Figure 4).

LSA

LEGEND

Property Boundary

Streams

Holly-leaved Ceanothus Density Classes (in "Observations per Acre")

No Observation of Holly-leaved Ceanothus

>0 - 25

>25 - 50

>50 - 75

>75 - 100

>100 - 255

N

0 175 350

FEET

SOURCE: USDA NAIP (2014).

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 3_Holly-leaved Ceanothus Density Classes.mxd (10/31/2018)

FIGURE 3

Stagecoach North
Napa County, California

Holly-leaved Ceanothus Density Classes

LSA

LEGEND

- Property Boundary
- Road
- Trail
- Proposed Clearing Limits
- Plant Populations to be Avoided

Plant Species

- Franciscan onion (*Allium peninsulare* var. *franciscanum*)
- Narrow-flowered brodiaea (*Brodiaea leptandra*)
- Small-flowered calycadenia (*Calycadenia micrantha*)
- Nodding harmonia (*Harmonia nutans*)
- Two-carpellate western flax (*Hesperolinon bicarpellatum*)
- Napa lomatium (*Lomatium reposum*)
- Green monardella (*Monardella viridis* subsp. *viridis*)

0 175 350
FEET

SOURCE: USDA NAIP (2014).

FIGURE 4

Stagecoach North
Napa County, California

Additional Special-status Plant Species and Proposed Clearing Limits

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 4_Additional Special-status Plant Species.mxd (10/25/2018)

Two-Carpellate Western Flax

Two-carpellate western flax is an annual herb in the flax family (Linaceae); this species has a CRPR of 1B. Two-carpellate western flax blooms from May to July. LSA observed this species throughout the project site, primarily in open areas along old trails and openings in chamise chaparral. The size of this species varies depending on micro-location (soil depth, exposure, aspect, etc.). LSA mapped approximately 4,030 square feet (0.09 acre) of two-carpellate western flax and estimates approximately 12,094 plants occur on the site (Figure 4).

Nodding Harmonia

Nodding harmonia (*Harmonia nutans*) is an annual species in the sunflower family (Asteraceae); this plant has a CRPR of 4. Nodding harmonia blooms from March through May and occurs in chaparral or woodland with rocky or gravelly volcanic substrates. LSA observed this species on the project site during the 2018 surveys; LSA counted 338 individual plants within an approximate 80 square foot area (Figure 4). Nodding harmonia has a relatively wide distribution on rocky substrates in Napa, Lake, Sonoma, and Yolo counties where extensive areas of potential habitat occur, much of it within regional and/or State parks and other undeveloped areas.

Napa Lomatium

Napa lomatium (*Lomatium repostum*) is a perennial herb in the carrot family (Apiaceae); this species has a CRPR of 4. Napa lomatium blooms from March to June and favors serpentine and volcanic soils in chaparral, and pine/oak woodland. LSA observed approximately 10 individual plants occurring in two separate locations on the project site (Figure 4).

Green Monardella

Green monardella is a perennial herb in the mint family (Lamiaceae); this species has a CRPR of 4. Green monardella blooms from June through September. LSA observed this species throughout the project site in open areas primarily along old trails; LSA mapped approximately 820 square feet (0.02 acres) of green monardella on the project site (Figure 4) and estimates approximately 2,707 individual green monardella plants occur on the project site.

Special-Status Animals

There are CNDDB occurrence records for four special-status animal species within 2 miles of the project site (Table C): foothill yellow-legged frog (*Rana boylii*), white-tailed kite (*Elanus leucurus*), bald eagle (*Haliaeetus leucocephalus*), and pallid bat (*Antrozous pallidus*). Other special-status animal species known to occur in the mountains of central Napa County include northern spotted owl (*Strix occidentalis caurina*), olive-sided flycatcher (*Contopus cooperi*), and purple martin (*Progne subis*). These species are also evaluated for the proposed project. In addition, five federally listed animal species that are associated with aquatic habitats not present on or adjacent to the project site are included on the official USFWS species list for the project: California freshwater shrimp (*Syncaris pacifica*), Conservancy fairy shrimp (*Branchinecta conservatio*), delta smelt (*Hypomesus transpacificus*), steelhead (*Oncorhynchus mykiss*), and California red-legged frog (*Rana draytonii*). Because suitable aquatic habitat for these species is not present on or adjacent to the project site and there are no known occurrences within 2 miles of the project site, these species do not occur on the project site and are not discussed further in this report.

Foothill Yellow-Legged Frog

This species is known to occur in the mountains east of the Napa Valley (Thomson et al. 2016; CDFW 2018). Suitable habitat includes perennial streams with clear flowing water, sunny banks, and slow flowing pools or backwaters for egg laying and tadpole rearing; such habitat is not present on the site. The ephemeral stream courses on the project site do not contain pools or surface water that provides suitable aquatic habitat for the foothill yellow-legged frogs; the on-site stream courses typically contain surface water only after rainfall events and are generally dry during most of the year. In addition, there are no springs or other mesic refugia that frogs could use as upland retreats. Therefore, this species would not be present on the project site. Also, suitable aquatic habitat does not appear to be present on adjoining properties.

White-Tailed Kite and Bald Eagle

The sensitivity of the white-tailed kite and bald eagle is largely focused on their nesting sites, but no suitable nesting or foraging habitat for these raptors is present on or adjacent to the project site.

Northern Spotted Owl

There are no known northern spotted owl records near the project site, and no suitable habitat for this species is present on or adjacent to the project site.

Olive-Sided Flycatcher and Purple Martin

There are no CNDDB occurrence records for the olive-sided flycatcher and purple martin within 2 miles of the project site; however, both these species are highly migratory and nest in northern western Napa County (Berner et al. 2003). The preferred nesting habitat of these two bird species is coniferous forest with tall emergent trees; this vegetation cover is not present on or adjacent to the project site and therefore neither species would be expected to nest here.

Table C: Special-Status Animals Evaluated for the Stagecoach North Vineyard Project

Species	Status* Federal/ State	Habitat	Discussion
Rana boylii Foothill yellow-legged frog	--/SCT; SSC	Occurs along streams in areas with clear flowing water and sunny banks. Requires slow flowing pools or backwaters for egg laying and tadpole rearing.	There are occurrence records for Sage Creek just over a mile north of the project site , but suitable habitat for this species is not present on or adjacent to the project site.
Elanus leucurus White-tailed kite	--/FP	This small raptor nests in trees in open areas and forages over grasslands, marshes, and other open habitats for small mammals (primarily voles). White-tailed kites do not generally forage in chaparral habitats.	There are occurrence records for this species within 2 miles of the project site, but suitable nesting and foraging habitat is not present on the project site.
Haliaeetus leucocephalus Bald eagle	--/SE	This large raptor generally nests in tall trees near water and forages for fish, waterfowl, other vertebrates, and carrion along shorelines or over water; however, they also forage in open terrestrial habitats such as grasslands.	This species nests and winters at Lake Hennessy about 3 miles northwest of the project site; suitable nesting and foraging habitat for this species is not present on or adjacent to the project site.
Strix occidentalis caurina Northern spotted owl	FT/ST; SSC	This owl prefers dense closed canopy forest, dominated by conifers and with good populations of small mammals (e.g., woodrats), for nesting and foraging.	In Napa County, this species nests primarily in the mountains flanking the western edge of the Napa Valley. This species is on the official USFWS species list for the project, but suitable habitat for the northern spotted owl is not present on or adjacent to the project site.
Contopus cooperi Olive-sided flycatcher	--/SSC	Prefers tall coniferous trees for nesting and foraging, but will also use non-native tall blue gum trees. Forages for aerial insects from tall perches. This species is a long distance neotropical migrant.	This long distance migrant nests in northern Napa County (Berner et al. 2003; Shuford and Gardali 2008), but suitable nesting habitat is not present on the project site. This species may occur occasionally on the project site as a migrant during spring and fall.
Progne subis Purple martin	--/SSC	In northwest California, this species generally nests in abandoned woodpecker holes in tall coniferous trees and forages for aerial insects over forest, open country, and water. Purple martins will also nest in holes in utility poles. This species is a long distance neotropical migrant.	Purple martins are known to nest at scattered locations in the mountains of northwestern Napa County (Berner et al. 2003), but there are no nesting records near the project site and suitable nesting habitat is not present on the project site.
Antrozous pallidus Pallid bat	--/SSC	Roosts in rock crevices, under bridges, in cavities and hollows in trees, and in buildings; may use occupied buildings as night roosts; feeds primarily on terrestrial arthropods in wide variety of open habitats.	Suitable roosting habitat is generally not present on the project site; however, scattered individuals could use rock outcrops as day roosts and this species could forage on the project site, if roosts are located nearby.

*Status:
FT = Federal-listed threatened
SE = State-listed endangered; ST = State-listed threatened; SCT = State candidate for threatened; FP = State fully protected
SSC = California species of special concern

Pallid Bat

Pallid bat occurrences are known from within 2 miles of the project site, but high quality day or maternity roost habitat (e.g., deep tree hollows, abandoned buildings, caves) for this species is not present on the project site. Pallid bats can also roost under exfoliating bark on trees, but this microhabitat was not observed on the trees on the project site. Scattered individuals could use shallow crevices in rock outcrops as day roosts, but such habitat is limited on the project site. Pallid bats may forage on the project site if suitable roosting sites are located nearby.

SENSITIVE BIOTIC COMMUNITIES

California bay forest is considered a sensitive natural (biotic) community by the CDFW and is identified as such in the Napa County Baseline Data Report (NCCDPD 2005). California bay forest has a State rarity rank of S3, meaning that this natural community is rare and threatened throughout its range (Sawyer et al. 2009).

POTENTIAL WATERS AND WETLANDS

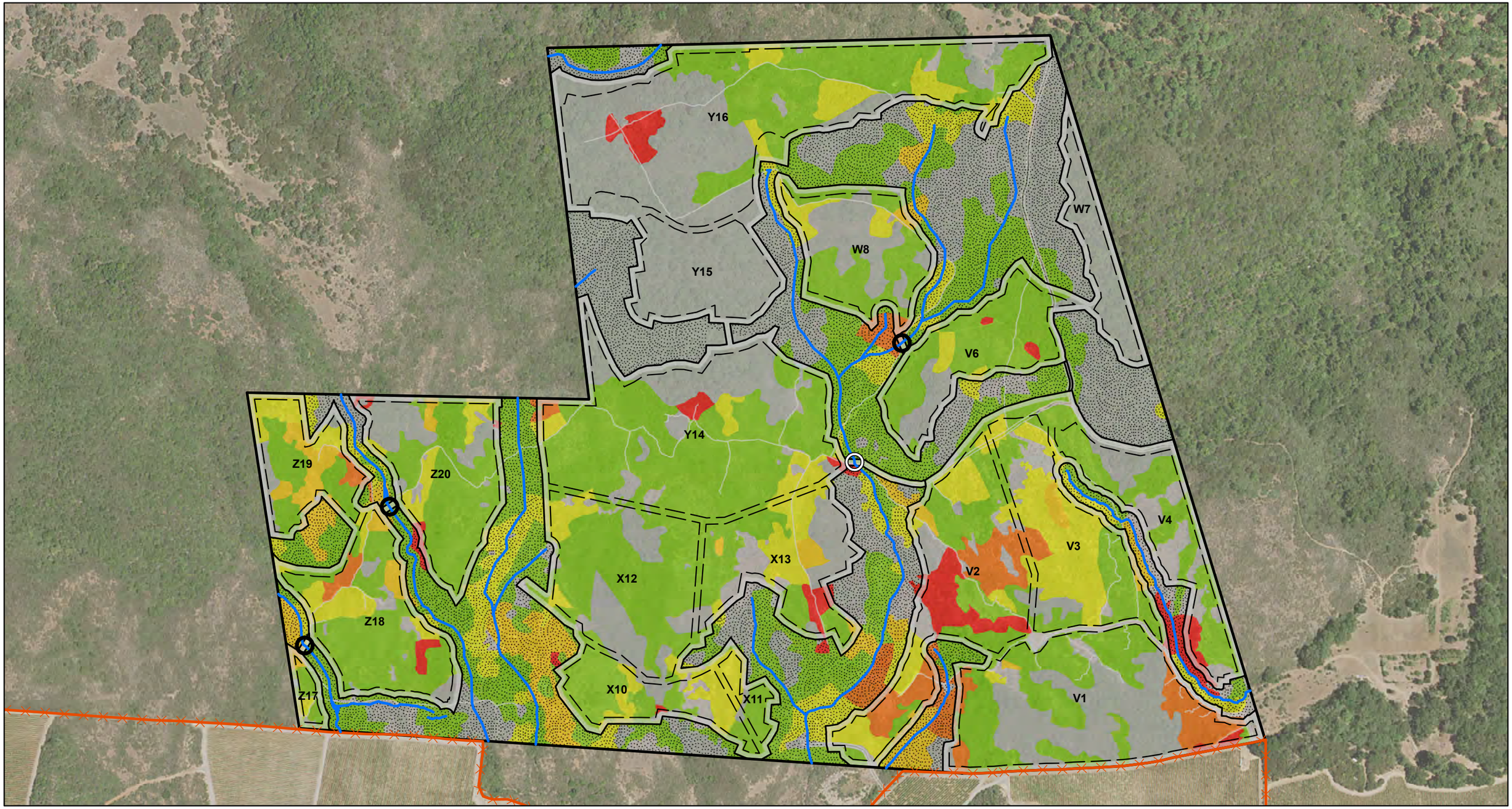
A formal wetland delineation was not within the scope of the field survey; however, the potential waters of the United States shown on Figure 2 are likely under the jurisdiction of the Corps, RWQCB, and/or the CDFW. There are no wetlands present on the project site.

STREAM SETBACKS

Napa County Conservation Regulations require stream setbacks. The Conservation Regulations define a stream as:

1. A watercourse designated by a solid or dash and three dots symbol on the largest scale U.S. Geological Survey maps most recently published, or replacement of that symbol;
2. Any watercourse with a well-defined channel with a depth greater than 4 feet and banks steeper than 3:1 and contains hydrophilic vegetation, riparian vegetation, or woody vegetation including tree species greater than 10 feet in height; or
3. Those watercourses listed in Resolution No. 94-19 (none of which occur on or adjacent to the project site).

According to these Conservation Regulations one ephemeral stream on the project site requires a stream setback because it is depicted as a dash dot (blue line) stream course on the U.S. Geological Survey 7.5-minute Yountville Quadrangle (Figure 1). This stream course runs north-south between proposed vineyard blocks Y14, X12, X10, and Z20 (Figure 5); these vineyard blocks are located to comply with required stream setbacks. Another stream course (not depicted as a blue line stream) on the project site also meets the County definition of a stream for purposes of the setback requirements of the Conservation Regulations. This stream course runs north-south between proposed vineyard blocks V2, V6, X13, and Y14 (Figure 5); these vineyard blocks are located to comply with required stream setbacks. All the other ephemeral streams on the project site do not meet the County definition of streams and thus do not require a setback; however, they are avoided to the greatest extent practicable (Figure 5).



LSA

LEGEND

- Property Boundary
- Potential Waters of the United States

Project Features

- V1 Proposed Clearing Limits
- Proposed Block Boundary
- Areas to be Preserved
- Culvert Replacement
- Rocked Water Crossing
- Existing Deer Fence

Holly-leaved Ceanothus Density Classes (in "Observations per Acre")

- No Observation of Holly-leafed Ceanothus
- >0 - 25
- >25 - 50
- >50 - 75
- >75 - 100
- >100 - 255

0 175 350
FEET

SOURCE: USDA NAIP (2014).

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 5_Project Features, Distribution of Holly-leaved Ceanothus and Potential Waters of US.mxd (10/29/2018)

FIGURE 5

Stagecoach North
Napa County, California

Project Features, Holly-leaved Ceanothus Density, and Potential Waters of the United States

MOVEMENT CORRIDORS

The project site has not been identified as part of a major regional movement corridor on the Calwild linkage map (NCCDPD 2005) and is not located along a riparian system or other natural landscape feature that can be considered an important local wildlife movement corridor. Nonetheless, the project site is within a landscape area where resident mid-sized to large mammals such as bobcats (*Lynx rufus*), mountain lion (*Puma concolor*), and mule deer (*Odocoileus hemionus*) can move with relative ease. Individuals of mid-sized to large mammals are likely to pass through the project site during their local movements, although not along a well-defined corridor.

Pacific treefrog (*Hyliola regilla*) tadpoles were found just south of the project site in shallow rocky pools along a drainage, but there are no aquatic features on or adjacent to the project site that would attract large numbers of breeding amphibians such as frogs or newts. Thus, it is unlikely that an important amphibian movement corridor occurs on the project site.

INVASIVE SPECIES

Not all alien plant species are considered invasive (Baldwin et al. 2012), but many are. Baldwin et al. (2012) recognize invasive plants as those species included in the Pest Ratings of Noxious Weed Species and/or Noxious Weed Seed, developed by the State of California, Department of Food and Agriculture, Division of Public Health and Pest Prevention Services, and/or the 4500 Noxious Weed Species list from Section 5004 of the Food and Agriculture Code. Baldwin et al. (2012) also recognize invasive plants as those in the California Invasive Plant Inventory Database developed by the California Invasive Plant Council and/or the Priority Species List of Bay Area Early Detection Network. Sixteen invasive alien plant species as identified by Baldwin et al. (2012) were observed on the project site. These 16 species are identified in Appendix B and include torilis (*Torilis arvensis*), Italian thistle (*Carduus pycnocephalus*), tocalote (*Centaurea melitensis*), yellow star-thistle (*Centaurea solstitialis*), smooth cat's ears (*Hypochaeris glabra*), rose clover (*Trifolium hirtum*), redstem filaree (*Erodium cicutarium*), slender wild oat (*Avena barbata*), common wild oat (*Avena fatua*), false brome (*Brachypodium distachyon*), rattlesnake grass (*Briza maxima*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), foxtail chess (*Bromus madritensis*), bristly dogtail grass (*Cynosurus echinatus*), and medusa head (*Elymus caput-medusae*).

POTENTIAL IMPACTS AND RECOMMENDED MITIGATION MEASURES

This section provides a discussion of the potential impacts to biological resources that could result from the proposed vineyard development and recommended mitigation measures to reduce impacts to a less than significant level. Impacted areas of vegetation compared to preserved areas are quantified in Table D. Impacts from vegetation clearing for vineyards, access roads, and turnarounds are shown on Figure 5. Preserved areas include stream setbacks.

Table D: Impacts to Vegetation and Cover Types

Vegetation Type	Area Cleared (acres)	Area Preserved (acres)	Total
Adenostoma fasciculatum Shrubland Alliance	48.86	22.73	71.59
Arctostaphylos glandulosa Alliance and *Arctostaphylos manzanita* Provisional Shrubland Alliance	3.76	1.97	5.73
California Annual Grasslands Alliance	6.56	2.26	8.82
Quercus kelloggii Forest Alliance	0.74	0.04	0.78
Sclerophyllous *Quercus* spp. Shrubland Alliance	22.55	7.32	29.87
Umbellularia californica Forest Alliance	31.76	18.61	50.37
Rock outcrops	1.09	0.52	1.61
Existing roads and cleared areas	1.02	0.50	1.52
Total	**116.34**	**53.95**	**170.29**

SIGNIFICANCE CRITERIA

Implementation of the project would have a significant impact on biological resources if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or listed as rare, threatened, or endangered by the California Department of Fish and Game or U.S. Fish and Wildlife Service.

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service.

- Have a substantial adverse effect on federally and State protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means.

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan.

- Result in a substantial conversion of oak woodlands.

LESS THAN SIGNIFICANT IMPACTS

The following project impacts are considered less than significant.

Clearing for the proposed vineyard blocks, access roads, and turnarounds will result in the loss of approximately 48.86 acres of chamise chaparral. Approximately 71.59 acres of chamise chaparral is present on the project site, of which about 48.86 acres (68 percent) will be removed and 22.73 acres (32 percent) will be preserved. Chamise chaparral is a relatively common shrub type in Napa County (Thorne et al. 2004) and is not considered a sensitive natural community; thus the loss of 48.86 acres is considered less than significant. Although the loss of 48.86 acres of chamise chaparral is not considered a significant impact in itself, holly-leaved ceanothus, a special-status species (CRPR 1B), occurs as a co-dominant shrub in this cover type on the project site and impacts to this plant would be considered significant if not mitigated. This impact is addressed below in the Potentially Significant Impacts section. Given the generally widespread occurrence of chamise chaparral in California, including Napa County, and that approximately 22.73 acres of this vegetation will be preserved on the project site, no mitigation is proposed.

Clearing for the proposed vineyard blocks, access roads, and turnarounds will result in the loss of approximately 1.09 acres of rock outcrops. The rock outcrops present on the project site are generally low in stature and do not support habitat for any special-status plant or animal species. Additionally, due to the general lack of deep crevices and cracks, the rock outcrops on the project site do not provide good bat roosting habitat. Of the total 1.61 acres of rock outcrops on the project site 0.52 acres will be included in the preserved area. Because the rock outcrops on the project site do not provide quality habitat for any special-status plant or animal species and bat impacts to 1.09 acres are considered less than significant, no mitigation is proposed.

The proposed vineyard blocks, access roads, and turnarounds could result in the loss of a small number of narrow-flowered California brodiaea, a CRPR 1B species. Approximately 30 individuals of this species were observed at three locations on the project site (Figure 4). The majority of the plants occur in areas that will be preserved (Figure 4); only a small portion of plants (2 to 3 individuals, approximately 1 percent) occur near an existing trail that is proposed to be used as a vineyard access road. Given that the majority (approximately 99 percent) of the on-site population of narrow-flowered California brodiaea will be preserved and are located in a preserved area, impacts to this species are considered less than significant and no mitigation is proposed. However,

orange fencing should be placed along the road in this area during construction to ensure that equipment using the road does not impact narrow-flowered California brodiaea.

POTENTIALLY SIGNIFICANT IMPACTS

The following impacts are considered significant, and mitigation is proposed to reduce each impact to a less than significant level.

Impact BIO-1: Clearing of vegetation for the proposed vineyard blocks, access roads, and turnarounds will result in the loss of approximately 1,915 holly-leaved ceanothus. A total of 2,822 holly-leaved ceanothus individuals were observed on the project site in 2016. Clearing for the proposed project will result in the loss of approximately 77.56 acres of sclerophyllous shrubland (i.e., *Adenostoma fasciculatum* Shrubland Alliance, *Arctostaphylos glandulosa* Alliance, *Arctostaphylos manzanita* Provisional Shrubland Alliance, and sclerophyllous *Quercus* spp. Shrubland Alliance) that provides habitat for approximately 2,822 holly-leaved ceanothus. Approximately 30.5 acres of sclerophyllous shrubland will be preserved, including about 907 holly-leaved ceanothus. Holly-leaved ceanothus is a narrow endemic restricted to volcanic soils in the inner North Coast Ranges. This plant is a CRPR 1B species, and impacting 1,915 individuals could be a significant impact unless mitigated.

Mitigation Measure BIO-1: To reduce the proposed project impacts on holly-leaved ceanothus to a less than significant level, two strategies will be employed:

1. Approximately 22.02 acres of sclerophyllous shrubland (i.e., suitable habitat for holly-leaved ceanothus) within the 53.95-acre preserved area will be preserved in perpetuity (the remaining 10 acres of sclerophyllous shrubland will be used to mitigate for California bay forest, see below). This can be accomplished by designating the preserved 22.02-acre area as a deed restriction.

2. The project proponent proposes to replace the 1,915 holly-leaved ceanothus impacted by the project at a 1:1 ratio (mitigated: impacted). This could be accomplished by propagating plants from seeds obtained from the plants on the project site. Growing from seed is the preferred technique as this captures more of the genetic diversity present in the species at a given location. Seed collection should be conducted by experienced native plant propagators from local native plant nurseries with experience in propagating native ceanothus. Propagation will include specific techniques to avoid introducing plant pathogens into the preserved area. After seedlings have been established in the nursery (generally 1 year), they can be replanted in suitable areas in the on-site preserve area.

Ceanothus flourishes in areas where dense chaparral has been opened up by burning or other disturbance; however, prescribed burning in the preserved areas is not practicable on the project site. An alternative to burning would be to “open up” the chaparral in the preserved areas by selective thinning. During the period of plant propagation in the nursery, the chamise chaparral within the preserved areas could be thinned by hand removal of selected chamise individuals and other shrubs to create openings for planting ceanothus seedlings; existing holly-leaved ceanothus in the preserved areas would be left intact. This would not be considered a significant impact because

chamise and chamise chaparral are not considered special-status species or sensitive natural communities respectively. Additionally, it is anticipated that during the hand thinning not all chamise shrubs would be removed. The project site perimeter and interior trails have previously been hand cleared, indicating this is a feasible means of opening up the chaparral, and during the 2018 surveys seedling holly-leaved ceanothus were observed growing in these areas. To accomplish the replacement of approximately 1,915 holly-leaved ceanothus, about 93 individuals per acre would need to be planted in the 22.02-acre preserved area. If it is not feasible to replace 1,915 within the preserved area, suitable areas on adjacent lands may need to be used.

Before clearing chamise chaparral on the project site, a detailed holly-leaved ceanothus mitigation and monitoring plan will be prepared by a qualified botanist/biologist. The plan will include details on seed collection and propagation, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-2: Clearing California bay forest for the proposed vineyard blocks, access roads, and turnarounds would result in the loss of 31.76 acres of a sensitive natural (biotic) community. California bay forest is considered a sensitive natural (biotic) community by the CDFW as identified in the Napa County Baseline Data Report (NCCDPD 2005). California bay forest has a State rarity rank of S3, meaning that this natural community is rare and threatened throughout its range (Sawyer et al. 2009). Impacting 31.76 acres of California bay forest is considered a significant impact unless mitigated.

Mitigation Measure BIO-2: The requirement to preserve and/or enhance California bay woodland at a 2:1 ratio can be achieved by the combination of the following mitigation measures:

1. Preservation and placement under a deed restriction of 18.61 acres of existing California bay woodland.

2. Enhancement of 10 acres of California bay woodland within the 53.95-acre preserved area. No more than 10 acres are available for this enhancement measure, because the remaining 22.02 acres are designated to mitigate for unavoidable impacts to holly-leaved ceanothus. Enhancement of California bay woodland could be achieved by planting California bay in a density similar to that occurring in the California bay forest mapped on the project site (Figure 2).

3. Reduce the proposed impact to California bay woodland from 31.76 acres to 19.79 acres.

Before clearing chamise chaparral on the project site, a California bay forest mitigation and monitoring plan will be prepared by a qualified botanist/biologist. The California bay forest plan should be integrated into the holly-leaved ceanothus mitigation and monitoring plan as a single plan. The plan will include details on seed collection and propagation, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. These two mitigation efforts combined would result in an approximate 1:1 ratio of impacted to preserved/replanted. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-3: Clearing vegetation for the proposed vineyard blocks, access roads, and turnarounds will result in the loss of a small population (6 individuals in 2015) of Franciscan onion, a CRPR 1B species. This species is a perennial herb (bulb) in the onion family (Alliaceae) and has a CRPR of 1B. Six individuals of this species were observed at a single location on the project site (Figure 4). Because this small population is within vineyard block Y14 avoidance of these plants is not feasible, and due to their CRPR 1B status, impacting this population could be a significant impact unless mitigated.

Mitigation Measure BIO-3: To mitigate for the plants that will be impacted, the bulbs of the Franciscan onion on the project site will be collected during the spring when the above ground foliage and/or flower are evident and the bulbs will be replanted in suitable habitat within the preserved areas.

Before vegetation clearing on the project site, a qualified botanist/biologist will prepare a detailed Franciscan onion mitigation and monitoring plan. The plan will include details on bulb collection and replanting, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-4: Clearing vegetation for the proposed vineyard blocks, access roads, and turnarounds will result in the loss of a small population (6 individuals in 2015) of small-flowered calycadenia and part of a population (8,331 individuals in 2015) of two-carpellate western flax, both CRPR 1B species. Both these species are annual plants, and numbers of individual plants in a given area can fluctuate widely from year to year based on various environmental parameters such as rainfall and fire. The numbers of individuals estimated on the project site during the 2015

blooming season document that these species are present, but provide only an estimate of the size of the populations because these species are annuals and individual numbers can vary from year to year. Maximum numbers would likely be present only during years when environmental conditions are optimal. Both these plants are CRPR 1B species, and impacting the populations on the project site could be a significant impact unless mitigated.

Mitigation Measure BIO-4: Thirty-one percent of the area (1,253 square feet) occupied by two-carpellate flax will be preserved. To mitigate for the plants that will be impacted, seeds will be collected from small-flowered calycadenia and two-carpellate western flax on the project site and scattered in suitable habitat within the preserved areas. Replacement will be at a minimum 1:1 ratio (mitigated: impacted). Seeded areas will be monitored as a part of the monitoring plan outlined below.

Before vegetation clearing on the project site, a detailed small-flowered calycadenia and two-carpellate western flax mitigation and monitoring plan will be prepared by a qualified botanist/biologist. The plan will include details on seed collection and propagation, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-5: The proposed vineyard blocks, access roads, and turnarounds could result in the loss of a small number of Napa lomatium, a CRPR 4 species. Clearing for proposed vineyard blocks would result in the loss of approximately 10 individuals of Napa lomatium. Plant species with a CRPR of 4 are of limited distribution or infrequent throughout a broader area in California, but they are not considered "rare" from a statewide perspective, they are considered uncommon enough that their status should be monitored regularly. Impacts to CRPR 4 species are generally not considered significant under CEQA; however, in Napa County impacts to this species would be considered significant.

Mitigation Measure BIO-5: The population of Napa lomatium located on the edge of vineyard block Z19 will be avoided and will be surrounded by a 20-foot buffer (Figure 4). To mitigate for the plants that will be impacted, seeds will be collected from Napa lomatium on the project site and scattered in suitable habitat within the preserved areas. Replacement will be at a minimum 1:1 ratio (mitigated: impacted). Seeded areas will be monitored as a part of the monitoring plan outlined below.

Before vegetation clearing on the project site, a detailed Napa lomatium mitigation and monitoring plan will be prepared by a qualified botanist/biologist. The plan will include details on seed collection and propagation, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success

criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-6: The proposed vineyard blocks, access roads, and turnarounds could result in the loss of approximately 1,893 green monardella, a CRPR 4.3 species. As noted above, plants with a CRPR of 4 are of limited distribution or infrequent throughout a broader area in California, but they are not considered "rare" from a statewide perspective, they are considered uncommon enough that their status should be monitored regularly. Impacts to CRPR 4 species are generally not considered significant under CEQA; however, in Napa County impacts to this species would be considered significant. Given that green monardella is not considered a rare plant and is widely occurring in suitable habitat in Napa, Sonoma, Lake, and Mendocino counties, and approximately 30 percent (814 individuals) of the population on the project will be preserved in the preserved area.

Mitigation Measure BIO-6: To mitigate for the plants that will be impacted, seeds will be collected from green monardella on the project site and scattered in suitable habitat within the preserved areas. Replacement will be at a minimum 1:1 ratio (mitigated: impacted). Seeded areas will be monitored as a part of the monitoring plan outlined below. Additional populations adjacent to vineyard blocks Z19, Z20, and V6 will be avoided (Figure 4); these avoided populations will be surrounded by 20-foot buffer area.

Before vegetation clearing on the project site, a detailed green monardella mitigation and monitoring plan will be prepared by a qualified botanist/biologist. The plan will include details on seed collection and propagation, techniques to avoid the introduction of plant pathogens to the preserved area, preparing the preserved area for planting, revegetation monitoring plan, success criteria, and reporting requirements. After replanting, the preserved area will be monitored for a minimum of 5 years. Annual reports, with interim success criteria to ensure the plan is on track to meet the mitigation goals, will be prepared. After the 5-year monitoring period, a report shall be prepared evaluating the success of the mitigation program and recommending any further actions if necessary. If the success criteria have not been met at the conclusion of the 5-year monitoring period, continued monitoring will be conducted until the success criteria have been achieved. An amount to be negotiated with the County should be designated to fund the mitigation and monitoring effort.

Impact BIO-7: The proposed vineyard blocks could result in the loss of a small number of nodding harmonia, a CRPR 4 species. As noted above, plants with a CRPR of 4 are of limited distribution or infrequent throughout a broader area in California, but they are not considered "rare" from a statewide perspective, they are considered uncommon enough that their status should be monitored regularly. Impacts to CRPR 4 species are generally not considered significant under CEQA; however, in Napa County impacts to this species would be considered significant. LSA observed 338

individuals of this annual species within an approximately 80 square foot area at a single location on the edge of vineyard block X13 the project site during the 2018 surveys (Figure 4).

Mitigation Measure BIO-7: To mitigate for the plants that could be impacted two strategies are available: 1) the proposed boundary of vineyard block X15 could be altered to avoid small area where nodding harmonia occurs, this could be feasible because the small area where this plant occur is at the edge of the proposed vineyard block; 2) the seeds will be collected from nodding harmonia on the project site and scattered in suitable habitat within the preserved areas. Replacement will be at a minimum 1:1 ratio (mitigated: impacted). Seeded areas will be monitored as a part of the monitoring plan outlines in provided in *Mitigation Measure BIO-6*.

The mitigation and monitoring plans for rare plants discussed above in measures Bio-1 through Bio-7 and Bio-11 (see below) could be combined in a single plan addressing all proposed mitigation measures for impacts to rare plants.

Impact BIO-8: Clearing vegetation for the proposed vineyard blocks and access roads could result in impacts to nesting birds protected under the Federal Migratory Bird Treaty Act and the California Fish and Game Code. Development of the proposed vineyards would result in the removal of trees and shrubs and other vegetation that could be used by nesting birds. A number of species of native birds that occur on the project site nest in California bay forest, oak woodland, and chaparral and could use these habitats within the proposed vineyard blocks as nest sites. If vegetation is removed during the nesting season (February 1 to August 31), impacts to nesting birds could occur. Impacts to active bird nests would violate the Migratory Bird Treaty Act and California Fish and Game Code; such impacts would be considered significant unless mitigated.

Mitigation Measure BIO-8: If vegetation removal is scheduled between February 1 and August 31, a qualified biologist[1] will conduct a nest survey of the area where vegetation is to be removed no more than 14 days prior to the scheduled removal. If an active nest is found, a suitable buffer will be established around the nest site and a qualified biologist will monitor the nest at periodic intervals until the young have fledged or it has been determined that the nest has failed. Depending on nesting species and the habitat, buffers for active nests generally range from 25 to 50 feet, but for large raptors can range up to 500 feet. Nest monitoring periods can range from several weeks to months depending on the species. After the monitoring biologist has determined that the nest site is inactive, clearing of vegetation and/or other construction activity can commence in the former buffer area.

Impact BIO-9: Construction of three proposed rocked water crossings and the replacement of an existing culvert in on-site stream courses could result in impacts to potential waters of the United States, waters of the State, and areas within CDFW jurisdiction. The proposed rocked water crossings will require the placement of clean field rock in streambeds within the OHWM; this constitutes the placement of fill in waters of the United States and requires a permit from the Corps under Section 404 of the CWA. In addition, this action requires Water Quality Certification (Section 401 permit) from the RWQCB. The California Department of Fish and Wildlife may also take

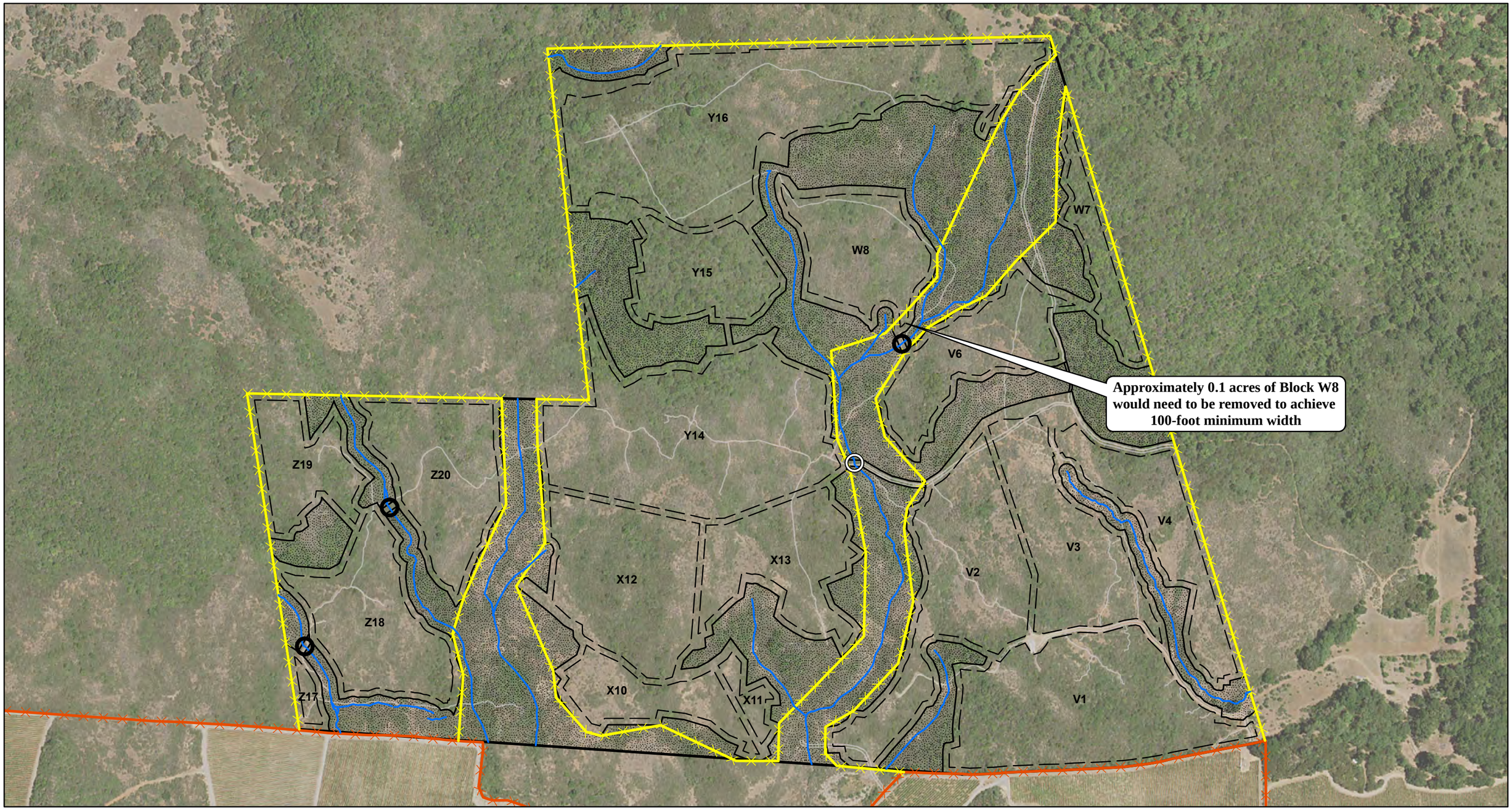
[1] Qualified biologist is defined as a professional biologist with a degree in wildlife biology or biological sciences and who has at least 1 year of experience conducting bird and nest surveys in the region.

jurisdiction over the on-site streams and would thus require a Lake and Streambed Alteration Agreement (Section 1602 permit). The extent of rocked water crossings (square feet) is not known at this time. The existing culvert is part of the streambed and its replacement would require the same suite of permits as required for the rocked water crossings.

Mitigation Measure BIO-9: All necessary permits will be obtained before construction of stream crossings and the culvert replacement and the applicant will comply with all permit minimization and mitigation measures. Impacts to waters of the United States would require a minimum mitigation ratio of 1:1 (mitigated: impacted) to comply with the Corps no net loss policy; however, the RWQCB may require a ratio of 2:1 (mitigated: impacted) or more. During construction of rocked water crossings and culvert replacement, all necessary Best Management Practices (BMP) will be implemented to ensure that no soil or other materials are discharged into the on-site stream courses.

Impact BIO-10: Construction of the proposed project, including deer fences around the project site, could create barriers to local wildlife movements and conflict with General Plan Policy CON-18. Various species of wildlife frequently move through their home ranges along stream courses, canyons, ridges, dirt roads, trails, or other linear landscape features. Prominent ridgelines (especially those that support oak woodland and chaparral cover) would also be important wildlife movement corridors; larger species such as mule deer (*Odocoileus hemionus*) and mountain lions (*Puma concolor*), both known to occur in the project site area, also frequently use human constructed trails and dirt roads for movement. Riparian corridors are also frequently important for wildlife movement because they often provide dense areas of vegetation traversing otherwise open or developed landscapes. Additionally, riparian corridors often provide a source of surface water for wildlife. The stream courses within the project site, however, are not expected to be regionally important in this regard, because they do not traverse an otherwise open or developed landscape, they support vegetation (i.e., chaparral) that is similar to surrounding areas, and they lack surface water for most of the year. Deer fencing around the project site and/or vineyard blocks could restrict non-target wildlife movement through the area such as raccoons, gray foxes, and other small to medium-sized mammals.

Mitigation Measure BIO-10: Prior to approval, the deer fence alignments on the project site will be constructed to minimize barriers to wildlife movement (with the exception of deer and wild pigs into the project site). Deer fencing around the project site will be constructed with a ground level mesh large enough to allow for the free movement of mid-sized to small animals. Vineyard fencing designated as “17/96” with 6-inch square openings at ground level will be substituted for standard “20/96” fencing with 3-inch high openings at ground level to facilitate wildlife movement (other than deer and or wild pigs) through the project site. Areas within the project site, where disturbance to existing vegetation will be minimized or preserved (Figure 5), could thus be accessed by mid-sized and smaller wildlife. This would reduce potential negative effects of the proposed deer fences on movement of smaller animals while effectively excluding deer and wild pigs from vineyards. Additionally, the proposed corridors between fenced vineyard clusters will be a minimum of 100 feet wide along their entire length (Figure 6), facilitating the movement of larger mammals through the area.



LSA

LEGEND

Property Boundary

Potential Waters of the United States

Project Features

V1 Proposed Clearing Limits

Proposed Block Boundary

Areas to be Preserved

Culvert Replacement

Rocked Water Crossing

Existing Deer Fence

Proposed Deer Fence

0 175 350

FEET

SOURCE: USDA NAIP (2014).

I:\PPI1801\GIS\Maps\Bio Report 2018\Figure 6_Existing and Proposed Deer Fence.mxd (10/25/2018)

FIGURE 6

Stagecoach North
Napa County, California

Existing and Proposed Deer Fence

Impact BIO-11: Clearing black oak forest for the proposed vineyard blocks, access roads, and turnarounds would result in the loss of 0.74 acres of this community and would conflict with the General Plan Policy CON-19. Impacting 0.74 acres of black oak forest is considered a significant impact unless mitigated.

Mitigation Measure BIO-11: To reduce the proposed project impacts on black oak forest to a less than significant level, two strategies can be employed:

- Avoidance: LSA mapped the exact extent of black oak occurrences on the project site (Figure 2). If these areas can be preserved and placed under a deed restriction, impacts on black oak forest would be reduced to a less than significant level.

- Compensatory Mitigation: Within the 53.95-acre preserved area (see Mitigation Measure BIO-1), black oaks could be planted in a density similar to that occurring in the black oak forest mapped on the project site (Figure 2). This could be accomplished in a similar manner as suggested for holly-leaved ceanothus by "opening up" the chaparral in the preserved areas by selective thinning and planting black oak in these areas. To the greatest extent feasible, black oak should be planted in areas with similar habitat conditions as currently existing black oak forest.

LIST OF PREPARERS

LSA

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Tim Milliken, Senior Botanist/Certified Arborist/Bryologist/Lichenologist
Bernhard Warzecha, Senior Biologist/Ecologist

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APPENDIX A

USFWS, CNDDB, AND CNPS SPECIES LISTS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To:
Consultation Code: 08ESMF00-2017-SLI-0382
Event Code: 08ESMF00-2019-E-00341
Project Name: Stagecoach North

October 16, 2018

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2017-SLI-0382

Event Code: 08ESMF00-2019-E-00341

Project Name: Stagecoach North

Project Type: AGRICULTURE

Project Description: Vineyard development

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/38.464409300363826N122.31226631283604W



Counties: Napa, CA

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Northern Spotted Owl *Strix occidentalis caurina* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1123	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Crustaceans

NAME	STATUS
California Freshwater Shrimp *Syncaris pacifica* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7903	Endangered
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered

Flowering Plants

NAME	STATUS
Contra Costa Goldfields *Lasthenia conjugens* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7058	Endangered
Few-flowered Navarretia *Navarretia leucocephala ssp. pauciflora (=N. pauciflora)* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8242	Endangered
Sebastopol Meadowfoam *Limnanthes vinculans* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/404	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Selected Elements by Element Code

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS Yountville (3812243) AND Taxonomic Group IS Fish OR Amphibians OR Reptiles OR Birds OR Mammals OR Mollusks OR Arachnids OR Crustaceans OR Insects OR Ferns OR Gymnosperms OR Monocots OR Dicots OR Lichens OR Bryophytes OR Fungi AND Communities IS Dune OR Herbaceous OR Marsh OR Riparian OR Woodland OR Forest OR Alpine OR Inland Waters OR Marine OR Estuarine OR Riverine OR Palustrine.

Your query returned 23 elements; 1 amphibian, 5 birds, 1 mammal, 1 reptile, 1 insect, and 14 plants.

Element Code	Species	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
AAABH01050	***Rana boylii*** foothill yellow-legged frog	None	Candidate Threatened	G3	S3	SSC
ABNFD01020	***Phalacrocorax auritus*** double-crested cormorant	None	None	G5	S4	WL
ABNGA04010	***Ardea herodias*** great blue heron	None	None	G5	S4	
ABNGA04040	***Ardea alba*** great egret	None	None	G5	S4	
ABNKC06010	***Elanus leucurus*** white-tailed kite	None	None	G5	S3S4	FP
ABNKC10010	***Haliaeetus leucocephalus*** bald eagle	Delisted	Endangered	G5	S3	FP
AMACC10010	***Antrozous pallidus*** pallid bat	None	None	G5	S3	SSC
ARAAD02030	***Emys marmorata*** western pond turtle	None	None	G3G4	S3	SSC
IIHYM24380	***Bombus caliginosus*** obscure bumble bee	None	None	G4?	S1S2	
PDAPI0Z130	***Eryngium jepsonii*** Jepson's coyote-thistle	None	None	G2	S2	1B.2
PDAST3M5G0	***Erigeron greenei*** Greene's narrow-leaved daisy	None	None	G3	S3	1B.2
PDBRA2G510	***Streptanthus hesperidis*** green jewelflower	None	None	G2	S2	1B.2
PDCAM060C0	***Downingia pusilla*** dwarf downingia	None	None	GU	S2	2B.2
PDLAM220H0	***Trichostema ruygtii*** Napa bluecurls	None	None	G1G2	S1S2	1B.2
PDLIM02090	***Limnanthes vinculans*** Sebastopol meadowfoam	Endangered	Endangered	G1	S1	1B.1
PDLIN010E0	***Hesperolinon sharsmithiae*** Sharsmith's western flax	None	None	G2Q	S2	1B.2
PDPLM09140	***Leptosiphon jepsonii*** Jepson's leptosiphon	None	None	G3	S3	1B.2

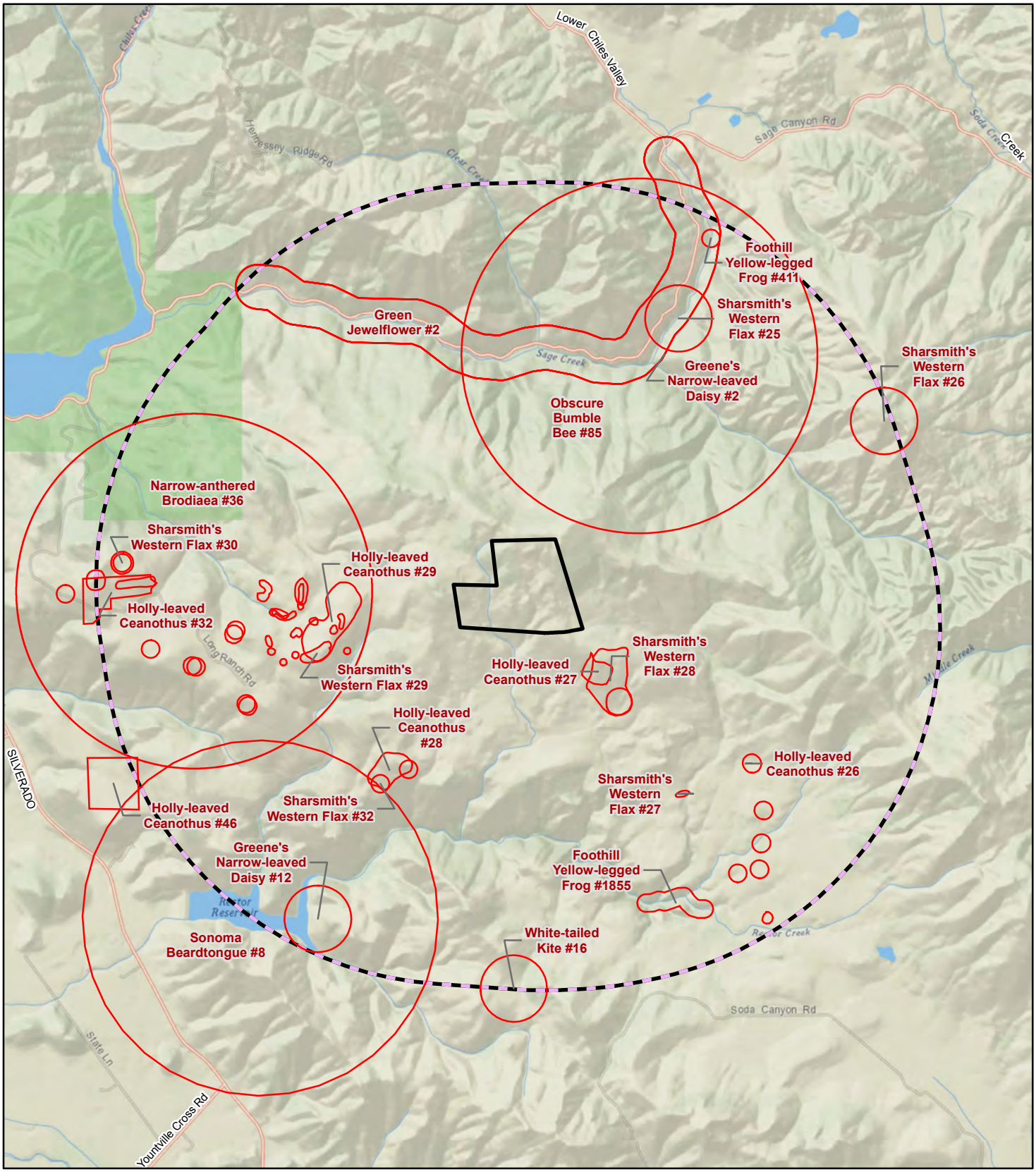
Selected Elements by Element Code

California Department of Fish and Wildlife

California Natural Diversity Database

Element Code	Species	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
PDPLM0C0E4	***Navarretia leucocephala ssp. pauciflora*** few-flowered navarretia	Endangered	Threatened	G4T1	S1	1B.1
PDRHA04160	***Ceanothus purpureus*** holly-leaved ceanothus	None	None	G2	S2	1B.2
PDSCR0D404	***Castilleja ambigua var. meadii*** Mead's owls-clover	None	None	G4T1	S1	1B.1
PDSCR1L483	***Penstemon newberryi var. sonomensis*** Sonoma beardtongue	None	None	G4T2	S2	1B.3
PMALI040Q0	***Sagittaria sanfordii*** Sanford's arrowhead	None	None	G3	S3	1B.2
PMLIL0C022	***Brodiaea leptandra*** narrow-anthered brodiaea	None	None	G3?	S3?	1B.2

Record Count: 23



LSA

FIGURE 1

N

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SOURCE: CDFW CNDDB (10/2018).

I:\PPI1801\GIS\Maps\CNDDB\CNDDB Occurrences within 2 miles (Oct 2018).mxd (10/26/2018)

Stagecoach North
Napa County, California
CNDDB Occurrences within 2 Miles

CNPS California Native Plant Society

Plant List

25 matches found. *Click on scientific name for details*

Search Criteria
California Rare Plant Rank is one of [1A, 1B, 2A, 2B, 3, 4], Found in Napa County, Found in Quad 3812243

Modify Search Criteria | Export to Excel | Modify Columns | Modify Sort | Display Photos

Scientific Name	Common Name	Family	Lifeform	Blooming Period	CA Rare Plant Rank	State Rank	Global Rank
Astragalus clevelandii	Cleveland's milk-vetch	Fabaceae	perennial herb	Jun-Sep	4.3	S4	G4
Brodiaea leptandra	narrow-anthered brodiaea	Themidaceae	perennial bulbiferous herb	May-Jul	1B.2	S3?	G3?
Calycadenia micrantha	small-flowered calycadenia	Asteraceae	annual herb	Jun-Sep	1B.2	S2	G2
Castilleja ambigua var. ambigua	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	Mar-Aug	4.2	S4	G4T5
Castilleja ambigua var. meadii	Mead's owl's-clover	Orobanchaceae	annual herb (hemiparasitic)	Apr-May	1B.1	S1	G4T1
Ceanothus purpureus	holly-leaved ceanothus	Rhamnaceae	perennial evergreen shrub	Feb-Jun	1B.2	S2	G2
Clarkia gracilis ssp. tracyi	Tracy's clarkia	Onagraceae	annual herb	Apr-Jul	4.2	S3	G5T3
Downingia pusilla	dwarf downingia	Campanulaceae	annual herb	Mar-May	2B.2	S2	GU
Erigeron greenei	Greene's narrow-leaved daisy	Asteraceae	perennial herb	May-Sep	1B.2	S3	G3
Eryngium jepsonii	Jepson's coyote thistle	Apiaceae	perennial herb	Apr-Aug	1B.2	S2?	G2?
Harmonia nutans	nodding harmonia	Asteraceae	annual herb	Mar-May	4.3	S3	G3
Hesperolinon bicarpellatum	two-carpellate western flax	Linaceae	annual herb	May-Jul	1B.2	S2	G2
Hesperolinon sharsmithiae	Sharsmith's western flax	Linaceae	annual herb	May-Jul	1B.2	S2	G2Q
Leptosiphon jepsonii	Jepson's leptosiphon	Polemoniaceae	annual herb	Mar-May	1B.2	S3	G3
Leptosiphon latisectus	broad-lobed leptosiphon	Polemoniaceae	annual herb	Apr-Jun	4.3	S4	G4
Limnanthes vinculans	Sebastopol meadowfoam	Limnanthaceae	annual herb	Apr-May	1B.1	S1	G1
Lomatium repostum	Napa lomatium	Apiaceae	perennial herb	Mar-Jun	4.3	S3	G3
Micropus amphibolus	Mt. Diablo cottonweed	Asteraceae	annual herb	Mar-May	3.2	S3S4	G3G4
Monardella viridis	green monardella	Lamiaceae	perennial rhizomatous herb	Jun-Sep	4.3	S3	G3
Navarretia leucocephala ssp. pauciflora	few-flowered navarretia	Polemoniaceae	annual herb	May-Jun	1B.1	S1	G4T1

Penstemon newberryi var. sonomensis	Sonoma beardtongue	Plantaginaceae	perennial herb	Apr-Aug	1B.3	S2	G4T2
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb (aquatic)	Feb-May	4.2	S3	G4
Sagittaria sanfordii	Sanford's arrowhead	Alismataceae	perennial rhizomatous herb (emergent)	May-Oct(Nov)	1B.2	S3	G3
Streptanthus hesperidis	green jewelflower	Brassicaceae	annual herb	May-Jul	1B.2	S2	G2
Trichostema ruygtii	Napa bluecurls	Lamiaceae	annual herb	Jun-Oct	1B.2	S1S2	G1G2

Suggested Citation

California Native Plant Society, Rare Plant Program. 2018. Inventory of Rare and Endangered Plants of California (online edition, v8-03 0.39). Website http://www.rareplants.cnps.org [accessed 31 October 2018].

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Questions and Comments
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APPENDIX B

PLANT AND ANIMAL LISTS

Plant Species Observed on the Stagecoach North Vineyard Project Site, Napa County, California

Scientific Name	Common Name	Native/Alien Species
LYCOPHYTES		
SELAGINELLACEAE	SPIKEMOSS FAMILY	
Selaginella bigelovii	Bigelow's moss fern	native
FERNS		
POLYPODIACEAE	POLYPODY FAMILY	
Polypodium californicum	California polypody	native
PTERIDACEAE	BRAKE FAMILY	
Myriopteris covillei	Coville's lip fern	native
Pellaea andromedifolia	Coffee fern	native
Pellaea mucronata var. *mucronata*	Bird's-foot fern	native
Pentagramma triangularis	Gold-back fern	native
GYMNOSPERMS		
PINACEAE	PINE FAMILY	
Pinus attenuata	Knobcone pine	native
MAGNOLIIDS		
LAURACEAE	LAUREL FAMILY	
Umbellularia californica	California laurel	native
EUDICOTS		
ANACARDIACEAE	SUMAC/CASHEW FAMILY	
Rhus aromatica	Fragrant sumac	native
Toxicodendron diversilobum	Poison oak	native
APIACEAE	CARROT FAMILY	
Daucus pusillus	America wild carrot	native
Lomatium dasycarpum	Wooly fruited lomatium	native
Lomatium repostum	Napa lomatium	native
Perideridia kelloggii	Kellogg's yampah	native
Sanicula arctopoides	Footsteps of spring	native
Sanicula bipinnatifida	Purple sanicle	native
Sanicula crassicaulis	Wood sanicle	native
Sanicula tuberosa	Skullcap	native
Torilis arvensis	Torilis	alien*
Yabea microcarpa	False carrot	native
ASTERACEAE	SUNFLOWER FAMILY	
Achillea millefolium	Common yarrow	native
Agoseris grandiflora	Mountain dandelion	native
Agoseris heterophylla	Annual mountain dandelion	native
Baccharis pilularis	Coyote brush	native
Calycadenia micrantha	Small-flowered calycadenia	native
Calycadenia truncata	Rosinweed	native
Carduus pycnocephalus	Italian thistle	alien*
Centaurea melitensis	Tocalote	alien*
Centaurea solstitialis	Yellow star-thistle	alien*
Cirsium occidentale var. *occidentale*	Cobweb thistle	native
Ericameria arborescens	Golden fleece	native
Eriophyllum lanatum var. *achilleoides*	Yarrow leaved wooly sunflower	native

Scientific Name	Common Name	Native/Alien Species
Eurybia radulina	Rough leaved aster	native
Grindelia hirsutula	Gumplant	native
Harmonia nutans	Nodding harmonia	native
Helianthella californica	California helianthella	native
Hesperevax sparsiflora	Few flowered evax	native
Hypochaeris glabra	Smooth cat's ears	alien*
Logfia gallica	Narrow-leaves cottonrose	alien
Madia exigua	Little tarweed	native
Madia gracilis	Gumweed	native
Micropus californicus	Slender cottonweed	native
Pseudognaphalium beneolens	Cudweed	native
Pseudognaphalium canescens	Wright's cudweed	native
Pseudognaphalium luteoalbum	Weedy cudweed	alien
Senecio aronicoides	Rayless ragwort	native
Senecio vulgaris	Common groundsel	alien
Sonchus asper var. *asper*	Prickly sow thistle	alien
Uropappus lindleyi	Silverpuffs	native
Wyethia glabra	Smooth mule's ears	native
BORAGINACEAE	BORAGE FAMILY	
Cynoglossum grande	Pacific hound's tongue	native
Eriodictyon californicum	California yerba santa	native
Nemophila heterophylla	White nemophila	native
Phacelia distans	Common phacelia	native
Phacelia imbricata	Imbricate phacelia	native
Plagiobothrys nothofulvus	Rusty haired popcorn flower	native
BRASSICACEAE	MUSTARD FAMILY	
Cardamine oligosperma	Bitter-cress	native
Thysanocarpus curvipes	Fringe pod	native
Thysanocarpus radians	Showy fringe pod	native
CAMPANULACEAE	BELLFLOWER FAMILY	
Heterocodon rariflorum	Western pear flower	native
CAPRIFOLIACEAE	HONEYSUCKLE FAMILY	
Lonicera interrupta	Chaparral honeysuckle	native
CARYOPHYLLACEAE	PINK FAMILY	
Petrorhagia prolifera	Childing pink	alien
Silene gallica	Windmill pink	alien
Silene laciniata subsp. *californica*	California Indian pink	native
Stellaria pallida	Pale starwort	native
CISTACEAE	ROCK ROSE FAMILY	
Crocanthemum scoparium	Peak rush-rose	native
CONVOLVULACEAE	MORNING GLORY	
Cuscuta californica	California dodder	native
CUCURBITACEAE	GOURD FAMILY	
Marah fabacea	Wild cucumber	native
CRASSULACEAE	STONECROP FAMILY	
Crassula connata	Sand pigmyweed	native
ERICACEAE	HEATH FAMILY	
Arbutus menziesii	Pacific madrone	native
Arctostaphylos glandulosa subsp. *glandulosa*	Eastwood's manzanita	native
Arctostaphylos manzanita subsp. *manzanita*	White leaf manzanita	native

Scientific Name	Common Name	Native/Alien Species
EUPHORBIACEAE	SPURGE FAMILY	
Croton setigerus	Turkey-mullein	native
Euphorbia peplus	Petty spurge	alien
FABACEAE	LEGUME FAMILY	
Acmispon brachycarpus	Short podded lotus	native
Acmispon glaber	Deerweed	native
Acmispon parviflorus	Small flowered lotus	native
Acmispon wrangelianus	Chilean trefoil	native
Hoita orbicularis	Creeping leather root	native
Lathyrus vestitus	Pacific pea	native
Lupinus bicolor	Sky lupine	native
Medicago lupulina	Black medick	alien
Pickeringia montana var. *montana*	Chaparral pea	native
Rupertia physodes	California tea	native
Trifolium albopurpureum	Indian clover	native
Trifolium ciliolatum	Tree clover	native
Trifolium depauperatum var. *truncatum*	Truncate sack clover	native
Trifolium dubium	Little hop clover	alien
Trifolium hirtum	Rose clover	alien*
Trifolium microcephalum	Small-head clover	native
Trifolium microdon	Thimble clover	native
Trifolium willdenovii	Tomcat clover	native
Vicia sativa	Spring vetch	alien
Vicia villosa	Hairy vetch	alien
FAGACEAE	OAK FAMILY	
Quercus agrifolia	Coast live oak	native
Quercus berberidifolia	Scrub oak	native
Quercus durata var. *durata*	Leather oak	native
Quercus chrysolepis	Canyon live oak	native
Quercus kelloggii	California black oak	native
Quercus wislizeni var. *wislizeni*	Interior live oak	native
GARRYACEAE	SILK TASSEL FAMILY	
Garrya fremontii	Fremont's silk tassel	native
GERANIACEAE	GERANIUM FAMILY	
Erodium botrys	Long beaked filaree	alien
Erodium cicutarium	Redstem filaree	alien*
Geranium molle	Woodland geranium	alien
HYPERICACEAE	ST. JOHN'S-WORT FAMILY	
Hypericum concinnum	Gold-wire	native
LAMIACEAE	MINT FAMILY	
Clinopodium douglasii	Yerba buena	native
Monardella viridis	Green monardella	native
Salvia sonomensis	Sonoma sage	native
Scutellaria siphocampyloides	Curve flowered skullcap	native
Scutellaria tuberosa	Dannie's skullcap	native
Stachys rigida var. *quercetorum*	Rough hedge-nettle	native
Trichostema laxum	Turpentine weed	native
LINACEAE	FLAX FAMILY	
Hesperolinon bicarpellatum	Two-carpellate western flax	native
MALVACEAE	MALLOW FAMILY	
Sidalcea diploscypha	Fringed checkerbloom	native

Scientific Name	Common Name	Native/Alien Species
MONTIACEAE	MINER'S LETTUCE FAMILY	
Claytonia parviflora	Miner's lettuce	native
MYRSINACEAE	MYRSINE FAMULY	
Lysimachia arvensis	Scarlet pimpernel	alien
ONAGRACEAE	EVENING PRIMROSE FAMILY	
Clarkia purpurea subsp. *quadrivulnera*	Winecup clarkia	native
OROBANCHACEAE	BROOMRAPE FAMILY	
Castilleja attenuata	Valley tassels	native
Castilleja foliolosa	Wooly paintbrush	native
Orobanche bulbosa	Chaparral broomrape	native
Orobanche fasciculata	Pinyon broomrape	native
PAPAVERACEAE	POPPY FAMILY	
Dendromecon rigida	Bush poppy	native
Eschscholzia californica	California poppy	native
PHRYMACEAE	LOPSEED FAMILY	
Mimulus aurantiacus	Bush monkey flower	native
Mimulus guttatus	Monkey flower	native
PLANTAGINACEAE	PLANTAIN FAMILY	
Penstemon heterophyllus	Bunchleaf penstemon	native
Plantago erecta	Foothill plantain	native
POLEMONIACEAE	PHLOX FAMILY	
Leptosiphon ciliatus	Whisker brush	native
Leptosiphon parviflorus	Variable linanthus	native
Navarretia heterodoxa	Calistoga navarretia	native
POLYGALACEAE	MILKWORT FAMILY	
Polygala californica	California milkwort	native
POLYGONACEAE	BUCKWHEAT FAMILY	
Chorizanthe polygonoides	Knotweed spineflower	native
PRIMULACEAE	PRIMROSE FAMILY	
Primula hendersonii	Mosquito bill	native
RANUNCULACEAE	BUTTERCUP FAMILY	
Clematis lasiantha	Chaparral clematis	native
Delphinium sp. (not *D. uliginosum*)	Delphinium	native
Ranunculus californicus	California buttercup	native
RHAMNACEAE	BUCKTHORN FAMILY	
Frangula californica ssp. *tomentella*	Hoary coffee berry	native
Ceanothus cuneatus var. *cuneatus*	Buckbrush	native
Ceanothus foliosus var. *foliosus*	Wavyleaf ceanothus	native
Ceanothus purpureus	Holly-leaved ceanothus	native
Rhamnus crocea	Red berry buckthorn	native
ROSACEAE	ROSE FAMILY	
Adenostoma fasciculatum	Chamise	native
Aphanes occidentalis	Western lady's mantle	native
Cercocarpus betuloides	Birch leaf mountain mahogany	native
Heteromeles arbutifolia	Toyon	native
RUBIACEAE	MADDER FAMILY	
Galium parisiense	Wall bedstraw	alien
Galium porrigens var. *porrigens*	Climbing bedstraw	native
Sherardia arvensis	Field madder	alien
VIOLACEAE	VIOLET FAMILY	
Viola purpurea	Mountain violet	native

Scientific Name	Common Name	Native/Alien Species
MONOCOTS		
AGAVACEAE	AGAVE FAMILY	
Chlorogalum pomeridianum	Soap plant	native
ALLIACEAE	ONION FAMILY	
Allium amplectens	Narrow leaved onion	native
Allium peninsulare var. *franciscanum*	Franciscan onion	native
AMARYLLIDACEAE	AMARYLLIS FAMILY	
Amaryllis belladonna	Belladonna lily	alien
IRIDACEAE	IRIS FAMILY	
Iris douglasiana	Douglas iris	native
Sisyrinchium bellum	Blue eyed grass	native
JUNCACEAE	RUSH FAMILY	
Juncus balticus subsp. *ater*	Baltic rush	native
Juncus bufonius	Toad rush	native
LILIACEAE	LILY FAMILY	
Calochortus argillosus	Clay Mariposa lily	native
Calochortus amabilis	Golden globe lily	native
Fritillaria recurva	Scarlet fritillary	native
MELANTHIACEAE	FALSE HELLEBORE FAMILY	
Toxicoscordion venenosum var. *venenosum*	Meadow death camas	native
ORCHIDACEAE	ORCHID FAMILY	
Piperia transversa	Flat spurred piperia	native
TECOPHILACEAE	TECOPHILAEA FAMILY	
Odontostomum hartwegii	Hartweg's doll's lily	native
THEMIDACEAE	BRODIAEA FAMILY	
Brodiaea leptandra	Narrow-flowered brodiaea	native
Brodiaea elegans	Harvest brodiaea	native
Dichelostemma capitatum	Blue dicks	native
Dichelostemma congestum	Ookow	native
POACEAE	GRASS FAMILY	
Aira caryophyllea	Silver hair grass	alien
Avena barbata	Slender wild oat	alien*
Avena fatua	Common wild oat	alien*
Brachypodium distachyon	False brome	alien*
Briza maxima	Rattlesnake grass	alien*
Briza minor	Little quaking grass	alien
Bromus carinatus	California brome	native
Bromus caroli-henrici	Weedy brome	alien
Bromus diandrus	Ripgut brome	alien*
Bromus hordeaceus	Soft chess	alien*
Bromus madritensis	Foxtail chess	alien*
Cynosurus echinatus	Bristly dogtail grass	alien*
Elymus caput-medusae	Medusa head	alien*
Elymus glaucus	Blue wildrye	native
Festuca bromoides	Brome fescue	alien
Festuca californica	California fescue	native
Festuca microstachys	Small fescue	native
Festuca rubra	Red fescue	native
Gastridium phleoides	Nit grass	alien
Koeleria macrantha	June grass	native
Melica californica	California melic	native

Scientific Name	Common Name	Native/Alien Species
Melica torreyana	Torrey's melic	native
Stipa lepida	Foothill needlegrass	native

* Invasive plant species (Baldwin et al. 2012).

Animal Species Observed on the Stagecoach North Vineyard Project Site, Napa County, California

LSA biologists observed or detected the sign (tracks, scat, nests, burrows, etc.) of the following vertebrate animal (wildlife) species on the project site.

Common Name	Scientific Name	Presumed Seasonal Occurrence/Nesting Codes[1]
Amphibians		
Pacific treefrog	*Hyliola regilla*	R
Reptiles		
Western fence lizard	*Sceloporus occidentalis*	R
Western skink	*Plestiodon skiltonianus*	R
Striped racer	*Coluber lateralis*	R
Birds		
California quail	*Callipepla californica*	R
Band-tailed pigeon	*Patagioenas fasciata*	R
Mourning dove	*Zenaida macroura*	R
Turkey vulture	*Cathartes aura*	R
Cooper's hawk	*Accipiter cooperii*	R
Anna's hummingbird	*Calypte anna*	R
Acorn woodpecker	*Melanerpes formicivorus*	R
Nuttall's woodpecker	*Dryobates nuttallii*	R
Northern flicker	*Colaptes auratus*	R
Pileated woodpecker	*Dryocopus pileatus*	R
Ash-throated flycatcher	*Myiarchus cinerascens*	S
California scrub-jay	*Aphelocoma californica*	R
Common raven	*Corvus corax*	R
Oak titmouse	*Baeolophus inornatus*	R
Bushtit	*Psaltriparus minimus*	R
Bewick's wren	*Thryomanes bewickii*	R
Wrentit	*Chamaea fasciata*	R
Western bluebird	*Sialia mexicana*	R
Hermit thrush	*Catharus guttatus*	W
American robin	*Turdus migratorius*	R/W
Varied thrush	*Ixoreus naevius*	W/T
California thrasher	*Toxostoma redivivum*	R
European starling*	*Sturnus vulgaris*	R
Orange-crowned warbler	*Oreothlypis celata*	M/S
Spotted towhee	*Pipilo maculatus*	R
California towhee	*Melozone crissalis*	R
Dark-eyed junco	*Junco hyemalis*	R
Golden-crowned sparrow	*Zonotrichia atricapilla*	W
Lesser goldfinch	*Spinus psaltria*	R
Mammals		
Black-tailed jackrabbit	*Lepus californicus*	R
Common gray fox	*Urocyon cinereoargenteus*	R (scat)
Mule deer	*Odocoileus hemionus*	R

Common Name	Scientific Name	Presumed Seasonal Occurrence/Nesting Codes[1]
Dusky-footed woodrat	*Neotoma fuscipes*	R
Botta's pocket gopher	*Thomomys bottae*	R
Sonoma chipmunk	*Tamias sonomae*	R

[1] The codes refer to the species' presumed seasonal occurrence on the site and probable breeding/nesting status (breeding was not confirmed in most cases).

M = Migrant: Occurs in the project area for brief periods during migration, primarily during the spring and fall months.
R = Year-round resident: resident/expected to nest/breed in the project area or in the vicinity.
S = Spring/summer resident: May nest in the project area or in the vicinity.
T = Transient: May occur in the project area sporadically, but unlikely to nest or occur regularly.
W = Winter visitor: Regularly present during winter; does not nest locally.
* = Non-native species.

APPENDIX E

CONFIDENTIAL: CULTURAL RESOURCES REPORT

APPENDIX F
NATIVE AMERICAN CORRESPONDENCE

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

Certified Mail

January 29, 2019

Jose Simon III, Chairperson
Middletown Rancheria
P.O. Box 1035
Middletown, CA 95461

Re: Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard, File #P18-00446-ECPA
APN 032-010-086

Dear Mr. Simon,

The Napa County Planning Division is processing a request for an Agricultural Erosion Control Plan (#P18-00446-ECPA) to develop an approximately 116.2-acre vineyard, located at Assessor's Parcel Number 032-010-086 (the parcel does not have a street address). Additional information about the proposal can be viewed online at the Planning, Building and Environmental Services Department's current projects webpage: http://www.countyofnapa.org/PBES/CurrentProjects/

This letter serves as notification to Middletown Rancheria that is traditionally and culturally affiliated with the geographic area of the proposed project pursuant to Public Resources Code 21080.3.1 (Assembly Bill 52). If your tribe wishes to consult on this project, please contact me in writing, within 30 days of receipt of this letter, to request consultation.

If you have any questions, please feel free to contact me by telephone at 707-299-1788 or via email at kyra.purvis@countyofnapa.org.

Sincerely,

Kyra Purvis
Planner II

Enclosure: Historical Resources Study

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

Certified Mail

January 29, 2019

Scott Gabaldon, Tribal Chair/Cultural Resources Manager
Mishewal Wappo Tribe of Alexander Valley
P.O Box 1086
Santa Rosa, CA 95402

Re: Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard, File #P18-00446-ECPA
APN 032-010-086

Dear Mr. Gabaldon,

The Napa County Planning Division is processing a request for an Agricultural Erosion Control Plan (#P18-00445-ECPA) to develop an approximately 116.2-acre vineyard, located at Assessor's Parcel Number 032-010-086 (the parcel does not have a street address). Additional information about the proposal can be viewed online at the Planning, Building and Environmental Services Department's current projects webpage: http://www.countyofnapa.org/PBES/CurrentProjects/

This letter serves as notification to the Mishewal Wappo Tribe of Alexander Valley that is traditionally and culturally affiliated with the geographic area of the proposed project pursuant to Public Resources Code 21080.3.1 (Assembly Bill 52). If your tribe wishes to consult on this project, please contact me in writing, within 30 days of receipt of this letter, to request consultation.

If you have any questions, please feel free to contact me by telephone at 707-299-1788 or via email at kyra.purvis@countyofnapa.org.

Sincerely,

Kyra Purvis
Planner II

Enclosure: Historical Resources Study

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

Certified Mail

January 29, 2019

Marilyn Delgado, Director of Cultural Resources
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

Re: Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard, File #P18-00446-ECPA
APN 032-010-086

Dear Ms. Delgado,

The Napa County Planning Division is processing a request for an Agricultural Erosion Control Plan (#P18-00446-ECPA) to develop an approximately 116.2-acre vineyard, located at Assessor's Parcel Number 032-010-086 (the parcel does not have a street address). Additional information about the proposal can be viewed online at the Planning, Building and Environmental Services Department's current projects webpage: http://www.countyofnapa.org/PBES/CurrentProjects/

This letter serves as notification to the Yocha Dehe Wintun Nation that is traditionally and culturally affiliated with the geographic area of the proposed project pursuant to Public Resources Code 21080.3.1 (Assembly Bill 52). If your tribe wishes to consult on this project, please contact me in writing, within 30 days of receipt of this letter, to request consultation.

If you have any questions, please feel free to contact me by telephone at 707-299-1788 or via email at kyra.purvis@countyofnapa.org.

Sincerely,

Kyra Purvis
Planner II

Enclosure: Historical Resources Study

YOCHA DEHE
CULTURAL RESOURCES

RECEIVED
MAR 01
Napa County Planning, Building
& Environmental Services

February 22, 2019

Napa County
Attn: Kyra Purvis, Planner II
1195 Third Street, Suite 210
Napa, CA 94559

RE: Stagecoach North Vineyard Project

Dear Ms. Purvis:

Thank you for your project notification letter dated, January 29, 2019, regarding cultural information on or near the proposed Stagecoach North Vineyard Project, Rutherford, Napa County. We appreciate your effort to contact us.

The Cultural Resources Department has reviewed the project and concluded that it is not within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we respectively decline any comment on this project. However based on the information provided, please defer correspondence to the following:

Michewal - Wappo Tribe of Alexander Valley
Attn: Scott Gadaldon
2275 Silk Road
Windsor, CA 95492

Middletown Rancheria
Attn: THPO
PO Box 1035
Middletown, CA 95461

Please refer to identification number YD - 02012019-03 in any future correspondence with Yocha Dehe Wintun Nation concerning this project.

Thank you for providing us with this notice and the opportunity to comment.

Sincerely,

Burnam Lowell Sr.

Burnam Lowell, Sr.
Tribal Historic Preservation Officer

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

November 21, 2019

Jose Simon III, Chairperson
Middletown Rancheria
P.O. Box 1035
Middletown CA 95461

Re: Closed Status of Tribal Consultation Invitation
Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard #P18-00446-ECPA
APN 032-010-086

Dear Mr. Simon,

On January 29, 2019, the Napa County Planning Division mailed to you, via certified delivery, notification of an invitation to consult on a pending request for an Agricultural Erosion Control Plan to develop an approximate 116.2 acre vineyard, located at Assessor's Parcel Number 032-010-086, Napa.

More than 30 days have elapsed since your confirmed receipt of the Planning Division's letter of invitation to consult on this proposed project, and staff has not received from you a written response with a request for consultation. Therefore, the Planning Division has concluded that consultation proceedings with your organization will not be initiated for this proposal.

Thank you for your ongoing interest in development projects in Napa County. If you have any questions, please feel free to contact me by telephone at 707-299-1338 or via email at donald.barrella@countyofnapa.org.
Sincerely,

Donald Barrella
Planner III

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

November 21, 2019

Scott Gabaldon
Tribal Chair/Cultural Resources Manager
Mishewal Wappo Tribe of Alexander Valley
P.O. Box 1086
Santa Rosa CA 95402

Re: Closed Status of Tribal Consultation Invitation
Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard #P18-00446-ECPA
APN 032-010-086

Dear Mr. Gabaldon,

On January 29, 2019, the Napa County Planning Division mailed to you, via certified delivery, notification of an invitation to consult on a pending request for an Agricultural Erosion Control Plan to develop an approximate 116.2 acre vineyard, located at Assessor's Parcel Number 032-010-086, Napa.

More than 30 days have elapsed since your confirmed receipt of the Planning Division's letter of invitation to consult on this proposed project, and staff has not received from you a written response with a request for consultation. Therefore, the Planning Division has concluded that consultation proceedings with your organization will not be initiated for this proposal.

Thank you for your ongoing interest in development projects in Napa County. If you have any questions, please feel free to contact me by telephone at 707-299-1338 or via email at donald.barrella@countyofnapa.org.

Sincerely,

Donald Barrella
Planner III

A Tradition of Stewardship
A Commitment to Service

Planning, Building & Environmental Services

1195 Third Street, Suite 210
Napa, CA 94559
www.countyofnapa.org

David Morrison
Director

November 21, 2019

Burnam Lowell, Sr.
Yocha Dehe Wintun Nation
P.O. Box 18
Brooks, CA 95606

Re: Closed Status of Tribal Consultation Invitation
Notification of Proposed Project Pursuant to Public Resources Code 21080.3.1
Stagecoach North Vineyard #P18-00446-ECPA
APN 032-010-086

Dear Mr. Lowell,

Thank you and the Tribe for your response letter dated February 22, on the referenced application (ID# YD-02012019-03). Because consultation has not been requested, and more than 30 days has elapsed since your confirmed receipt of the Planning Division's consultation invitation for this proposed project, the Planning Division has closed the consultation invitation.

Thank you for your ongoing interest in development projects in Napa County. If you have any questions, please feel free to contact me by telephone at 707-299-1338 or via email at donald.barrella@countyofnapa.org.

Sincerely,

Donald Barrella
Planner III

APPENDIX G
GEOTECHNICAL REPORT

GILPIN GEOSCIENCES, INC.
Earthquake & Engineering Geology

MEMORANDUM



To: Cody Corsetti, Jim Bushey, PPI Engineering

From: Lou Gilpin, Gilpin Geosciences, Inc
Date: May 10, 2019

Project: Erosion Control Plan
Stagecoach North, Soda Canyon Road Napa, California

Project No.: 91621.04

Subject: Block V6 Rock Topple Hazard Mitigation

This memorandum summarizes our recommendations for mitigating the rock topple hazards downslope of the prominent rock outcrop south of vineyard Block V6 and upslope of vineyard Blocks V2 and V3, at Stagecoach North. We previously evaluated the slope in a Gilpin Geosciences report dated 7 December 2018 where we recommended "constructing a four-foot-high berm approximately 20' downslope of the rock outcrop." We understand that this lies beyond the limits of the proposed ECP area and we present our revised recommendations in this memorandum.

The rock outcrop lies just south of proposed vineyard Block V6 and approximately 100 feet upslope of vineyard Block V2 and V3. We recommend placing a line of closely spaced boulder debris at the upslope edge of the vineyard Blocks V2 and V3 to arrest any rock blocks toppling out of the outcrop. The boulders should be a minimum of 3-feet in diameter, and placed overlapping, or as close as possible, given their shapes. Alternatively, a 4-feet high by 8 feet-wide berm can be constructed, consisting of smaller diameter rock debris consisting of minimum 3-4-inch diamter material.

We trust this memorandum provides you with the information you require at this time. If you have any questions or need additional information regarding this memorandum, please call or email.

Gilpin Geosciences, Inc
Earthquake & Engineering Geology

December 7, 2018
91621.04

Annalee Sanborn
PPI Engineering, Inc.
2800 Jefferson Street
Napa, CA 94558

Subject: Engineering Geological and Geotechnical Evaluation
Stagecoach North Vineyards
Soda Canyon Road
Napa, California

Dear Ms. Sanborn:

We are pleased to submit our engineering geological and geotechnical evaluation for the "Stagecoach North Vineyards Track I Erosion Control Plan" PPI Engineering has prepared. As engineering geologist for Langan Treadwell Rollo (Langan), we previously prepared a geologic and geotechnical report for a previous version of the ECP, dated 29 January 2016. This evaluation updates the Langan report and supplements the new erosion control plan to satisfy the County-required landslide evaluation/geotechnical reporting per County Code section F 18.108.027 - Sensitive Domestic Water Supply Drainages.

We understand that Stagecoach North contains approximately 91.3 net acres of undeveloped land proposed for vineyards (Figure 1). The new vineyard development is planned for the south-facing slopes of the Vaca Mountains between Sage and Rector Canyon drainages. The proposed vineyard areas extend up the slopes to near the ridgeline.

SCOPE OF SERVICES

The objective of our consultation is to provide you with information regarding the slope stability and geologic hazards associated with the site and the proposed vineyard

improvements. We understand our evaluation will be used for both the erosion control plan as well as the preparation of an Environmental Impact Report (EIR). We have completed the following phases and tasks according to our proposal dated 23 April 2018:

1. Researched and reviewed available publications and reports regarding the geologic conditions in the site vicinity;
2. Reviewed available historical aerial photographs of the site to identify geological hazards that may be associated with slopes such as landslides, past grading, or other surface conditions that may impact the proposed vineyard development;
3. Performed a geological reconnaissance of the site to document current site conditions;
4. Performed geological analyses and constructed cross sections to evaluate slope conditions at the proposed vineyard blocks
5. Reviewed the PPI Engineering, Inc. Erosion Control Plan; and,
6. Summarized our findings, conclusions, and preliminary recommendations in a letter report for your use.

REGIONAL GEOLOGY

The project site is located within the Coast Range Physiographic Province of California which is characterized by northwest – southeast trending ridges and valleys. These ridges and valleys are structurally controlled by the San Andreas Fault system which accommodates shearing between the North American the Pacific Plates. The study site is underlain at depth by the Franciscan Formation basement rocks, a sequence of sheared and deformed sandstone and shale mixed with remnants of the oceanic crust from the collision between the ancient Farallon and North American Plates over 25 million years ago. Overlying the Franciscan Complex are Tertiary and Quaternary sedimentary and volcanic rocks.

The bedrock in the site vicinity is mapped as Sonoma Volcanics (Bezore et al., 2005). This unit is characterized by andesitic and basaltic volcanic flows that trend northeast and dip steeply to the north and south. Surficial deposits mapped on the site include landslides along the southeastern portion of the site (Figure 2) and young (Quaternary, 2 million years old to present) colluvium and alluvium within drainage channels and low relief

topographic zones.

The regional geologic map (Bezore et al., 2005) shows one of three landslide deposits on the southeastern edge of the site (Figure 2). Aerial photo analysis by Dwyer et al. (1976) mapped two questionable debris flows in the same vicinity. Based on our site reconnaissance, the landslides mapped by Dwyer et al. (1976) do not occur on the subject site. The California LIDAR imagery of the Napa watershed highlights the landslides east of the site as shown on Figure 4.

The soil mapped at the site is the Sobrante Loam, occurring on 5-30% slope, that is described as developing on sandstone (USDA, 1978). However, andesitic bedrock is mapped on the site which suggests the soils on the site may be better characterized by the Kidd series soil.

SEISMICITY AND SEISMIC HAZARDS

The major active faults in the area include the Hayward, Maacama, Green Valley, Rodgers Creek and San Andreas faults. For these and other active faults within a 50-kilometer radius of the site, the distance from the site and estimated mean characteristic Moment magnitude are [2007 Working Group on California Earthquake Probabilities (WGCEP) (USGS 2008) and Cao et al. (2003)] summarized in Table 1.

Table 1
Major Faults within 50 Kilometers (31 Miles) of the Site

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude
West Napa	8	Southwest	6.7
Hunting Creek – Berryessa	8	East	7.1
Green Valley	15	Southeast	6.8
Rodgers Creek	30.5	West	7.07
Total Hayward – Rodgers Creek	30.5	West	7.33
Great Valley 3	34	Northeast	6.9

Fault Segment	Approx. Distance from fault (km)	Direction from Site	Mean Characteristic Moment Magnitude
Maacama - Garberville	35	Wes	7.4
Great Valley 5	35.6	Southeast	6.7
Total Hayward	44	South	7.0
Collayomi	47.4	Northwest	6.7

The U.S. Geological Survey's 2014 Working Group on California Earthquake Probabilities (2013) has compiled the earthquake fault research for the San Francisco Bay area in order to estimate the probability of fault segment rupture. They have determined that the overall probability of moment magnitude 6.7 or greater earthquake occurring in the San Francisco Region during the next 30 years (starting from 2014) is 72 percent. The highest probabilities are assigned to the Hayward fault, Calaveras fault, and the northern segment of the San Andreas fault. These probabilities are 14.3, 7.4, and 6.4 percent, respectively.

Active faults have been mapped in the vicinity. The closest active faults to the site are the West Napa and Hunting Creek - Berryessa faults approximately 8 kilometers southwest and east of the site, respectively. The West Napa fault is classified as a type B fault by the UBC (ICBO, 1988) and is capable of generating a Moment Magnitude 6.7 earthquake. Other active faults in the vicinity of the site are listed in Table 1. The Hunting Creek – Berryessa fault is classified as a type B fault by the UBC (ICBO, 1988) and is capable of generating a Moment Magnitude 7.1 earthquake.

Other fault traces have been documented in the site vicinity (Figure 2). Based on the USGS Quaternary Fault and Fold database, there are two unnamed fault lineaments within 0.25 miles of the project site that may be part of the Atlas Peak – Foss Valley Lineament (Bryant and others, 2007). The Atlas Peak – Foss Valley lineament zone is approximately 2 miles wide and may represent a northern extent of the Green Valley Fault (Bryant and others, 2007). No fault traces have been mapped trending toward or on the subject property.

The 2000 Napa Earthquake (M_w 5.2) was centered between Napa and Yountville

approximately 15 km from the site. It produced moderate ground shaking and minor damage in the residential area west of downtown Napa. In 2014, the epicenter of the South Napa earthquake (M_w 6.0) was located approximately 28 km southwest of the site and produced strong to very strong shaking in downtown Napa.

SITE CONDITIONS

We evaluated the site conditions based on aerial photo interpretation (References) and a geological reconnaissance on 20 October 2015. The site is situated just south of a narrow west-northwest trending ridgeline that ranges in elevation from 2180 feet to 1910 feet above sea level (Figure 3). Elevations on the subject property range from 1700 feet to 2100 feet. The entire property consists of approximately 170 acres of undeveloped land with native trees, bushes, and other vegetation. Of this there is a net 91.3 acres of vineyard development proposed.

In general, the project site is a south-facing slope with ephemeral drainages, broad low relief areas and several small knobs where volcanic rock crops out. We mapped alluvium in the throughgoing channels, and colluvium in three small areas where the topography forms benches on the slope (Figures 3 and 5). Slope gradients throughout the property vary from 30% on steeper terrain and 10% on more gentle slopes.

During our geologic site reconnaissance we did not observe any active landsliding on the site (Figure 3). However, prominent rock exposures at locations shown on Figure 3 expose volcanic blocks on a vertical outcrop face that are prone to toppling as the result of normal erosional weathering and when triggered by earthquake shaking. Some existing displaced blocks are evidence of the ongoing process. While published mapping identified landslide hazards on the eastern edge of the site, we determined during field mapping that these features can be attributed to a combination of local volcanic bedrock structure and differential erosion and are unrelated to landsliding. The ridge that forms the top of the feature is defined by a localized increase in the volcanic flow layer inclination (dip) (Figures 3 and 5).

CONCLUSIONS AND RECOMMENDATIONS

Based on our research and review of the site conditions, we conclude development of the vineyard is feasible within the project site. No evidence of deep-seated slope stability issues was noted and we do not anticipate any significant changes to the surface conditions resulting from development of the land for the proposed vineyard.

The rock topple hazard is localized at the eastern edge of the vineyard development and, if it is not removed during vineyard development, it can be mitigated by scaling (removal) of the loose blocks from the steep face of the rock outcrops. Alternatively, if the rock outcrop is excluded from the vineyard development the topple hazard can be mitigated by constructing a four-foot-high berm approximately 20 feet downslope of the rock outcrop. The berm can be composed of rock boulder debris generated from the vineyard grading. A bench should be cut into firm soil or bedrock prior to placement of the rock for the berm. The bench should be 8 to 10 feet wide. Since the rock placed on the bench will be free draining, installation of a subdrain on or below the bench will not be necessary. The initial filling of the bench should be with free-draining coarse material. Any soil accumulated during the vineyard construction should not be placed on the bench surface. Instead, soil should be placed on the surface at more level areas of the disposal area or the vineyard site.

It is recommended that any proposed drainage system for the vineyard incorporates natural drainages and swales, and that runoff is not allowed to concentrate or pond adjacent to the steeper slopes.

The Erosion Control Plan (PPI Engineering, 2018) has proposed construction of 5 detention basins as detailed on Sheets 1 - 11 of the Detention Basin Design and described in the Erosion Control Plan document on pages SP 9 through SP 17 (PPI Engineering, 2018). We concur with the specifications presented with the following additions:

- The project engineering geologist or geotechnical engineer should observe the bottom of the proposed keyways for the 5 detention basin berms.

- The placement of the fill should be subject to field density testing to confirm the fill is compacted to at least 90 percent relative compaction as set forth in the specifications.

- The project engineering geologist should be present to observe final grading of the detention basin 1.5:1 horizontal to vertical upslope cuts to confirm the cut slopes are stable. The cuts vary from 4 to 10 feet in height and are shown on plans for Detention Bansins 2, 3 and 5.

The Erosion Control Plan (PPI Engineering, 2018) has proposed several temporary drainage improvements for the proposed vineyard blocks that include straw mulch and straw wattles. The layout as shown in the plan appears appropriate with respect to the existing surface conditions described in this letter.

Therefore, we find that the vineyard development is feasible based on our engineering geological and geotechnical evaluation and the site has favorable slope stability conditions with low slope inclinations, combined with moderately strong to strong volcanic bedrock underlying the site that will not be adversely affected by the proposed new vineyards.

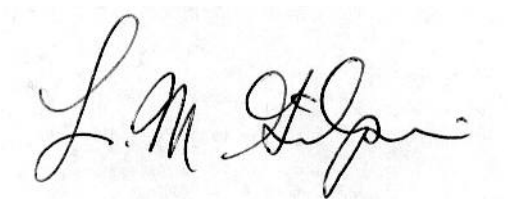
LIMITATIONS

Our services have been performed in accordance with generally accepted principles and practices of the geological and geotechnical engineering profession. This warranty is in lieu of all other warranties, either expressed or implied. In addition, the conclusions and recommendations presented in this report are professional opinions based on the indicated project criteria and data described in this report. They are intended only for the purpose, site location and project indicated.

We trust this letter provides you with the information you require. If you have questions or require additional information, please call or email.

Sincerely yours,

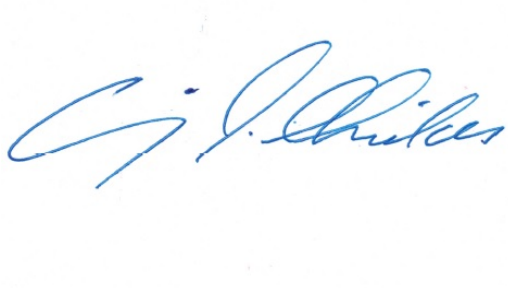
GILPIN GEOSCIENCES, INC.





Lou M. Gilpin
Engineering Geologist EG#1518

ROCKRIDGE GEOTECHNICAL, INC.





Craig S. Shields, P.E., G.E.
Geotechnical Engineer # 2116

Attachments:

REFERENCES

FIGURES

Figure 1 – Site Location Map
Figure 2 – Regional Geology Map
Figure 3 – Site Plan and Geologic Map
Figure 4 – Site Plan on LIDAR Base Map

Figure 5 – Geologic Cross Sections

REFERENCES

Bezore, S.P., Clahan, K.B., Sowers, J.M., and Witter, R.C., 2005, Geologic Map of the Yountville 7.5′ Quadrangle Napa County, California: A Digital Database: California Geological Survey Preliminary Geologic map, scale 1;24,000.

Bryant, W.A., Sander, E.F., and Wills, C.J., 2007, Digital Database for the Concord and Green Valley Faults: U.S. Geological Survey National Earthquake Hazards Reduction Program Final Technical Report No. 05HQGR0029, 7p., 2 Figures, 4 Tables.

Dwyer, M. J., Noguchi, N., and O'Rourke, J., 1976, Reconnaissance photo-interpretation map of landslides in 24 selected 7.5 minute quadrangles in Lake, Napa, Solano, and Sonoma Counties, California: U.S. Geological Survey Open File Report 76-74, St. Helena Quadrangle, scale 1:24,000.

Fox, K.T., Sims, J.D., Bartow, J.A., and Helley, E.J., 1973, Preliminary Geologic map of Eastern Sonoma County and western Napa County, California: U.S. Geological Survey Miscellaneous Field Studies MF-483, scale 1:62500.

International Conference of Building Officials, 1988, Maps of known active fault near-source zones in California and adjacent portions of Nevada: prepared by California Division of Conservation Division of Mines and Geology, p. 19, with maps.

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U.S. Department of Agriculture, 1978, Soil Survey of Napa County, California: U.S. Department of Agriculture Soil Conservation Service, Washington, D.C.

U.S. Geological Survey Working Group, 2013, Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, 97 p., California Geological Survey Special Report 228, and Southern California Earthquake Center Publication 1792, ttp://pubs.usgs.gov/of/2013/1165/.

U.S. Geological Survey, 1978, Yountville Quadrangle California 7.5 Minute Series (Topographic), scale 1;24,000.

Wakabayashi, J., and Smith, D.L., 1994, Evaluation of recurrence intervals, characteristic earthquakes and slip rates associated with thrusting along the Coast Range-Central Valley geomorphic boundary, California: Bulletin of the Seismological Society of America, v. 84, p.1960-1970.

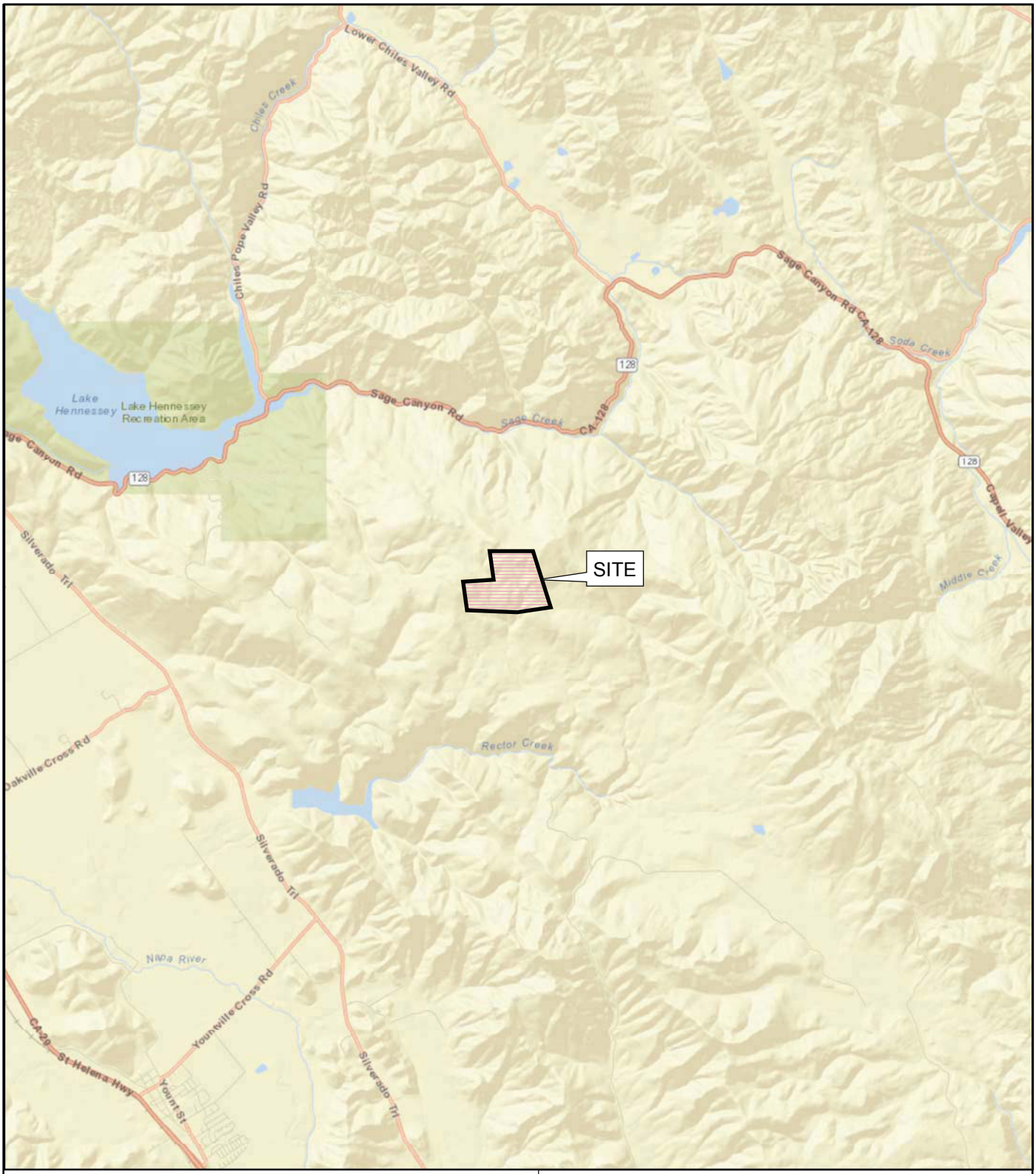
U.S. Geological Survey and California Geological Survey, 2006, Quaternary Fault and

Fold Database for the United States, accessed from
http//earthquakes.usgs.gov/regional/qfaults/

List of Aerial Photographs Reviewed

Date	Photo Number	Scale	Type
1968	844 12-3		Black & White
1988	3306-33-15 to 18	1:7,200	Black & White Stereo
1991	4070-16-4 to 6	1:12,000	Black & White Stereo
1995	4900-12-24 to 26	1:12,000	Infrared Stereo
1995	4900-11-18 to 20	1:12,000	Black & White Stereo
1998	6017-11-24 to 26	1:12,000	Infrared Stereo
1999	6323-12-23 to 25	1:12,000	Infrared Stereo
2005	8930-13-6 to 8	1:12,000	Black & White Stereo

FIGURES



N

0 5,000 10,000

Feet

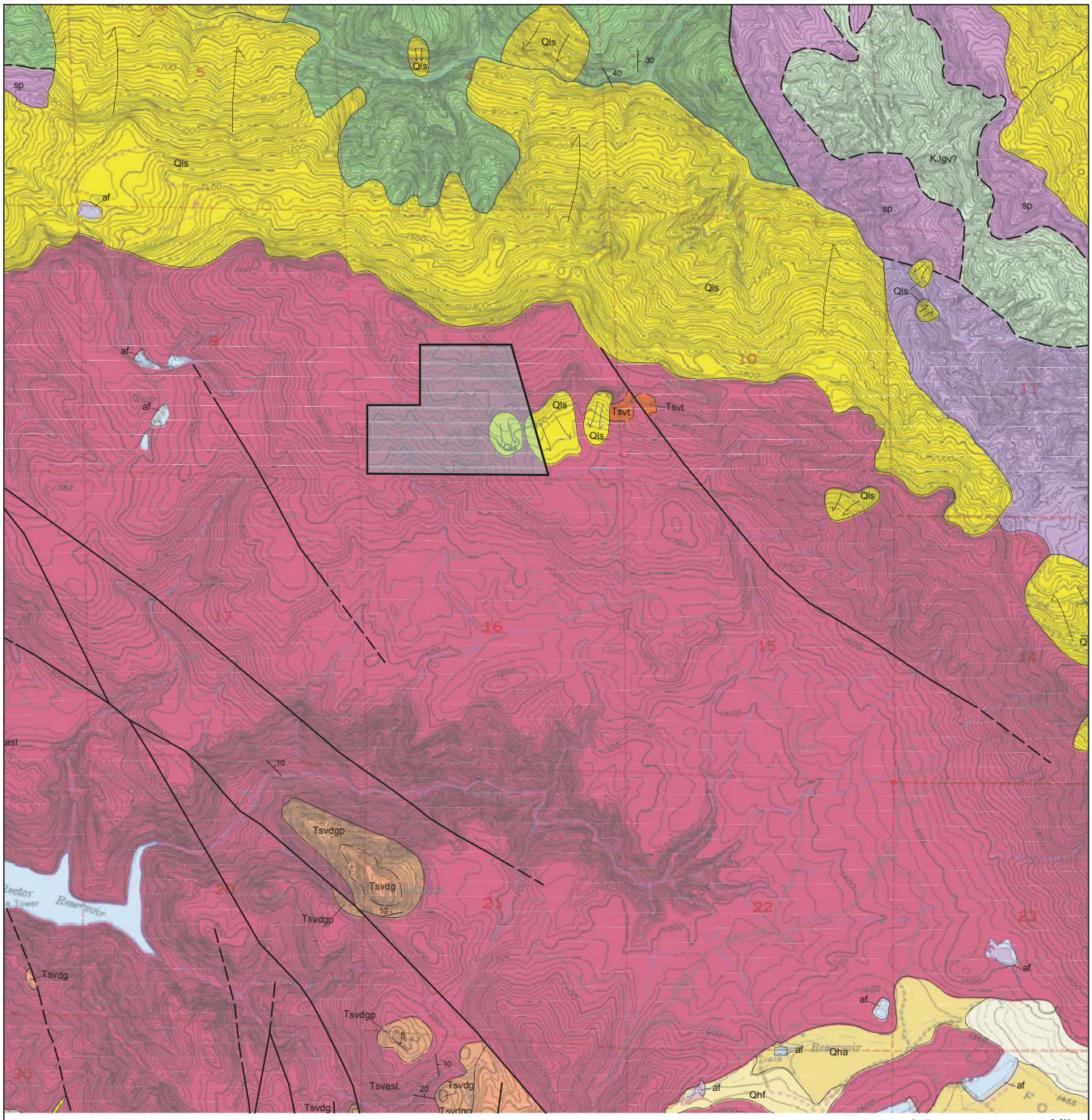
NOTES:
World street basemap is provided through Langan's Esri ArcGIS software licensing and ArcGIS online.
Credits: Sources: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN.

SITE LOCATION MAP

STAGECOACH NORTH
Napa, California

Date 12/7/18	Project No. 91621.04	Figure 1

Gilpin Geosciences, Inc.
Earthquake & Engineering Geology Consultants



0 0.5 1 Mile

Approximate scale

Explanation

Approximate project area

Fault, solid where accurately located, dashed where approximately located

Geologic contact, solid where accurately located, dashed where approximately located

Qls - Landslide deposit (Holocene and Pleistocene)

Tsval - Andesite lava flow and flow breccia

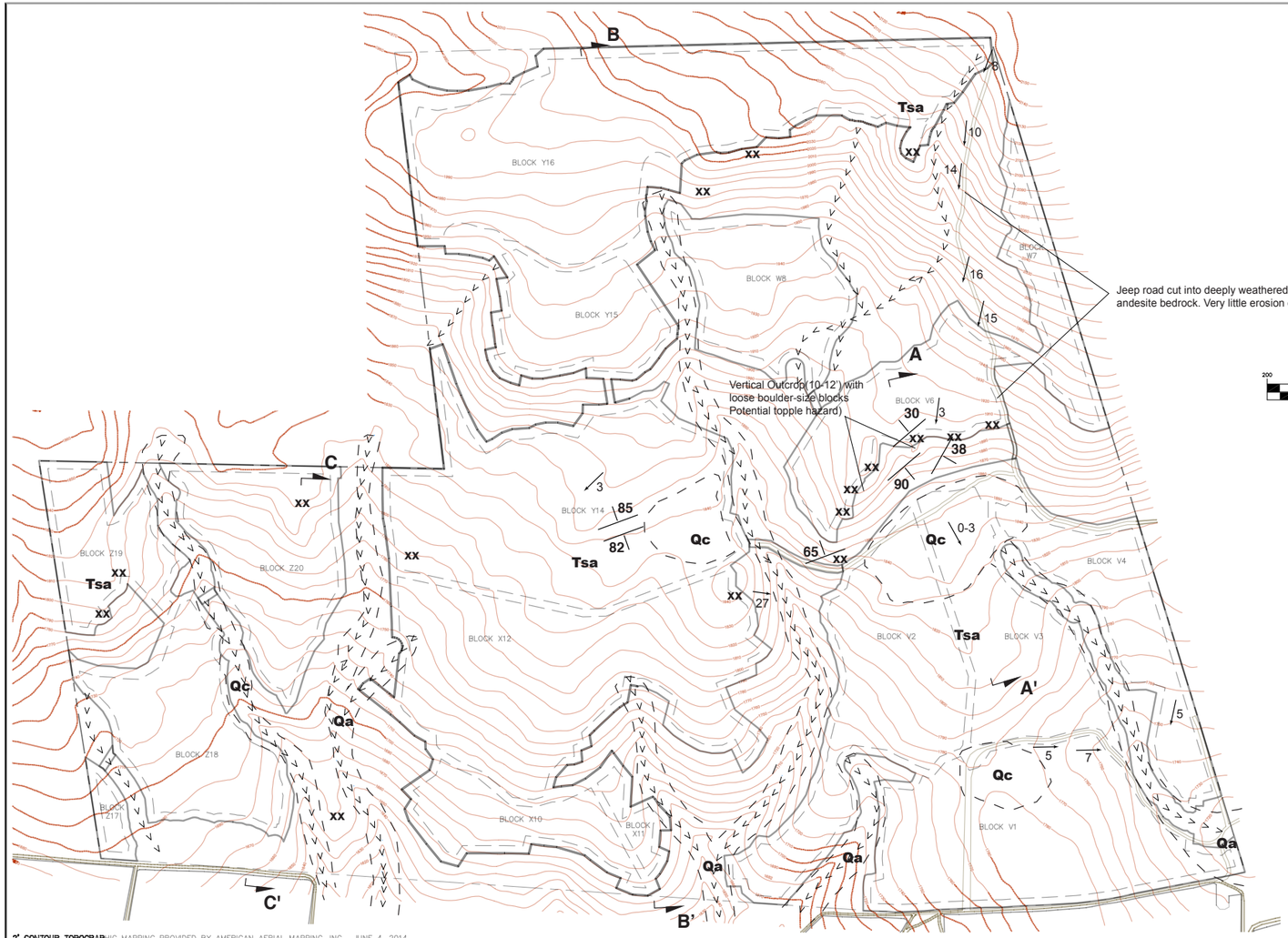
Reference: Benzore et al., 2005.

GEOLOGIC MAP

STAGECOACH NORTH
Napa, California

Date 12/7/18	Project No. 91621.04	Figure 2

Gilpin Geosciences, Inc.
Earthquake & Engineering Geology Consultants



GRAPHIC SCALE

200 0 100 200 400 800

(IN FFFT)

1 inch = 200 ft.

2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014
NOTE: INTERMEDIATE CONTOURS ARE TURNED OFF ON THIS SHEET

EXPLANATION

Qa Alluvium, consists primarily of thin deposits (less than 2 feet) of sand, gravel and cobbles

Qc Colluvium, consists primarily of thin (less than 2 feet) of sandy clay, gravel, cobbles and boulders)

Tsa Andesite (Sonoma Volcanics) moderately hard, moderately strong to strong

KEY

- Geologic contact
- 28 Slope inclination with degrees
- Erosion gully
- xx Rock outcrop
- 37 Strike and dip of flow layering in volcanic rock
- A A' Cross section location

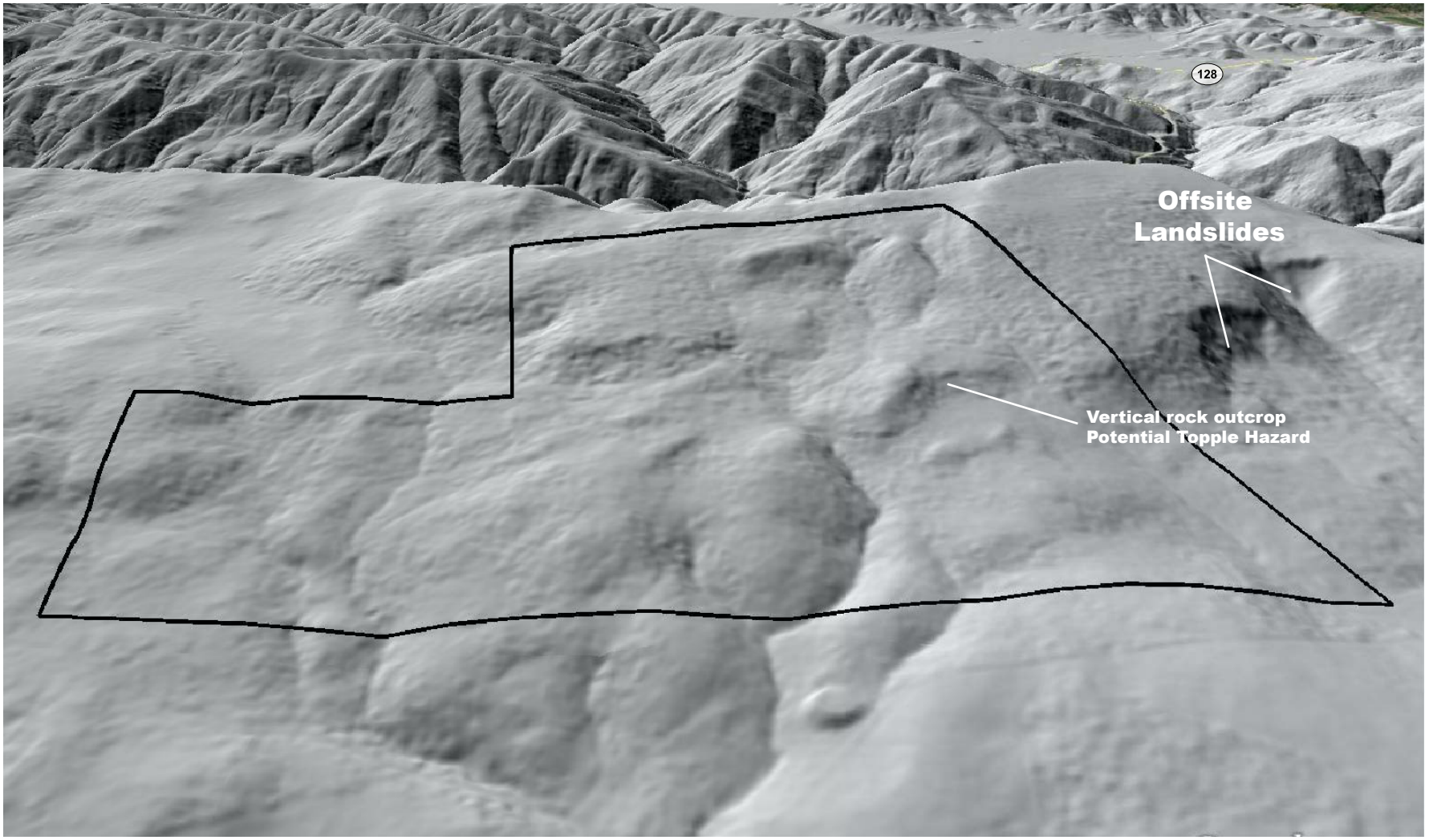
Note:
1. Standard tap and compass mapping techniques, feature locations are approximate.

SITE PLAN AND GEOLOGIC MAP

STAGECOACH NORTH
Napa, California

Date 12/7/18	Project No. 91621.04	Figure 3

Gilpin Geosciences, Inc.
Earthquake & Engineering Geology Consultants



EXPLANATION

Approximate project area

0 400 Feet

Approximate scale

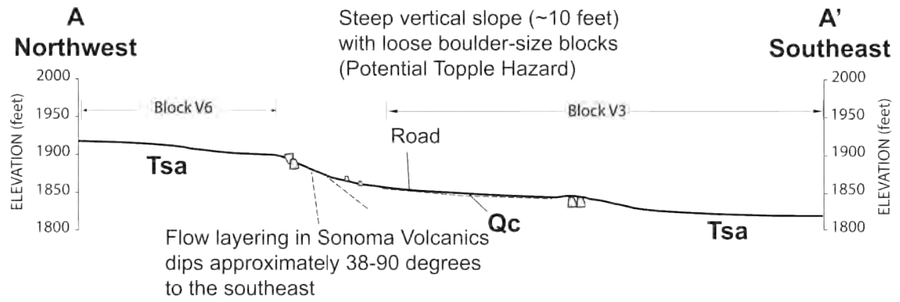
Reference: Napa watershed, CA LiDAR imagery basemap

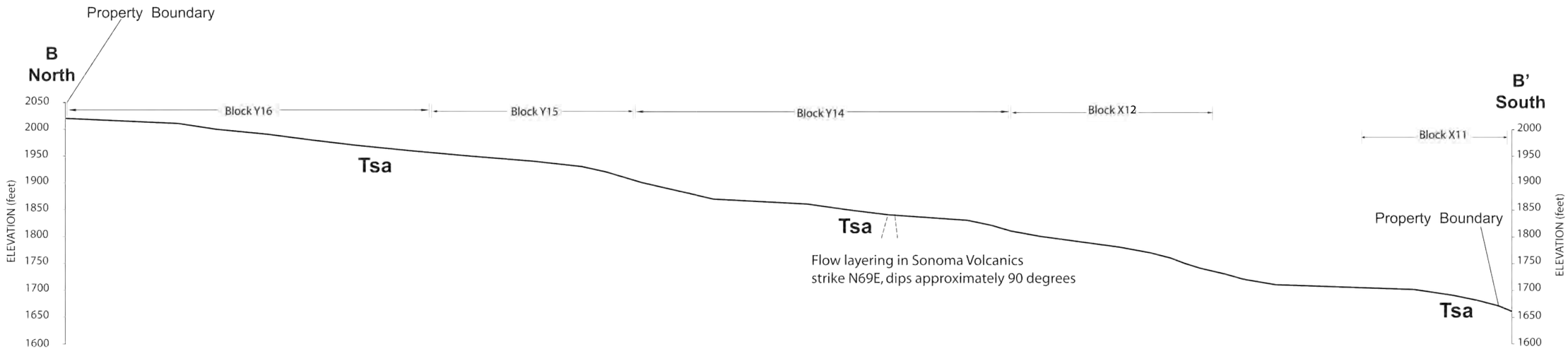
SITE LIDAR MAP

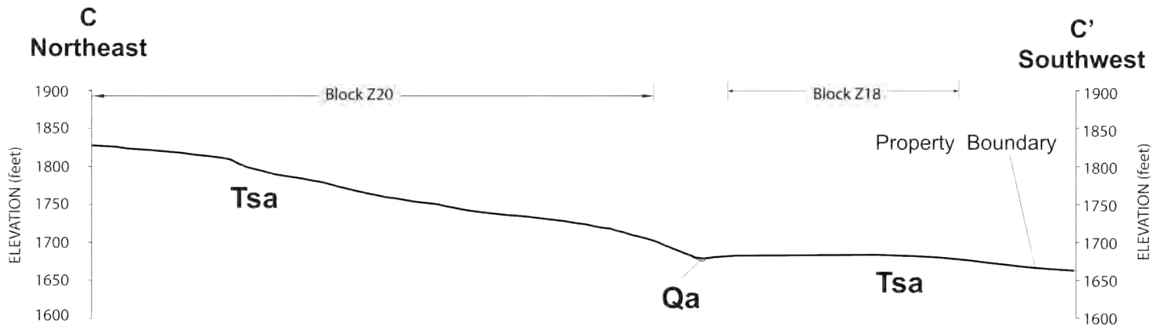
STAGECOACH NORTH
Napa, California

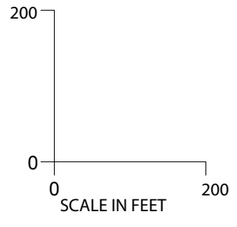
Date 12/7/18	Project No. 91621.04	Figure 4

Gilpin Geosciences, Inc.
Earthquake & Engineering Geology Consultants









EXPLANATION

GEOLOGIC UNITS

Qa Alluvium
Qc Colluvium
Tsa Andesite (Sonoma Volcanics) moderately hard, moderately strong

Notes:
1. Geologic interpretation based on limited subsurface exploration, actual conditions may vary.
2. Line of section shown on plan.
3. Existing topography by PPI Engineering, August 2015.

GEOLOGIC CROSS SECTIONS A-A', B-B', AND C-C'

STAGECOACH NORTH
Napa, California

Date 12/7/18	Project No. 91621.04	Figure 5

Gilpin Geosciences, Inc.
Earthquake & Engineering Geology Consultants

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APPENDIX H
SOIL LOSS ANALYSIS

PPI ENGINEERING
VINEYARD DESIGN
EROSION CONTROL
WATER DEVELOPMENT
DRAINAGE
PERMITTING
GPS/GIS

2800 Jefferson Street
Napa, California 94558
707-253-1806
www.ppiengineering.com

MEMORANDUM

Date: December 10, 2018

To: Patrick Ryan, Napa County Planning, Building and Environmental Services

From: James R. Bushey, P.E.
Cody J. Corsetti, P.E.

Cc: Brian Bordona, Napa County Planning, Building and Environmental Services

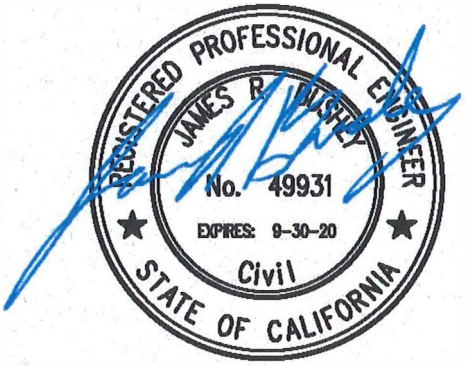
Re: Stagecoach North Track I ECP
APN 032-010-086
Soil Loss Analysis

This memo transmits the findings of a soil loss modeling analysis for the above-referenced Track I Erosion Control Plan (ECP). The Universal Soil Loss Equation (USLE) was used to predict pre- and post-project soil loss from within the proposed vineyard development areas. A combination of topographic maps, aerial photos, and site visits were used to determine pre-project transect locations, slopes, and cover values. Pre- and post-project cover values are consistent with the United States Department of Agriculture (USDA) – Natural Resource Conservation Service (NRCS) publication titled "The Universal Soil Loss Equation Special Applications for Napa County, California" (May 1994).

A site visit was conducted on December 1, 2015 with Jim Bushey of PPI Engineering, Dave Steiner (Certified Professional in Erosion and Sediment Control, CPESC), Charles Schembre formerly of the Napa County Resource Conservation District, and Brian Bordona, Patrick Ryan and Wesley Salter from the Napa County Planning, Building and Environmental Services Department to determine the pre-project cover values for each block and/or transect area. A more recent inspection was completed by Cody Corsetti of PPI Engineering on November 2, 2018 to verify that the existing cover values agreed upon by all at the December 2015 field visit were still accurate and applicable to this analysis. Consequently, all cover values used for this analysis reflect those that were first catalogued in 2015 and should accurately represent existing

conditions prior to the rainy season. Post-project cover values were calculated using the percent cover specified in the ECP.

The model, summarized on page 1 of the supporting documents (Attachment A), predicts a net decrease of approximately 160 tons of soil loss per year for the project as a whole. All but one of the transect areas (Transect Y16C) show post-project soil loss decreases. The calculated soil loss increase for Transect Y16C (0.09 tons/year) is more than offset by the calculated soil loss decrease associated with Transect Y16D (11.33 tons/year) which is located upstream of the Transect Y16C area. The ECP has been designed to ensure compliance with Napa County policies requiring no-net-increase in soil loss for post-project conditions. Please see Attachment A for data tables and calculations and Attachment B for maps of transect locations.



ATTACHMENT A

USLE CALCULATIONS

Stagecoach North Track I ECP
USLE Calculations
PPI Engineering
12/10/2018
CC

USLE Calculations - Transect Summary Sheet

Proposed Block Transect	Proposed Development Acres	Pre-Project Soil Loss (tons/year)	Post-Project Soil Loss (tons/year)	Net Increase/Decrease (tons/year)
A1	0.17	0.68	0.17	0.51
A2	0.03	0.25	0.02	0.23
A3	0.04	0.02	0.00	0.01
A4	0.04	0.04	0.04	0.00
A5	0.03	0.03	0.01	0.02
A6	0.04	0.03	0.01	0.02
V1A	4.66	5.41	3.77	1.64
V1B	5.88	6.83	5.05	1.78
V2A	6.61	35.58	27.75	7.83
V2B	2.15	15.31	10.71	4.60
V3	6.45	33.75	26.85	6.90
V4	5.71	22.69	17.41	5.28
V6A	3.20	12.74	9.52	3.22
V6B	2.18	10.73	7.93	2.80
W7	2.81	9.25	7.71	1.54
W8	5.32	32.07	20.97	11.10
X10	1.22	7.94	4.86	3.08
X11	1.06	6.52	3.26	3.26
XY1	11.23	70.12	53.83	16.28
XY2	6.89	89.64	37.19	52.45
XY3	9.77	45.87	43.52	2.35
Y14	1.47	1.42	1.11	0.31
Y15	4.50	4.58	3.48	1.11
Y16A	2.33	0.92	0.77	0.15
Y16B	4.39	6.62	4.28	2.34
Y16C	4.31	3.58	3.67	0.09
Y16D	3.43	21.41	10.08	11.33
Y16E	3.23	12.91	12.42	0.49
Z17	0.69	1.27	1.27	0.00
Z18	6.33	28.87	22.56	6.30
Z19	3.78	5.66	4.61	1.05
Z20A	4.34	30.81	22.43	8.38
Z20B	1.92	13.71	9.99	3.73
Totals	116.21	537.25	377.24	160.01

Note: Individual estimates may not add to the totals due to rounding

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Pre-Project Transect Summary Sheet

Proposed Block Transect	Proposed Development Acres	Soil Loss (tons/acre/year)	Total (tons/year)
A1	0.17	3.92	0.68
A2	0.03	9.50	0.25
A3	0.04	0.46	0.02
A4	0.04	0.88	0.04
A5	0.03	0.90	0.03
A6	0.04	0.81	0.03
V1A	4.66	1.16	5.41
V1B	5.88	1.16	6.83
V2A	6.61	5.38	35.58
V2B	2.15	7.14	15.31
V3	6.45	5.23	33.75
V4	5.71	3.97	22.69
V6A	3.20	3.99	12.74
V6B	2.18	4.92	10.73
W7	2.81	3.29	9.25
W8	5.32	6.03	32.07
X10	1.22	6.50	7.94
X11	1.06	6.15	6.52
XY1	11.23	6.24	70.12
XY2	6.89	13.02	89.64
XY3	9.77	4.69	45.87
Y14	1.47	0.97	1.42
Y15	4.50	1.02	4.58
Y16A	2.33	0.40	0.92
Y16B	4.39	1.51	6.62
Y16C	4.31	0.83	3.58
Y16D	3.43	6.25	21.41
Y16E	3.23	4.00	12.91
Z17	0.69	1.85	1.27
Z18	6.33	4.56	28.87
Z19	3.78	1.50	5.66
Z20A	4.34	7.09	30.81
Z20B	1.92	7.14	13.71
Totals	116.21		537.25

Note: Individual estimates may not add to the totals due to rounding

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Post-Project Transect Summary Sheet

Proposed Block Transect	Proposed Development Acres	Soil Loss (tons/acre/year)	Total (tons/year)
A1	0.17	0.98	0.17
A2	0.03	0.62	0.02
A3	0.04	0.12	0.00
A4	0.04	0.88	0.04
A5	0.03	0.17	0.01
A6	0.04	0.27	0.01
V1A	4.66	0.81	3.77
V1B	5.88	0.86	5.05
V2A	6.61	4.20	27.75
V2B	2.15	4.99	10.71
V3	6.45	4.16	26.85
V4	5.71	3.05	17.41
V6A	3.20	2.98	9.52
V6B	2.18	3.63	7.93
W7	2.81	2.74	7.71
W8	5.32	3.94	20.97
X10	1.22	3.98	4.86
X11	1.06	3.08	3.26
XY1	11.23	4.79	53.83
XY2A	4.52	5.94	26.80
XY2B	2.37	4.38	10.39
XY3	9.77	4.45	43.52
Y14	1.47	0.76	1.11
Y15	4.50	0.77	3.48
Y16A	2.33	0.33	0.77
Y16B	4.39	0.98	4.28
Y16C	4.31	0.85	3.67
Y16D	3.43	2.94	10.08
Y16E	3.23	3.85	12.42
Z17	0.69	1.84	1.27
Z18	6.33	3.56	22.56
Z19	3.78	1.22	4.61
Z20A	4.34	5.16	22.43
Z20B	1.92	5.20	9.99
Totals	116.21		377.24

Note: Individual estimates may not add to the totals due to rounding

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Transect A1

Proposed Development Acres:	0.17
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	26
Number of Segments:	1
Individual Segment Lengths (ft):	26
Segment:	
Gradient (%):	39
m:	
Individual LS:	4.10
Factor:	
Product:	
LS, Length and Steepness:	4.10
Total Transect Average Gradient (%):	39
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	75%
Percent Grass:	0%
Percent Weeds:	100%
C, Cover (Table 5)[1]:	0.046
A, Soil Loss (tons/acre):	3.92
Soil Loss in Proposed Development (tons):	0.68

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A1

Proposed Development Acres:	0.17	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	26	
Number of Segments:	1	
Individual Segment Lengths (ft):	26	
Segment:		
Gradient (%):	39	
m:		
Individual LS:	4.10	
Factor:		
Product:		
LS, Length and Steepness:	4.10	
Total Transect Average Gradient (%):	39	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Gravel Road)***
Age of Development:	Over 3 Years	
Ground Cover:	90%	
C, Cover (Table 4)[1]:	0.011	
A, Soil Loss (tons/acre):	0.98	
Soil Loss in Proposed Development (tons):	0.17	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect A2

Proposed Development Acres:	0.03
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	26
Number of Segments:	1
Individual Segment Lengths (ft):	26
Segment:	
Gradient (%):	27
m:	
Individual LS:	2.62
Factor:	
Product:	
LS, Length and Steepness:	2.62
Total Transect Average Gradient (%):	27
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	No Canopy
Canopy Cover:	0%
Ground Cover:	30%
Percent Grass:	50%
Percent Weeds:	50%
C, Cover (Table 5)[1]:	0.173
A, Soil Loss (tons/acre):	9.50
Soil Loss in Proposed Development (tons):	0.25

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A2

Proposed Development Acres:	0.03	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	26	
Number of Segments:	1	
Individual Segment Lengths (ft):	26	
Segment:		
Gradient (%):	27	
m:		
Individual LS:	2.62	
Factor:		
Product:		
LS, Length and Steepness:	2.62	
Total Transect Average Gradient (%):	27	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Gravel Road)***
Age of Development:	Over 3 Years	
Ground Cover:	90%	
C, Cover (Table 4)[1]:	0.011	
A, Soil Loss (tons/acre):	0.62	
Soil Loss in Proposed Development (tons):	0.02	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect A3

Proposed Development Acres:	0.04
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	24
Number of Segments:	1
Individual Segment Lengths (ft):	24
Segment:	
Gradient (%):	8
m:	0.5
Individual LS:	0.48
Factor:	
Product:	
LS, Length and Steepness:	0.48
Total Transect Average Gradient (%):	8
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	75%
Percent Grass:	0%
Percent Weeds:	100%
C, Cover (Table 5)[1]:	0.046
A, Soil Loss (tons/acre):	0.46
Soil Loss in Proposed Development (tons):	0.02

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A3

Proposed Development Acres:	0.04	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	24	
Number of Segments:	1	
Individual Segment Lengths (ft):	24	
Segment:		
Gradient (%):	8	
m:	0.5	
Individual LS:	0.48	
Factor:		
Product:		
LS, Length and Steepness:	0.48	
Total Transect Average Gradient (%):	8	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Rocked Crossing)***
Age of Development:	Over 3 Years	
Ground Cover:	90%	
C, Cover (Table 4)[1]:	0.011	
A, Soil Loss (tons/acre):	0.12	
Soil Loss in Proposed Development (tons):	0.00	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect A4

Proposed Development Acres:	0.04
Soil Unit No. (100-182):	152
Soil Name:	Hambright-Rock Outcrop
K, Soil Erodibility:	0.1
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	78
Number of Segments:	1
Individual Segment Lengths (ft):	78
Segment:	
Gradient (%):	26
m:	
Individual LS:	4.33
Factor:	
Product:	
LS, Length and Steepness:	4.33
Total Transect Average Gradient (%):	26
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	85%
Percent Grass:	10%
Percent Weeds:	90%
C, Cover (Table 5)[1]:	0.027
A, Soil Loss (tons/acre):	0.88
Soil Loss in Proposed Development (tons):	0.04

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A4

Proposed Development Acres:	0.04	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	45	
Number of Segments:	1	
Individual Segment Lengths (ft):	45	
Segment:		
Gradient (%):	27	
m:		
Individual LS:	3.45	
Factor:		
Product:		
LS, Length and Steepness:	3.45	
Total Transect Average Gradient (%):	27	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Vineyard Avenue)***
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	0.88	
Soil Loss in Proposed Development (tons):	0.04	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect A5

Proposed Development Acres:	0.03
Soil Unit No. (100-182):	152
Soil Name:	Hambright-Rock Outcrop
K, Soil Erodibility:	0.1
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	28
Number of Segments:	1
Individual Segment Lengths (ft):	28
Segment:	
Gradient (%):	21
m:	
Individual LS:	1.96
Factor:	
Product:	
LS, Length and Steepness:	1.96
Total Transect Average Gradient (%):	21
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	60%
Percent Grass:	20%
Percent Weeds:	80%
C, Cover (Table 5)[1]:	0.061
A, Soil Loss (tons/acre):	0.90
Soil Loss in Proposed Development (tons):	0.03

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A5

Proposed Development Acres:	0.03	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	28	
Number of Segments:	1	
Individual Segment Lengths (ft):	28	
Segment:		
Gradient (%):	21	
m:		
Individual LS:	1.96	
Factor:		
Product:		
LS, Length and Steepness:	1.96	
Total Transect Average Gradient (%):	21	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Rocked Crossing)***
Age of Development:	Over 3 Years	
Ground Cover:	90%	
C, Cover (Table 4)[1]:	0.011	
A, Soil Loss (tons/acre):	0.17	
Soil Loss in Proposed Development (tons):	0.01	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect A6

Proposed Development Acres:	0.04
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	53
Number of Segments:	1
Individual Segment Lengths (ft):	53
Segment:	
Gradient (%):	11
m:	
Individual LS:	1.13
Factor:	
Product:	
LS, Length and Steepness:	1.13
Total Transect Average Gradient (%):	11
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	70%
Percent Grass:	60%
Percent Weeds:	40%
C, Cover (Table 5)[1]:	0.034
A, Soil Loss (tons/acre):	0.81
Soil Loss in Proposed Development (tons):	0.03

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect A6

Proposed Development Acres:	0.04	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	53	
Number of Segments:	1	
Individual Segment Lengths (ft):	53	
Segment:		
Gradient (%):	11	
m:		
Individual LS:	1.13	
Factor:		
Product:		
LS, Length and Steepness:	1.13	
Total Transect Average Gradient (%):	11	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	***(Rocked Crossing)***
Age of Development:	Over 3 Years	
Ground Cover:	90%	
C, Cover (Table 4)[1]:	0.011	
A, Soil Loss (tons/acre):	0.27	
Soil Loss in Proposed Development (tons):	0.01	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V1A

Proposed Development Acres:	4.66	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	488	
Number of Segments:	2	
Individual Segment Lengths (ft):	244	
Segment:	1	2
Gradient (%):	11	16
m:		
Individual LS:	3.42	5.70
Factor:	0.35	0.65
Product:	1.20	3.70
LS, Length and Steepness:	4.90	
Total Transect Average Gradient (%):	14	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Segmented C-value:		
Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	70%	90%
Percent Grass:	0%	0%
Percent Weeds:	100%	100%
C, Cover (Table 5)[1]:	0.053	0.020
Segment Factor:	0.35	0.65
Segmented C:	0.032	
A, Soil Loss (tons/acre):	1.16	
Soil Loss in Proposed Development (tons):	5.41	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V1A

Proposed Development Acres:	4.66	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	488	
Number of Segments:	2	
Individual Segment Lengths (ft):	244	
Segment:	1	2
Gradient (%):	11	16
m:		
Individual LS:	3.42	5.70
Factor:	0.35	0.65
Product:	1.20	3.70
LS, Length and Steepness:	4.90	
Total Transect Average Gradient (%):	14	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	80%	
C, Cover (Table 4)[1]:	0.022	
A, Soil Loss (tons/acre):	0.81	
Soil Loss in Proposed Development (tons):	3.77	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V1B

Proposed Development Acres:	5.88	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	425	
Number of Segments:	2	
Individual Segment Lengths (ft):	213	
Segment:	1	2
Gradient (%):	9	19
m:	0.5	
Individual LS:	2.41	6.70
Factor:	0.35	0.65
Product:	0.84	4.36
LS, Length and Steepness:	5.20	
Total Transect Average Gradient (%):	14	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Segmented C Value:		
Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3 ' Tall
Canopy Cover:	75%	75%
Ground Cover:	90%	80%
Percent Grass:	0%	10%
Percent Weeds:	100%	90%
C, Cover (Table 5)[1]:	0.020	0.035
Segment Factor:	0.35	0.65
Segmented C:	0.030	
A, Soil Loss (tons/acre):	1.16	
Soil Loss in Proposed Development (tons):	6.83	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V1B

Proposed Development Acres:	5.88	
Soil Unit No. (100-182):	152	
Soil Name:	Hambright-Rock Outcrop	
K, Soil Erodibility:	0.1	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	425	
Number of Segments:	2	
Individual Segment Lengths (ft):	213	
Segment:	1	2
Gradient (%):	9	19
m:	0.5	
Individual LS:	2.41	6.70
Factor:	0.35	0.65
Product:	0.84	4.36
LS, Length and Steepness:	5.20	
Total Transect Average Gradient (%):	14	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	80%	
C, Cover (Table 4)[1]:	0.022	
A, Soil Loss (tons/acre):	0.86	
Soil Loss in Proposed Development (tons):	5.05	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V2A

Proposed Development Acres:	6.61			
Soil Unit No. (100-182):	176			
Soil Name:	Rock Outcrop-Hambright			
K, Soil Erodibility:	0.28			
T, Soil Loss Tolerance (tons/acre):	1			
R, Rainfall:	75			
Total Transect Length (ft):	781			
Number of Segments:	4			
Individual Segment Lengths (ft):	195			
Segment:	1	2	3	4
Gradient (%):	7	15	15	14
m:	0.5			
Individual LS:	2.30	6.61	6.61	6.01
Factor:	0.12	0.23	0.30	0.35
Product:	0.28	1.52	1.98	2.11
LS, Length and Steepness:	5.88			
Total Transect Average Gradient (%):	13			
Farming Practice:	Up & Down Hill			
P, Practice Factor (Table 6)[1]:	1.00			

Segmented C-value:

Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	70%	70%
Percent Grass:	50%	20%
Percent Weeds:	50%	80%
C, Cover (Table 5)[1]:	0.037	0.047
Segment Factor:	0.35	0.65
Segmeneted C:	0.044	

A, Soil Loss (tons/acre):	5.38
Soil Loss in Proposed Development (tons):	35.58

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V2A

Proposed Development Acres:	6.61			
Soil Unit No. (100-182):	176			
Soil Name:	Rock Outcrop-Hambright			
K, Soil Erodibility:	0.28			
T, Soil Loss Tolerance (tons/acre):	1			
R, Rainfall:	75			
Total Transect Length (ft):	781			
Number of Segments:	4			
Individual Segment Lengths (ft):	195			
Segment:	1	2	3	4
Gradient (%):	7	15	15	14
m:	0.5			
Individual LS:	2.30	6.61	6.61	6.01
Factor:	0.12	0.23	0.30	0.35
Product:	0.28	1.52	1.98	2.11
LS, Length and Steepness:	5.88			
Total Transect Average Gradient (%):	13			
Farming Practice:	Up & Down Hill			
P, Practice Factor (Table 6)[1]:	1.00			
Cover Strategy:	Permanent			
Age of Development:	Over 3 Years			
Ground Cover:	75%			
C, Cover (Table 4)[1]:	0.034			
A, Soil Loss (tons/acre):	4.20			
Soil Loss in Proposed Development (tons):	27.75			

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V2B

Proposed Development Acres:	2.15	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	460	
Number of Segments:	2	
Individual Segment Lengths (ft):	230	
Segment:	1	2
Gradient (%):	11	23
m:		
Individual LS:	3.32	8.97
Factor:	0.35	0.65
Product:	1.16	5.83
LS, Length and Steepness:	6.99	
Total Transect Average Gradient (%):	17	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Segmented C-value:		
Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	90%	60%
Percent Grass:	0%	10%
Percent Weeds:	100%	90%
C, Cover (Table 5)[1]:	0.020	0.064
Segment Factor:	0.35	0.65
Segmented C:	0.049	
A, Soil Loss (tons/acre):	7.14	
Soil Loss in Proposed Development (tons):	15.31	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V2B

Proposed Development Acres:	2.15	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	460	
Number of Segments:	2	
Individual Segment Lengths (ft):	230	
Segment:	1	2
Gradient (%):	11	23
m:		
Individual LS:	3.32	8.97
Factor:	0.35	0.65
Product:	1.16	5.83
LS, Length and Steepness:	6.99	
Total Transect Average Gradient (%):	17	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	4.99	
Soil Loss in Proposed Development (tons):	10.71	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V3

Proposed Development Acres:	6.45				
Soil Unit No. (100-182):	176				
Soil Name:	Rock Outcrop-Hambright				
K, Soil Erodibility:	0.28				
T, Soil Loss Tolerance (tons/acre):	1				
R, Rainfall:	75				
Total Transect Length (ft):	831				
Number of Segments:	4				
Individual Segment Lengths (ft):	208				
Segment:	1	2	3	4	
Gradient (%):	12	8	19	12	
m:		0.5			
Individual LS:	5.02	2.85	9.37	5.02	
Factor:	0.12	0.23	0.30	0.35	
Product:	0.60	0.66	2.81	1.76	
LS, Length and Steepness:	5.83				
Total Transect Average Gradient (%):	13				
Farming Practice:	Up & Down Hill				
P, Practice Factor (Table 6)[1]:	1.00				

Segmented C-value:

Segment:		
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	70%	70%
Percent Grass:	40%	30%
Percent Weeds:	60%	70%
C, Cover (Table 5)[1]:	0.040	0.044
Segment Factor:	0.35	0.65
Segmented C:	0.043	

A, Soil Loss (tons/acre):	5.23
Soil Loss in Proposed Development (tons):	33.75

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V3

Proposed Development Acres:	6.45				
Soil Unit No. (100-182):	176				
Soil Name:	Rock Outcrop-Hambright				
K, Soil Erodibility:	0.28				
T, Soil Loss Tolerance (tons/acre):	1				
R, Rainfall:	75				
Total Transect Length (ft):	831				
Number of Segments:	4				
Individual Segment Lengths (ft):	208				
Segment:	1	2	3	4	
Gradient (%):	12	8	19	12	
m:		0.5			
Individual LS:	5.02	2.85	9.37	5.02	
Factor:	0.12	0.23	0.30	0.35	
Product:	0.60	0.66	2.81	1.76	
LS, Length and Steepness:	5.83				
Total Transect Average Gradient (%):	13				
Farming Practice:	Up & Down Hill				
P, Practice Factor (Table 6)[1]:	1.00				
Cover Strategy:	Permanent				
Age of Development:	Over 3 Years				
Ground Cover:	75%				
C, Cover (Table 4)[1]:	0.034				
A, Soil Loss (tons/acre):	4.16				
Soil Loss in Proposed Development (tons):	26.85				

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V4

Proposed Development Acres:	5.71		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	542		
Number of Segments:	2		
Individual Segment Lengths (ft):	271		
Segment:	1	2	
Gradient (%):	15	11	
m:			
Individual LS:	5.50	3.60	
Factor:	0.35	0.65	
Product:	1.93	2.34	
LS, Length and Steepness:	4.27		
Total Transect Average Gradient (%):	13		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Segmented C-value:			
Segment:	1	2	3
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%	50%
Ground Cover:	90%	60%	70%
Percent Grass:	0%	40%	30%
Percent Weeds:	100%	60%	70%
C, Cover (Table 5)[1]:	0.020	0.054	0.047
Segment Factor:	0.19	0.35	0.46
Segmented C:	0.044		
A, Soil Loss (tons/acre):	3.97		
Soil Loss in Proposed Development (tons):	22.69		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V4

Proposed Development Acres:	5.71	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	542	
Number of Segments:	2	
Individual Segment Lengths (ft):	271	
Segment:	1	2
Gradient (%):	15	11
m:		
Individual LS:	5.50	3.60
Factor:	0.35	0.65
Product:	1.93	2.34
LS, Length and Steepness:	4.27	
Total Transect Average Gradient (%):	13	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	3.05	
Soil Loss in Proposed Development (tons):	17.41	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V6A

Proposed Development Acres:	3.20	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	476	
Number of Segments:	2	
Individual Segment Lengths (ft):	238	
Segment:	1	2
Gradient (%):	6	16
m:	0.5	
Individual LS:	1.47	5.63
Factor:	0.35	0.65
Product:	0.51	3.66
LS, Length and Steepness:	4.17	
Total Transect Average Gradient (%):	11	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Vegetative Canopy:	Brush 3' Tall	
Canopy Cover:	75%	
Ground Cover:	75%	
Percent Grass:	0%	
Percent Weeds:	100%	
C, Cover (Table 5)[1]:	0.046	
A, Soil Loss (tons/acre):	3.99	
Soil Loss in Proposed Development (tons):	12.74	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V6A

Proposed Development Acres:	3.20	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	476	
Number of Segments:	2	
Individual Segment Lengths (ft):	238	
Segment:	1	2
Gradient (%):	6	16
m:	0.5	
Individual LS:	1.47	5.63
Factor:	0.35	0.65
Product:	0.51	3.66
LS, Length and Steepness:	4.17	
Total Transect Average Gradient (%):	11	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	2.98	
Soil Loss in Proposed Development (tons):	9.52	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect V6B

Proposed Development Acres:	2.18	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	370	
Number of Segments:	2	
Individual Segment Lengths (ft):	185	
Segment:	1	2
Gradient (%):	22	13
m:		
Individual LS:	7.59	3.74
Factor:	0.35	0.65
Product:	2.66	2.43
LS, Length and Steepness:	5.09	
Total Transect Average Gradient (%):	18	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Segmented C-value:		
Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	50%
Ground Cover:	90%	60%
Percent Grass:	0%	40%
Percent Weeds:	100%	60%
C, Cover (Table 5)[1]:	0.020	0.060
Segment Factor:	0.35	0.65
Segmented C:	0.046	
A, Soil Loss (tons/acre):	4.92	
Soil Loss in Proposed Development (tons):	10.73	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect V6B

Proposed Development Acres:	2.18	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	370	
Number of Segments:	2	
Individual Segment Lengths (ft):	185	
Segment:	1	2
Gradient (%):	22	13
m:		
Individual LS:	7.59	3.74
Factor:	0.35	0.65
Product:	2.66	2.43
LS, Length and Steepness:	5.09	
Total Transect Average Gradient (%):	18	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	3.63	
Soil Loss in Proposed Development (tons):	7.93	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect W7

Proposed Development Acres:	2.81
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	283
Number of Segments:	1
Individual Segment Lengths (ft):	283
Segment:	
Gradient (%):	25
m:	
Individual LS:	7.84
Factor:	
Product:	
LS, Length and Steepness:	7.84
Total Transect Average Gradient (%):	25
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	90%
Percent Grass:	0%
Percent Weeds:	100%
C, Cover (Table 5)[1]:	0.020
A, Soil Loss (tons/acre):	3.29
Soil Loss in Proposed Development (tons):	9.25

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect W7

Proposed Development Acres:	2.81
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	283
Number of Segments:	1
Individual Segment Lengths (ft):	283
Segment:	
Gradient (%):	25
m:	
Individual LS:	7.84
Factor:	
Product:	
LS, Length and Steepness:	7.84
Total Transect Average Gradient (%):	25
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Cover Strategy:	Permanent
Age of Development:	Over 3 Years
Ground Cover:	85%
C, Cover (Table 4)[1]:	0.017
A, Soil Loss (tons/acre):	2.74
Soil Loss in Proposed Development (tons):	7.71

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect W8

Proposed Development Acres:	5.32		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	570		
Number of Segments:	3		
Individual Segment Lengths (ft):	190		
Segment:	1	2	3
Gradient (%):	10	8	21
m:		0.5	
Individual LS:	3.24	2.36	8.86
Factor:	0.19	0.35	0.46
Product:	0.62	0.83	4.08
LS, Length and Steepness:	5.52		
Total Transect Average Gradient (%):	13		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		

Segmented C-value:

Segment	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	80%	60%
Percent Grass:	10%	20%
Percent Weeds:	90%	80%
C, Cover (Table 5)[1]:	0.035	0.061
Segment Factor:	0.35	0.65
Segmented C:	0.052	

A, Soil Loss (tons/acre):	6.03
Soil Loss in Proposed Development (tons):	32.07

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Transect W8

Proposed Development Acres:	5.32		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	570		
Number of Segments:	3		
Individual Segment Lengths (ft):	190		
Segment:	1	2	3
Gradient (%):	10	8	21
m:		0.5	
Individual LS:	3.24	2.36	8.86
Factor:	0.19	0.35	0.46
Product:	0.62	0.83	4.08
LS, Length and Steepness:	5.52		
Total Transect Average Gradient (%):	13		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	75%		
C, Cover (Table 4)[1]:	0.034		
A, Soil Loss (tons/acre):	3.94		
Soil Loss in Proposed Development (tons):	20.97		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect X10

Proposed Development Acres:	1.22	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	247	
Number of Segments:	2	
Individual Segment Lengths (ft):	124	
Segment:	1	2
Gradient (%):	19	21
m:		
Individual LS:	5.11	5.83
Factor:	0.35	0.65
Product:	1.79	3.79
LS, Length and Steepness:	5.58	
Total Transect Average Gradient (%):	20	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Vegetative Canopy:	Brush 3' Tall	
Canopy Cover:	50%	
Ground Cover:	60%	
Percent Grass:	50%	
Percent Weeds:	50%	
C, Cover (Table 5)[1]:	0.056	
A, Soil Loss (tons/acre):	6.50	
Soil Loss in Proposed Development (tons):	7.94	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect X10

Proposed Development Acres:	1.22	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	247	
Number of Segments:	2	
Individual Segment Lengths (ft):	124	
Segment:	1	2
Gradient (%):	19	21
m:		
Individual LS:	5.11	5.83
Factor:	0.35	0.65
Product:	1.79	3.79
LS, Length and Steepness:	5.58	
Total Transect Average Gradient (%):	20	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	3.98	
Soil Loss in Proposed Development (tons):	4.86	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect X11

Proposed Development Acres:	1.06	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	238	
Number of Segments:	2	
Individual Segment Lengths (ft):	119	
Segment:	1	2
Gradient (%):	13	19
m:		
Individual LS:	3.00	5.01
Factor:	0.35	0.65
Product:	1.05	3.26
LS, Length and Steepness:	4.31	
Total Transect Average Gradient (%):	16	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Vegetative Canopy:	Brush 3' Tall	
Canopy Cover:	75%	
Ground Cover:	60%	
Percent Grass:	0%	
Percent Weeds:	100%	
C, Cover (Table 5)[1]:	0.068	
A, Soil Loss (tons/acre):	6.15	
Soil Loss in Proposed Development (tons):	6.52	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect X11

Proposed Development Acres:	1.06	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	238	
Number of Segments:	2	
Individual Segment Lengths (ft):	119	
Segment:	1	2
Gradient (%):	13	19
m:		
Individual LS:	3.00	5.01
Factor:	0.35	0.65
Product:	1.05	3.26
LS, Length and Steepness:	4.31	
Total Transect Average Gradient (%):	16	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	3.08	
Soil Loss in Proposed Development (tons):	3.26	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect XY1

Proposed Development Acres:	11.23					
Soil Unit No. (100-182):	176					
Soil Name:	Rock Outcrop-Hambright					
K, Soil Erodibility:	0.28					
T, Soil Loss Tolerance (tons/acre):	1					
R, Rainfall:	75					
Total Transect Length (ft):	1145					
Number of Segments:	5					
Individual Segment Lengths (ft):	229					
Segment:	1	2	3	4	5	
Gradient (%):	14	8	11	16	15	
m:		0.5				
Individual LS:	7.28	3.35	5.23	8.73	8.00	
Factor:	0.09	0.16	0.21	0.25	0.28	
Product:	0.66	0.54	1.10	2.18	2.24	
LS, Length and Steepness:	6.71					
Total Transect Average Gradient (%):	13					
Farming Practice:	Up & Down Hill					
P, Practice Factor (Table 6)[1]:	1.00					

Segmented C-value:

Segment:	1	2
Vegetative Canopy:	Brush 6.5' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	90%	60%
Percent Grass:	0%	30%
Percent Weeds:	100%	70%
C, Cover (Table 5)[1]:	0.021	0.057
Segment Factor:	0.35	0.65
Segmented C:	0.044	

A, Soil Loss (tons/acre):	6.24
Soil Loss in Proposed Development (tons):	70.12

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect XY1

Proposed Development Acres:	11.23					
Soil Unit No. (100-182):	176					
Soil Name:	Rock Outcrop-Hambright					
K, Soil Erodibility:	0.28					
T, Soil Loss Tolerance (tons/acre):	1					
R, Rainfall:	75					
Total Transect Length (ft):	1145					
Number of Segments:	5					
Individual Segment Lengths (ft):	229					
Segment:	1	2	3	4	5	
Gradient (%):	14	8	11	16	15	
m:		0.5				
Individual LS:	7.28	3.35	5.23	8.73	8.00	
Factor:	0.09	0.16	0.21	0.25	0.28	
Product:	0.66	0.54	1.10	2.18	2.24	
LS, Length and Steepness:	6.71					
Total Transect Average Gradient (%):	13					
Farming Practice:	Up & Down Hill					
P, Practice Factor (Table 6)[1]:	1.00					
Cover Strategy:	Permanent					
Age of Development:	Over 3 Years					
Ground Cover:	75%					
C, Cover (Table 4)[1]:	0.034					
A, Soil Loss (tons/acre):	4.79					
Soil Loss in Proposed Development (tons):	53.83					

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect XY2

Proposed Development Acres:	6.89			
Soil Unit No. (100-182):	176			
Soil Name:	Rock Outcrop-Hambright			
K, Soil Erodibility:	0.28			
T, Soil Loss Tolerance (tons/acre):	1			
R, Rainfall:	75			
Total Transect Length (ft):	1032			
Number of Segments:	4			
Individual Segment Lengths (ft):	258			
Segment:	1	2	3	4
Gradient (%):	9	17	22	21
m:	0.5			
Individual LS:	3.76	9.00	12.68	11.93
Factor:	0.12	0.23	0.30	0.35
Product:	0.45	2.07	3.80	4.17
LS, Length and Steepness:	10.50			
Total Transect Average Gradient (%):	17			
Farming Practice:	Up & Down Hill			
P, Practice Factor (Table 6)[1]:	1.00			

Segmented C-value:

Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	50%
Ground Cover:	70%	60%
Percent Grass:	10%	30%
Percent Weeds:	90%	70%
C, Cover (Table 5)[1]:	0.050	0.064
Segment Factor:	0.35	0.65
Segmented C:	0.059	

A, Soil Loss (tons/acre):	13.02
Soil Loss in Proposed Development (tons):	89.64

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect XY2A

Proposed Development Acres:	4.52		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	759		
Number of Segments:	3		
Individual Segment Lengths (ft):	253		
Segment:	1	2	3
Gradient (%):	9	17	22
m:	0.5		
Individual LS:	3.22	7.71	10.87
Factor:	0.19	0.35	0.46
Product:	0.61	2.70	5.00
LS, Length and Steepness:	8.31		
Total Transect Average Gradient (%):	16		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	75%		
C, Cover (Table 4)[1]:	0.034		
A, Soil Loss (tons/acre):	5.94		
Soil Loss in Proposed Development (tons):	26.80		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect XY2B

Proposed Development Acres:	2.37
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	273
Number of Segments:	1
Individual Segment Lengths (ft):	273
Segment:	
Gradient (%):	21
m:	
Individual LS:	6.13
Factor:	
Product:	
LS, Length and Steepness:	6.13
Total Transect Average Gradient (%):	21
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Cover Strategy:	Permanent
Age of Development:	Over 3 Years
Ground Cover:	75%
C, Cover (Table 4)[1]:	0.034
A, Soil Loss (tons/acre):	4.38
Soil Loss in Proposed Development (tons):	10.39

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect XY3

Proposed Development Acres:	9.77					
Soil Unit No. (100-182):	176					
Soil Name:	Rock Outcrop-Hambright					
K, Soil Erodibility:	0.28					
T, Soil Loss Tolerance (tons/acre):	1					
R, Rainfall:	75					
Total Transect Length (ft):	1056					
Number of Segments:	5					
Individual Segment Lengths (ft):	211					
Segment:	1	2	3	4	5	
Gradient (%):	15	12	8	12	17	
m:			0.5			
Individual LS:	7.68	5.66	3.22	5.66	9.10	
Factor:	0.09	0.16	0.21	0.25	0.28	
Product:	0.69	0.91	0.68	1.42	2.55	
LS, Length and Steepness:	6.24					
Total Transect Average Gradient (%):	13					
Farming Practice:	Up & Down Hill					
P, Practice Factor (Table 6)[1]:	1.00					
Segmented C-value:						
Segment:	1	2				
Vegetative Canopy:	Brush 6.5' Tall	Brush 3' Tall				
Canopy Cover:	75%	75%				
Ground Cover:	90%	70%				
Percent Grass:	0%	30%				
Percent Weeds:	100%	70%				
C, Cover (Table 5)[1]:	0.021	0.044				
Segment Factor:	0.35	0.65				
Segmented C:	0.036					
A, Soil Loss (tons/acre):	4.69					
Soil Loss in Proposed Development (tons):	45.87					

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect XY3

Proposed Development Acres:	9.77				
Soil Unit No. (100-182):	176				
Soil Name:	Rock Outcrop-Hambright				
K, Soil Erodibility:	0.28				
T, Soil Loss Tolerance (tons/acre):	1				
R, Rainfall:	75				
Total Transect Length (ft):	1056				
Number of Segments:	5				
Individual Segment Lengths (ft):	211				
Segment:	1	2	3	4	5
Gradient (%):	15	12	8	12	17
m:			0.5		
Individual LS:	7.68	5.66	3.22	5.66	9.10
Factor:	0.09	0.16	0.21	0.25	0.28
Product:	0.69	0.91	0.68	1.42	2.55
LS, Length and Steepness:	6.24				
Total Transect Average Gradient (%):	13				
Farming Practice:	Up & Down Hill				
P, Practice Factor (Table 6)[1]:	1.00				
Cover Strategy:	Permanent				
Age of Development:	Over 3 Years				
Ground Cover:	75%				
C, Cover (Table 4)[1]:	0.034				
A, Soil Loss (tons/acre):	4.45				
Soil Loss in Proposed Development (tons):	43.52				

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y14

Proposed Development Acres:	1.47		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	478		
Number of Segments:	3		
Individual Segment Lengths (ft):	159		
Segment:	1	2	3
Gradient (%):	16	9	8
m:		0.5	0.5
Individual LS:	5.64	2.56	2.16
Factor:	0.19	0.35	0.46
Product:	1.07	0.90	1.00
LS, Length and Steepness:	2.96		
Total Transect Average Gradient (%):	11		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Vegetative Canopy:	Brush 3' Tall		
Canopy Cover:	75%		
Ground Cover:	70%		
Percent Grass:	30%		
Percent Weeds:	70%		
C, Cover (Table 5)[1]:	0.044		
A, Soil Loss (tons/acre):	0.97		
Soil Loss in Proposed Development (tons):	1.42		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y14

Proposed Development Acres:	1.47		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	478		
Number of Segments:	3		
Individual Segment Lengths (ft):	159		
Segment:	1	2	3
Gradient (%):	16	9	8
m:		0.5	0.5
Individual LS:	5.64	2.56	2.16
Factor:	0.19	0.35	0.46
Product:	1.07	0.90	1.00
LS, Length and Steepness:	2.96		
Total Transect Average Gradient (%):	11		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	75%		
C, Cover (Table 4)[1]:	0.034		
A, Soil Loss (tons/acre):	0.76		
Soil Loss in Proposed Development (tons):	1.11		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y15

Proposed Development Acres:	4.50			
Soil Unit No. (100-182):	152			
Soil Name:	Hambright-Rock Outcrop			
K, Soil Erodibility:	0.1			
T, Soil Loss Tolerance (tons/acre):	1			
R, Rainfall:	75			
Total Transect Length (ft):	362			
Number of Segments:	4			
Individual Segment Lengths (ft):	91			
Segment:	1	2	3	4
Gradient (%):	9	10	11	24
m:	0.5			
Individual LS:	2.23	2.58	2.94	8.41
Factor:	0.12	0.23	0.30	0.35
Product:	0.27	0.59	0.88	2.94
LS, Length and Steepness:	4.69			
Total Transect Average Gradient (%):	14			
Farming Practice:	Up & Down Hill			
P, Practice Factor (Table 6)[1]:	1.00			
Vegetative Canopy:	Brush 3' Tall			
Canopy Cover:	75%			
Ground Cover:	85%			
Percent Grass:	0%			
Percent Weeds:	100%			
C, Cover (Table 5)[1]:	0.029			
A, Soil Loss (tons/acre):	1.02			
Soil Loss in Proposed Development (tons):	4.58			

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y15

Proposed Development Acres:	4.50			
Soil Unit No. (100-182):	152			
Soil Name:	Hambright-Rock Outcrop			
K, Soil Erodibility:	0.1			
T, Soil Loss Tolerance (tons/acre):	1			
R, Rainfall:	75			
Total Transect Length (ft):	362			
Number of Segments:	4			
Individual Segment Lengths (ft):	91			
Segment:	1	2	3	4
Gradient (%):	9	10	11	24
m:	0.5			
Individual LS:	2.23	2.58	2.94	8.41
Factor:	0.12	0.23	0.30	0.35
Product:	0.27	0.59	0.88	2.94
LS, Length and Steepness:	4.69			
Total Transect Average Gradient (%):	14			
Farming Practice:	Up & Down Hill			
P, Practice Factor (Table 6)[1]:	1.00			
Cover Strategy:	Permanent			
Age of Development:	Over 3 Years			
Ground Cover:	80%			
C, Cover (Table 4)[1]:	0.022			
A, Soil Loss (tons/acre):	0.77			
Soil Loss in Proposed Development (tons):	3.48			

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y16A

Proposed Development Acres:	2.33
Soil Unit No. (100-182):	152
Soil Name:	Hambright-Rock Outcrop
K, Soil Erodibility:	0.1
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	291
Number of Segments:	1
Individual Segment Lengths (ft):	291
Segment:	
Gradient (%):	11
m:	
Individual LS:	2.64
Factor:	
Product:	
LS, Length and Steepness:	2.64
Total Transect Average Gradient (%):	11
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	90%
Percent Grass:	0%
Percent Weeds:	100%
C, Cover (Table 5)[1]:	0.020
A, Soil Loss (tons/acre):	0.40
Soil Loss in Proposed Development (tons):	0.92

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y16A

Proposed Development Acres:	2.33
Soil Unit No. (100-182):	152
Soil Name:	Hambright-Rock Outcrop
K, Soil Erodibility:	0.1
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	218
Number of Segments:	1
Individual Segment Lengths (ft):	218
Segment:	
Gradient (%):	10
m:	
Individual LS:	2.00
Factor:	
Product:	
LS, Length and Steepness:	2.00
Total Transect Average Gradient (%):	10
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Cover Strategy:	Permanent
Age of Development:	Over 3 Years
Ground Cover:	80%
C, Cover (Table 4)[1]:	0.022
A, Soil Loss (tons/acre):	0.33
Soil Loss in Proposed Development (tons):	0.77

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y16B

Proposed Development Acres:	4.39		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	506		
Number of Segments:	3		
Individual Segment Lengths (ft):	169		
Segment:	1	2	3
Gradient (%):	7	14	23
m:	0.5		
Individual LS:	1.85	4.84	9.41
Factor:	0.19	0.35	0.46
Product:	0.35	1.69	4.33
LS, Length and Steepness:	6.37		
Total Transect Average Gradient (%):	15		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		

Segmented C-value:

Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	75%	75%
Ground Cover:	70%	90%
Percent Grass:	0%	0%
Percent Weeds:	100%	100%
C, Cover (Table 5)[1]:	0.053	0.02
Segment Factor:	0.35	0.65
Segmented C:	0.032	

A, Soil Loss (tons/acre):	1.51
Soil Loss in Proposed Development (tons):	6.62

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y16B

Proposed Development Acres:	4.39		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	446		
Number of Segments:	3		
Individual Segment Lengths (ft):	149		
Segment:	1	2	3
Gradient (%):	7	12	24
m:	0.5		
Individual LS:	1.74	3.68	9.34
Factor:	0.19	0.35	0.46
Product:	0.33	1.29	4.29
LS, Length and Steepness:	5.91		
Total Transect Average Gradient (%):	14		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	80%		
C, Cover (Table 4)[1]:	0.022		
A, Soil Loss (tons/acre):	0.98		
Soil Loss in Proposed Development (tons):	4.28		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y16C

Proposed Development Acres:	4.31		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	760		
Number of Segments:	1		
Individual Segment Lengths (ft):	760		
Segment:			
Gradient (%):	13		
m:			
Individual LS:	5.36		
Factor:			
Product:			
LS, Length and Steepness:	5.36		
Total Transect Average Gradient (%):	13		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Segmented C-value:			
Segment:	1	2	
Vegetative Canopy:	Brush 3' Tall	Brush 6.5' Tall	
Canopy Cover:	75%	75%	
Ground Cover:	90%	90%	
Percent Grass:	0%	0%	
Percent Weeds:	100%	100%	
C, Cover (Table 5)[1]:	0.020	0.021	
Segment Factor:	0.35	0.65	
Segmented C:	0.021		
A, Soil Loss (tons/acre):	0.83		
Soil Loss in Proposed Development (tons):	3.58		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y16C

Proposed Development Acres:	4.31
Soil Unit No. (100-182):	152
Soil Name:	Hambright-Rock Outcrop
K, Soil Erodibility:	0.1
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	702
Number of Segments:	1
Individual Segment Lengths (ft):	702
Segment:	
Gradient (%):	13
m:	
Individual LS:	5.15
Factor:	
Product:	
LS, Length and Steepness:	5.15
Total Transect Average Gradient (%):	13
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Cover Strategy:	Permanent
Age of Development:	Over 3 Years
Ground Cover:	80%
C, Cover (Table 4)[1]:	0.022
A, Soil Loss (tons/acre):	0.85
Soil Loss in Proposed Development (tons):	3.67

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y16D

Proposed Development Acres:	3.43		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	669		
Number of Segments:	3		
Individual Segment Lengths (ft):	223		
Segment:	1	2	3
Gradient (%):	12	10	19
m:			
Individual LS:	4.51	3.51	8.41
Factor:	0.19	0.35	0.46
Product:	0.86	1.23	3.87
LS, Length and Steepness:	5.95		
Total Transect Average Gradient (%):	14		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Vegetative Canopy:	Brush 3' Tall		
Canopy Cover:	75%		
Ground Cover:	60%		
Percent Grass:	50%		
Percent Weeds:	50%		
C, Cover (Table 5)[1]:	0.050		
A, Soil Loss (tons/acre):	6.25		
Soil Loss in Proposed Development (tons):	21.41		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

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Transect Y16D

Proposed Development Acres:	3.43		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	599		
Number of Segments:	3		
Individual Segment Lengths (ft):	200		
Segment:	1	2	3
Gradient (%):	12	8	23
m:		0.5	
Individual LS:	4.27	2.42	10.24
Factor:	0.19	0.35	0.46
Product:	0.81	0.85	4.71
LS, Length and Steepness:	6.37		
Total Transect Average Gradient (%):	14		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	80%		
C, Cover (Table 4)[1]:	0.022		
A, Soil Loss (tons/acre):	2.94		
Soil Loss in Proposed Development (tons):	10.08		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

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Transect Y16E

Proposed Development Acres:	3.23	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	334	
Number of Segments:	2	
Individual Segment Lengths (ft):	167	
Segment:	1	2
Gradient (%):	18	28
m:		
Individual LS:	5.53	9.84
Factor:	0.35	0.65
Product:	1.93	6.40
LS, Length and Steepness:	8.33	
Total Transect Average Gradient (%):	23	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Segmented C-value:		
Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 3' Tall
Canopy Cover:	50%	75%
Ground Cover:	80%	90%
Percent Grass:	40%	0%
Percent Weeds:	60%	100%
C, Cover (Table 5)[1]:	0.028	0.020
Segment Factor:	0.35	0.65
Segmented C:	0.023	
A, Soil Loss (tons/acre):	4.00	
Soil Loss in Proposed Development (tons):	12.91	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Y16E

Proposed Development Acres:	3.23	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	334	
Number of Segments:	2	
Individual Segment Lengths (ft):	167	
Segment:	1	2
Gradient (%):	18	28
m:		
Individual LS:	5.53	9.84
Factor:	0.35	0.65
Product:	1.93	6.40
LS, Length and Steepness:	8.33	
Total Transect Average Gradient (%):	23	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	80%	
C, Cover (Table 4)[1]:	0.022	
A, Soil Loss (tons/acre):	3.85	
Soil Loss in Proposed Development (tons):	12.42	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Pre-Project
PPI Engineering
12/10/2018
CC

Transect Z17

Proposed Development Acres:	0.69
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	362
Number of Segments:	1
Individual Segment Lengths (ft):	362
Segment:	
Gradient (%):	10
m:	
Individual LS:	2.58
Factor:	
Product:	
LS, Length and Steepness:	2.58
Total Transect Average Gradient (%):	10
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Vegetative Canopy:	Brush 3' Tall
Canopy Cover:	75%
Ground Cover:	70%
Percent Grass:	60%
Percent Weeds:	40%
C, Cover (Table 5)[1]:	0.034
A, Soil Loss (tons/acre):	1.85
Soil Loss in Proposed Development (tons):	1.27

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Z17

Proposed Development Acres:	0.69
Soil Unit No. (100-182):	176
Soil Name:	Rock Outcrop-Hambright
K, Soil Erodibility:	0.28
T, Soil Loss Tolerance (tons/acre):	1
R, Rainfall:	75
Total Transect Length (ft):	362
Number of Segments:	1
Individual Segment Lengths (ft):	362
Segment:	
Gradient (%):	10
m:	
Individual LS:	2.58
Factor:	
Product:	
LS, Length and Steepness:	2.58
Total Transect Average Gradient (%):	10
Farming Practice:	Up & Down Hill
P, Practice Factor (Table 6)[1]:	1.00
Cover Strategy:	Permanent
Age of Development:	Over 3 Years
Ground Cover:	75%
C, Cover (Table 4)[1]:	0.034
A, Soil Loss (tons/acre):	1.84
Soil Loss in Proposed Development (tons):	1.27

[1] Tables 4 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Pre-Project
PPI Engineering
12/10/2018
CC

Transect Z18

Proposed Development Acres:	6.33					
Soil Unit No. (100-182):	176					
Soil Name:	Rock Outcrop-Hambright					
K, Soil Erodibility:	0.28					
T, Soil Loss Tolerance (tons/acre):	1					
R, Rainfall:	75					
Total Transect Length (ft):	849					
Number of Segments:	5					
Individual Segment Lengths (ft):	170					
Segment:	1	2	3	4	5	
Gradient (%):	15	4	11	10	17	
m:		0.4				
Individual LS:	6.89	0.94	4.51	3.95	8.16	
Factor:	0.09	0.16	0.21	0.25	0.28	
Product:	0.62	0.15	0.95	0.99	2.28	
LS, Length and Steepness:	4.99					
Total Transect Average Gradient (%):	11					
Farming Practice:	Up & Down Hill					
P, Practice Factor (Table 6)[1]:	1.00					

Segmented C-value:

Segment:	1	2
Vegetative Canopy:	Brush 3' Tall	Brush 6.5' Tall
Canopy Cover:	75%	75%
Ground Cover:	60%	80%
Percent Grass:	50%	0%
Percent Weeds:	50%	100%
C, Cover (Table 5)[1]:	0.050	0.040
Segment Factor:	0.35	0.65
Segmented C:	0.044	

A, Soil Loss (tons/acre):	4.56
Soil Loss in Proposed Development (tons):	28.87

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Z18

Proposed Development Acres:	6.33				
Soil Unit No. (100-182):	176				
Soil Name:	Rock Outcrop-Hambright				
K, Soil Erodibility:	0.28				
T, Soil Loss Tolerance (tons/acre):	1				
R, Rainfall:	75				
Total Transect Length (ft):	849				
Number of Segments:	5				
Individual Segment Lengths (ft):	170				
Segment:	1	2	3	4	5
Gradient (%):	15	4	11	10	17
m:		0.4			
Individual LS:	6.89	0.94	4.51	3.95	8.16
Factor:	0.09	0.16	0.21	0.25	0.28
Product:	0.62	0.15	0.95	0.99	2.28
LS, Length and Steepness:	4.99				
Total Transect Average Gradient (%):	11				
Farming Practice:	Up & Down Hill				
P, Practice Factor (Table 6)[1]:	1.00				
Cover Strategy:	Permanent				
Age of Development:	Over 3 Years				
Ground Cover:	75%				
C, Cover (Table 4)[1]:	0.034				
A, Soil Loss (tons/acre):	3.56				
Soil Loss in Proposed Development (tons):	22.56				

[1] Tables 4 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Pre-Project
PPI Engineering
12/10/2018
CC

Transect Z19

Proposed Development Acres:	3.78		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	673		
Number of Segments:	3		
Individual Segment Lengths (ft):	224		
Segment:	1	2	3
Gradient (%):	11	9	25
m:		0.5	
Individual LS:	4.01	3.04	12.09
Factor:	0.19	0.35	0.46
Product:	0.76	1.06	5.56
LS, Length and Steepness:	7.39		
Total Transect Average Gradient (%):	15		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Vegetative Canopy:	Brush 3' Tall		
Canopy Cover:	75%		
Ground Cover:	85%		
Percent Grass:	10%		
Percent Weeds:	90%		
C, Cover (Table 5)[1]:	0.027		
A, Soil Loss (tons/acre):	1.50		
Soil Loss in Proposed Development (tons):	5.66		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Z19

Proposed Development Acres:	3.78		
Soil Unit No. (100-182):	152		
Soil Name:	Hambright-Rock Outcrop		
K, Soil Erodibility:	0.1		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	673		
Number of Segments:	3		
Individual Segment Lengths (ft):	224		
Segment:	1	2	3
Gradient (%):	11	9	25
m:		0.5	
Individual LS:	4.01	3.04	12.09
Factor:	0.19	0.35	0.46
Product:	0.76	1.06	5.56
LS, Length and Steepness:	7.39		
Total Transect Average Gradient (%):	15		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	80%		
C, Cover (Table 4)[1]:	0.022		
A, Soil Loss (tons/acre):	1.22		
Soil Loss in Proposed Development (tons):	4.61		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Pre-Project
PPI Engineering
12/10/2018
CC

Transect Z20A

Proposed Development Acres:	4.34	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	409	
Number of Segments:	2	
Individual Segment Lengths (ft):	205	
Segment:	1	2
Gradient (%):	23	19
m:		
Individual LS:	8.46	6.57
Factor:	0.35	0.65
Product:	2.96	4.27
LS, Length and Steepness:	7.23	
Total Transect Average Gradient (%):	21	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Vegetative Canopy:	Brush 3' Tall	
Canopy Cover:	75%	
Ground Cover:	70%	
Percent Grass:	20%	
Percent Weeds:	80%	
C, Cover (Table 5)[1]:	0.047	
A, Soil Loss (tons/acre):	7.09	
Soil Loss in Proposed Development (tons):	30.81	

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Z20A

Proposed Development Acres:	4.34	
Soil Unit No. (100-182):	176	
Soil Name:	Rock Outcrop-Hambright	
K, Soil Erodibility:	0.28	
T, Soil Loss Tolerance (tons/acre):	1	
R, Rainfall:	75	
Total Transect Length (ft):	409	
Number of Segments:	2	
Individual Segment Lengths (ft):	205	
Segment:	1	2
Gradient (%):	23	19
m:		
Individual LS:	8.46	6.57
Factor:	0.35	0.65
Product:	2.96	4.27
LS, Length and Steepness:	7.23	
Total Transect Average Gradient (%):	21	
Farming Practice:	Up & Down Hill	
P, Practice Factor (Table 6)[1]:	1.00	
Cover Strategy:	Permanent	
Age of Development:	Over 3 Years	
Ground Cover:	75%	
C, Cover (Table 4)[1]:	0.034	
A, Soil Loss (tons/acre):	5.16	
Soil Loss in Proposed Development (tons):	22.43	

[1] Tables 4 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Pre-Project
PPI Engineering
12/10/2018
CC

Transect Z20B

Proposed Development Acres:	1.92		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	434		
Number of Segments:	3		
Individual Segment Lengths (ft):	145		
Segment:	1	2	3
Gradient (%):	19	22	19
m:			
Individual LS:	6.77	8.22	6.77
Factor:	0.19	0.35	0.46
Product:	1.29	2.88	3.11
LS, Length and Steepness:	7.28		
Total Transect Average Gradient (%):	20		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Vegetative Canopy:	Brush 3' Tall		
Canopy Cover:	75%		
Ground Cover:	70%		
Percent Grass:	20%		
Percent Weeds:	80%		
C, Cover (Table 5)[1]:	0.047		
A, Soil Loss (tons/acre):	7.14		
Soil Loss in Proposed Development (tons):	13.71		

[1] Tables 5 & 6 - USLE Special Applications for Napa County

Stagecoach North Track I ECP
USLE Calculations Post-Project
PPI Engineering
12/10/2018
CC

Transect Z20B

Proposed Development Acres:	1.92		
Soil Unit No. (100-182):	176		
Soil Name:	Rock Outcrop-Hambright		
K, Soil Erodibility:	0.28		
T, Soil Loss Tolerance (tons/acre):	1		
R, Rainfall:	75		
Total Transect Length (ft):	434		
Number of Segments:	3		
Individual Segment Lengths (ft):	145		
Segment:	1	2	3
Gradient (%):	19	22	19
m:			
Individual LS:	6.77	8.22	6.77
Factor:	0.19	0.35	0.46
Product:	1.29	2.88	3.11
LS, Length and Steepness:	7.28		
Total Transect Average Gradient (%):	20		
Farming Practice:	Up & Down Hill		
P, Practice Factor (Table 6)[1]:	1.00		
Cover Strategy:	Permanent		
Age of Development:	Over 3 Years		
Ground Cover:	75%		
C, Cover (Table 4)[1]:	0.034		
A, Soil Loss (tons/acre):	5.20		
Soil Loss in Proposed Development (tons):	9.99		

[1] Tables 4 & 6 - USLE Special Applications for Napa County

SCS MAPPING UNIT

#	K	T	SOIL NAME
100	0.24	3	Aiken
101	0.24	3	Aiken
102	0.24	3	Aiken
103	0.24	5	Bale
104	0.2	5	Bale
105	0.2	5	Bale
106	0.24	5	Bale
107	0.32	4	Boomer
108	0.15	4	Boomer
109	0.15	4	Boomer
110	0.28	4	Boomer-Forward-Felta
111	0.28	4	Boomer-Forward-Felta
112	0.43	3	Bressa-Dibble
113	0.43	3	Bressa-Dibble
114	0.43	3	Bressa-Dibble
115	0.43	3	Bressa-Dibble
116	0.17	5	Clear Lake
117	0.32	3	Clear Lake
118	0.43	5	Cole
119	0.43	5	Cole
120	0.37	3	Contra Costa
121	0.24	2	Contra Costa
122	0.2	4	Coombs
123	0.2	4	Coombs
124	0.15	2	Cortina
125	0.1	5	Cortina
126	0.2	5	Diablo
127	0.2	5	Diablo
128	0.2	5	Diablo
129	0.24	5	Diablo
130	0.32	5	Egbert
131	0.32	4	Fagan
132	0.32	4	Fagan
133	0.32	4	Fagan
134	0.32	4	Fagan
135	0.15	3	Felton
136	0.15	3	Felton
137	0.15	3	Felton
138	0.2	3	Forward

SCS MAPPING UNIT

#	K	T	SOIL NAME
139	0.17	3	Forward
140	0.17	3	Forward
141	0.17	3	Forward-Kidd
142	0.37	2	Guenoc
143	0.37	2	Guenoc-Rock Outcrop
144	0.37	2	Guenoc-Rock Outcrop
145	0.32	4	Haire
146	0.32	4	Haire
147	0.28	4	Haire
148	0.28	4	Haire
149	0.28	4	Haire
150	0.28	4	Haire
151	0.1	1	Hambright-Rock Outcrop
152	0.1	1	Hambright-Rock Outcrop
153	0.1	1	Henneke
154	0.1	1	Henneke
155	0.28	2	Kidd
156	0.28	2	Kidd
157	0.24	1	Lodo-Maymen-Felton
158	0.28	2	Los Gatos
159	0.28	2	Los Gatos
160	0.28	2	Los Gatos
161	0.24	5	Maxwell
162	0.17	1	Maymen-Los Gatos
163	0.32	1	Maymen-Millsholm-Lodo
164	0.32	1	Millsholm
165	0.32	1	Millsholm
166	0.28	1	Montara
167	0.28	1	Montara
168	0.15	5	Perkins
169	0.15	5	Perkins
170	0.43	5	Pleasanton
171	0.28	4	Pleasanton
172	0.28	5	Reyes
173	0.28	5	Reyes
174	0.05	5	Riverwash
175		1	Rock Outcrop
176	0.28	1	Rock Outcrop-Hambright
177	0.28	1	Rock Outcrop-Kidd

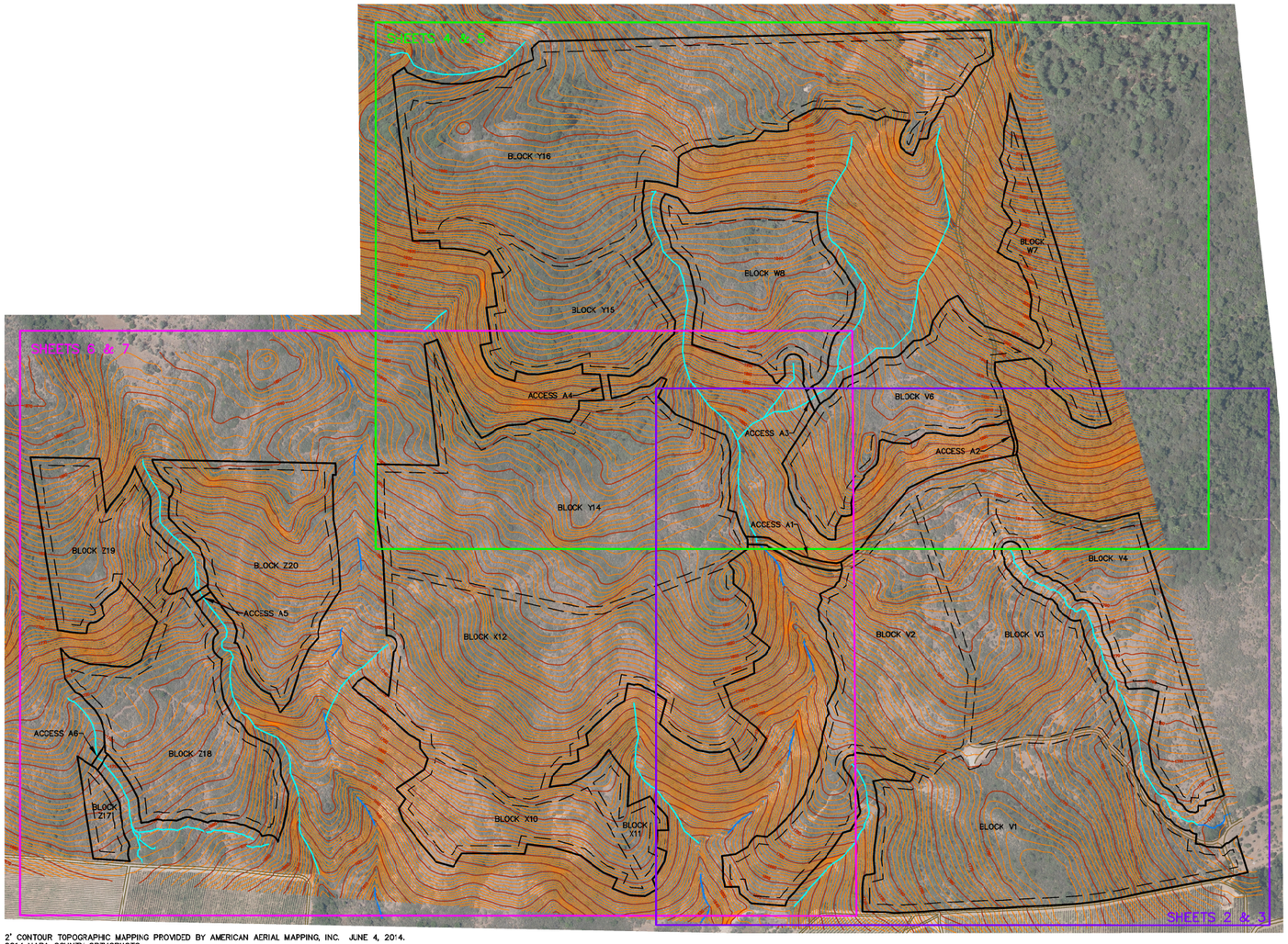
Stagecoach North Track I ECP
USLE Calculations
PPI Engineering
12/10/2018
CC

SCS MAPPING UNIT

#	K	T	SOIL NAME
178	0.32	2	Sobrante
179	0.32	2	Sobrante
180	0.55	5	Tehama
181	0.43	5	Yolo
182	0.43	5	Yolo

ATTACHMENT B

USLE MAPS



2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
2014 NAPA COUNTY ORTHOPHOTO.

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA
- PROPOSED VINEYARD BLOCK BOUNDARY

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STAGECOACH NORTH
SODA CANYON ROAD
SOIL LOSS ANALYSIS
SITE PLAN

PPI ENGINEERING
2800 JEFFERSON STREET
NAPA, CA 94558
707/253-1306 FAX 707/253-1604

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO: 117718C1	SCALE: AS SHOWN	DRAWN BY: JCJ, CC	DATE: 12-10-18	SHEET: 1 OF: 7
DWG. NO: 11771801B				

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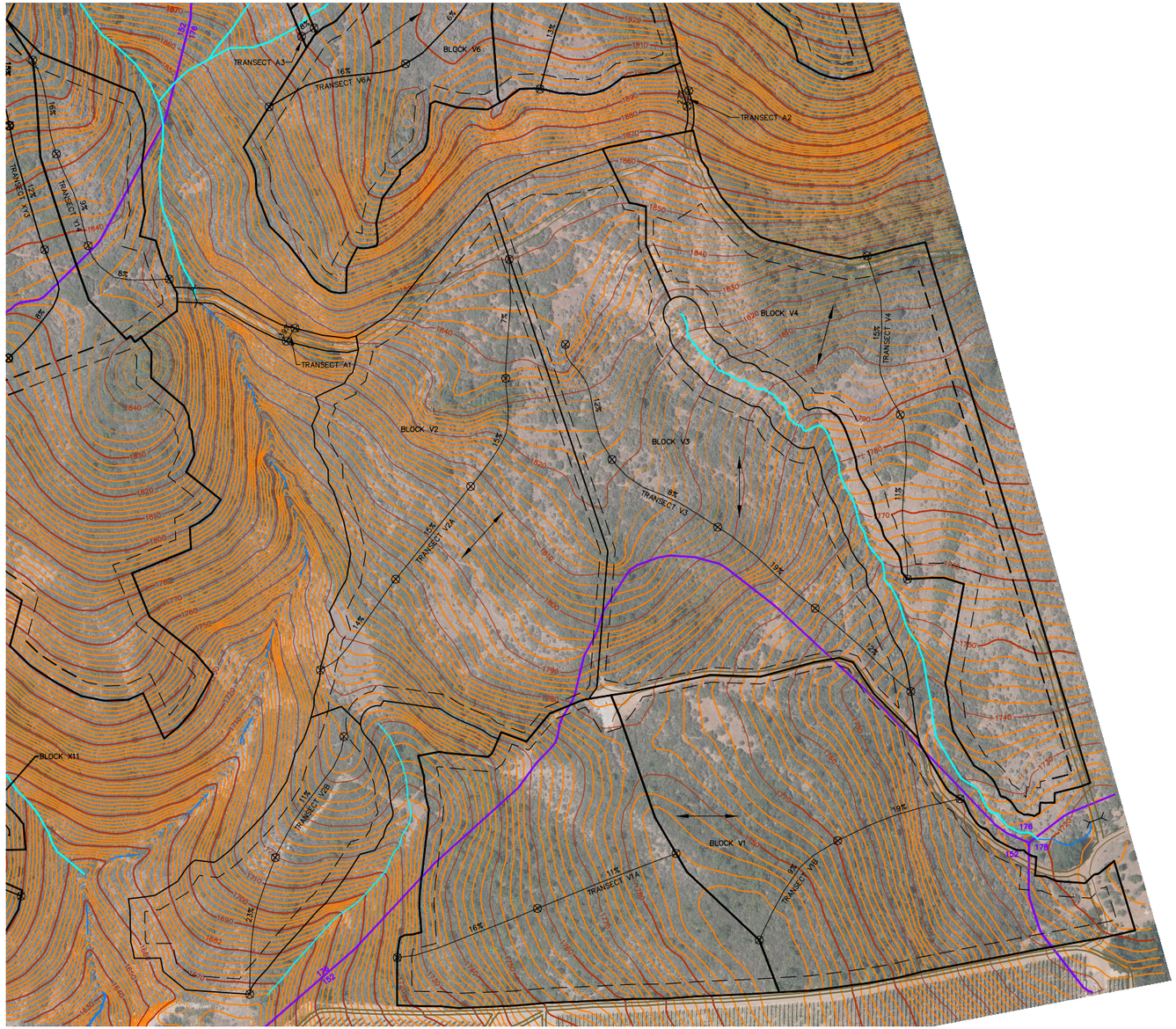
SEE SHEETS 4 & 5

SEE SHEETS 6 & 7



2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
2014 NAPA COUNTY ORTHOPHOTO.

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING CULVERT
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA BY TRANSECT
- PROPOSED VINEYARD BLOCK BOUNDARY
- X% — USLE TRANSECT SEGMENT WITH SLOPE
- PROPOSED VINEROW DIRECTION
- 144 / 176 — SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

152	HAMBRIGHT-ROCK OUTCROP COMPLEX, 30-75% SLOPE
176	ROCK OUTCROP-HAMBRIGHT COMPLEX, 50-75% SLOPE
178	SOBRANTE LOAM, 5-30% SLOPE

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PPI ENGINEERING
2800 JEFFERSON STREET
NAPA, CA 94558
707/253-1806 FAX 707/253-1604

STAGECOACH NORTH
SODA CANYON ROAD
PRE-PROJECT SOIL LOSS ANALYSIS
BLOCKS V1-V4

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO:	SCALE:	DRAWN BY:	DATE:	SHEET:
11771801	AS SHOWN	JCJ, CC	12-10-18	2 OF: 7
DWG. NO: 11771801B				

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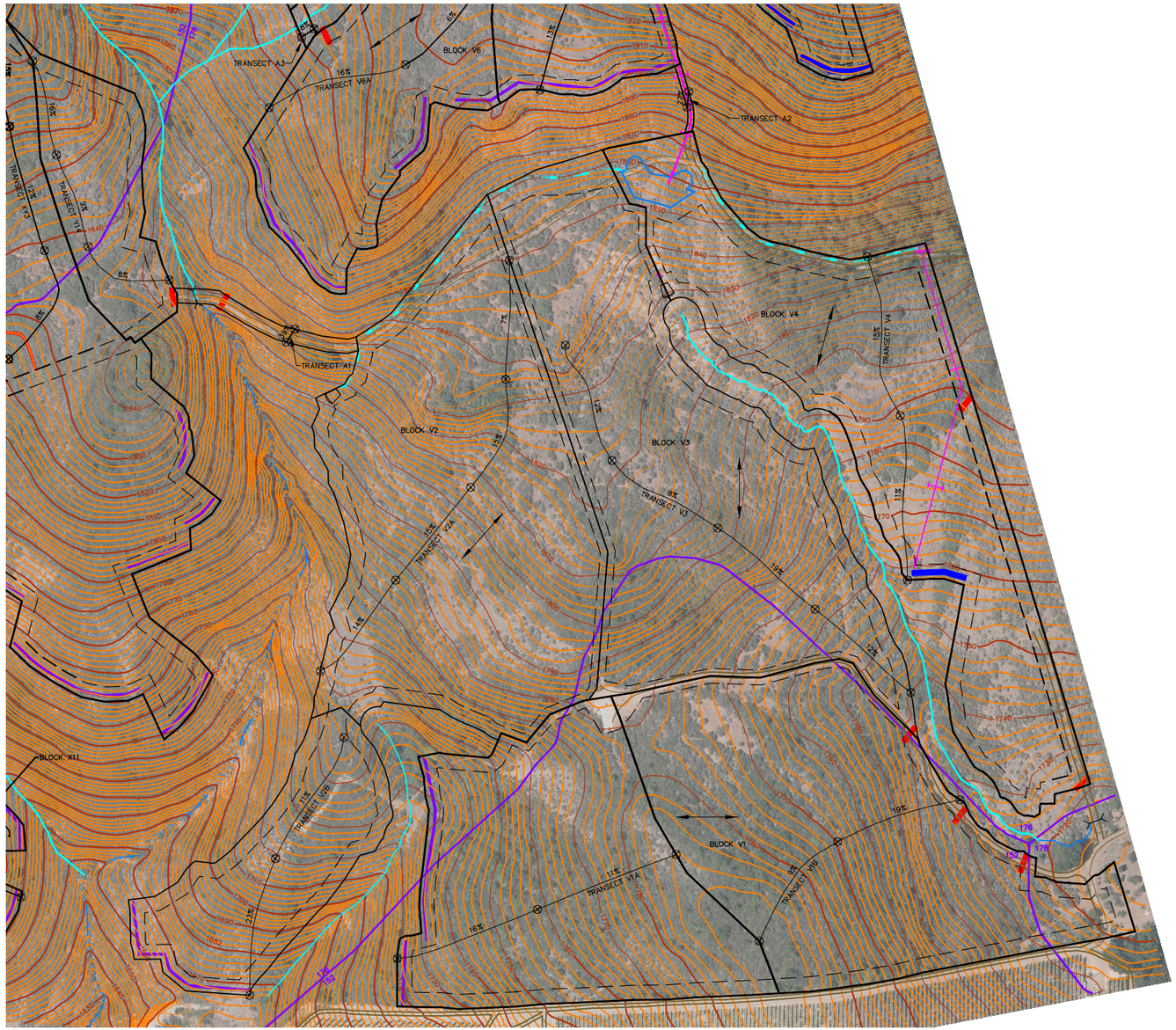
SEE SHEETS 4 & 5

SEE SHEETS 6 & 7



2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
2014 NAPA COUNTY ORTHOPHOTO.

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING CULVERT
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA BY TRANSECT
- PROPOSED VINEYARD BLOCK BOUNDARY
- X% — USLE TRANSECT SEGMENT WITH SLOPE
- PROPOSED DIVERSION DITCH
- PROPOSED DROP INLET
- PROPOSED SURFACE DRAINAGE PIPELINE
- PROPOSED CUTOFF COLLAR
- PROPOSED ROCK BENCH/LEVEL SPREADER
- PROPOSED ROCK FILLED AVENUE
- PROPOSED OUTSLOPED INFIELD LEVEL SPREADER
- PROPOSED ROLLING DIP
- PROPOSED ROCK ENERGY DISSIPATER
- PROPOSED DETENTION BASIN
- PROPOSED VINEROW DIRECTION
- 144 / 176 — SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

152	HAMBRIGHT–ROCK OUTCROP COMPLEX, 30–75% SLOPE
176	ROCK OUTCROP–HAMBRIGHT COMPLEX, 50–75% SLOPE
178	SOBRANTE LOAM, 5–30% SLOPE

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2800 JEFFERSON STREET
NAPA, CA 94558
707/253-1806 FAX 707/253-1604

STAGECOACH NORTH
SODA CANYON ROAD
POST–PROJECT SOIL LOSS ANALYSIS
BLOCKS V1–V4

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO:	SCALE:	DRAWN BY:	DATE:	SHEET:
11771801	AS SHOWN	JCJ, CC	12–10–18	3 OF: 7

DWG. NO: 11771801B

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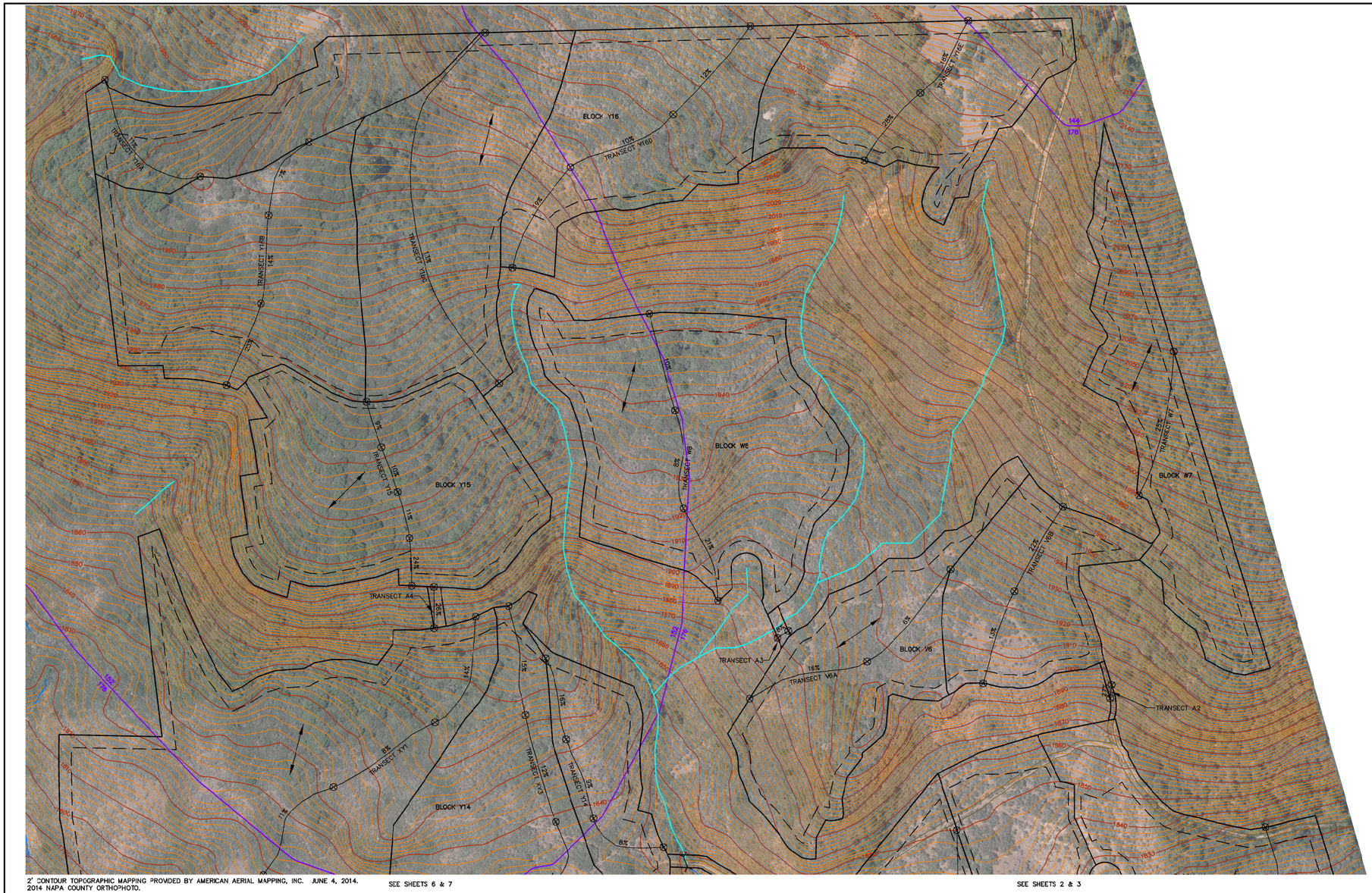

2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
2014 NAPA COUNTY ORTHOPHOTO.

SEE SHEETS 6 & 7

SEE SHEETS 2 & 3

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING CULVERT
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA BY TRANSECT
- PROPOSED VINEYARD BLOCK BOUNDARY
- USLE TRANSECT SEGMENT WITH SLOPE
- PROPOSED VINEROW DIRECTION
- 144 / 176 SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

144	GUENOC-ROCK OUTCROP COMPLEX, 30-75% SLOPE
152	HAMBRIGHT-ROCK OUTCROP COMPLEX, 30-75% SLOPE
176	ROCK OUTCROP-HAMBRIGHT COMPLEX, 50-75% SLOPE

STAGECOACH NORTH
SODA CANYON ROAD
PRE-PROJECT SOIL LOSS ANALYSIS
BLOCKS V6, W7, W8, Y15, & Y16

PPI ENGINEERING
2800 JEFFERSON STREET
NAPA, CA 94558
707/253-1906 FAX 707/253-1604

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO: 117718C1
DWG. NO: 11771801B
SCALE: AS SHOWN
DRAWN BY: JCJ, CC
DATE: 12-10-18
SHEET: 4 OF: 7

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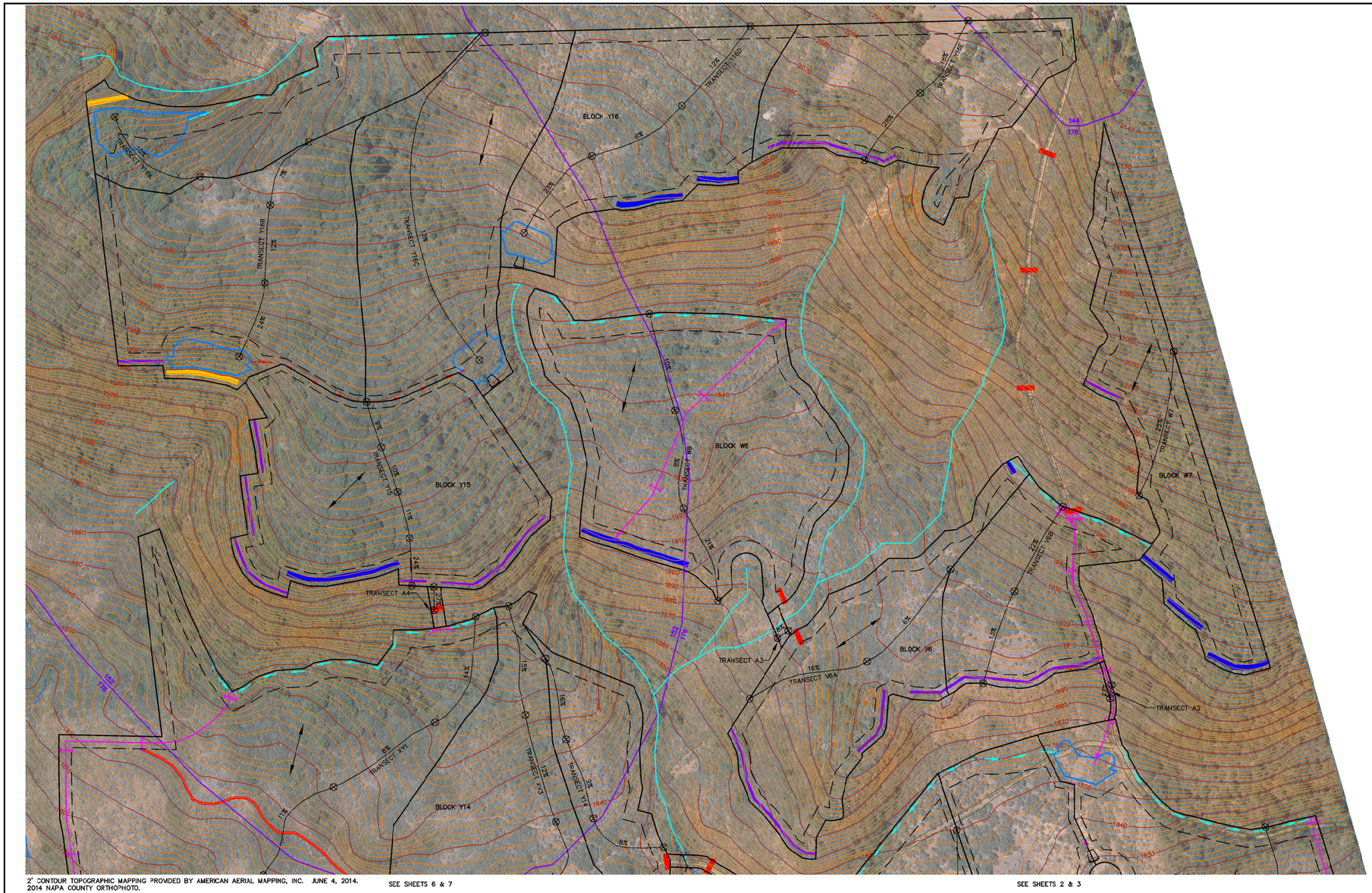

2' CONTOUR TOPOGRAPHIC MAPPING PROVIDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
2014 NAPA COUNTY ORTHOPHOTO.

SEE SHEETS 6 & 7

SEE SHEETS 2 & 3

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING CULVERT
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA BY TRANSECT
- PROPOSED VINEYARD BLOCK BOUNDARY
- USLE TRANSECT SEGMENT WITH SLOPE
- PROPOSED DIVERSION DITCH
- PROPOSED DIVERSION AVENUE
- PROPOSED CULVERT
- PROPOSED DROP INLET
- PROPOSED SURFACE DRAINAGE PIPELINE
- PROPOSED CUTOFF COLLAR
- PROPOSED ROCK BENCH/LEVEL SPREADER
- PROPOSED DETENTION BASIN ROCK LEVEL SPREADER
- PROPOSED ROCK FILLED AVENUE
- PROPOSED OUTSLOPED INFIELD LEVEL SPREADER
- PROPOSED ROLLING DIP
- PROPOSED ROCK ENERGY DISSIPATER
- PROPOSED DETENTION BASIN
- PROPOSED VINEROW DIRECTION
- 144 / 176 SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

144	GUENOC-ROCK OUTCROP COMPLEX, 30-75% SLOPE
152	HAMBRIGHT-ROCK OUTCROP COMPLEX, 30-75% SLOPE
176	ROCK OUTCROP-HAMBRIGHT COMPLEX, 50-75% SLOPE

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STAGECOACH NORTH
SODA CANYON ROAD
POST-PROJECT SOIL LOSS ANALYSIS
BLOCKS V6, W7, W8, Y15, & Y16

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO: 11771801	SCALE: AS SHOWN	DRAWN BY: JCJ, CC	DATE: 12-10-18	SHEET: 5 OF: 7
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SEE SHEETS 4 & 5



SEE SHEETS 2 & 3

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2014 NAPA COUNTY ORTHOPHOTO.

GRAPHIC SCALE

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(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
- OTHER WATERS OF THE U.S.
- EXISTING CULVERT
- EXISTING ROAD
- PROPOSED VINEYARD DEVELOPMENT AREA BY TRANSECT
- PROPOSED VINEYARD BLOCK BOUNDARY
- X% — USLE TRANSECT SEGMENT WITH SLOPE
- PROPOSED VINEROW DIRECTION
- 152 / 176 — SOIL TYPE BOUNDARY

USDA SOIL CLASSIFICATIONS:

152	HAMBRIGHT–ROCK OUTCROP COMPLEX, 30–75% SLOPE
176	ROCK OUTCROP–HAMBRIGHT COMPLEX, 50–75% SLOPE

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STAGECOACH NORTH
SODA CANYON ROAD
PRE–PROJECT SOIL LOSS ANALYSIS
BLOCKS Y14, X10–X12, & Z17–Z20

PPI ENGINEERING
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707/253–1300 FAX 707/253–1604

DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO: 117718C1			
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SHEET: 6 OF: 7

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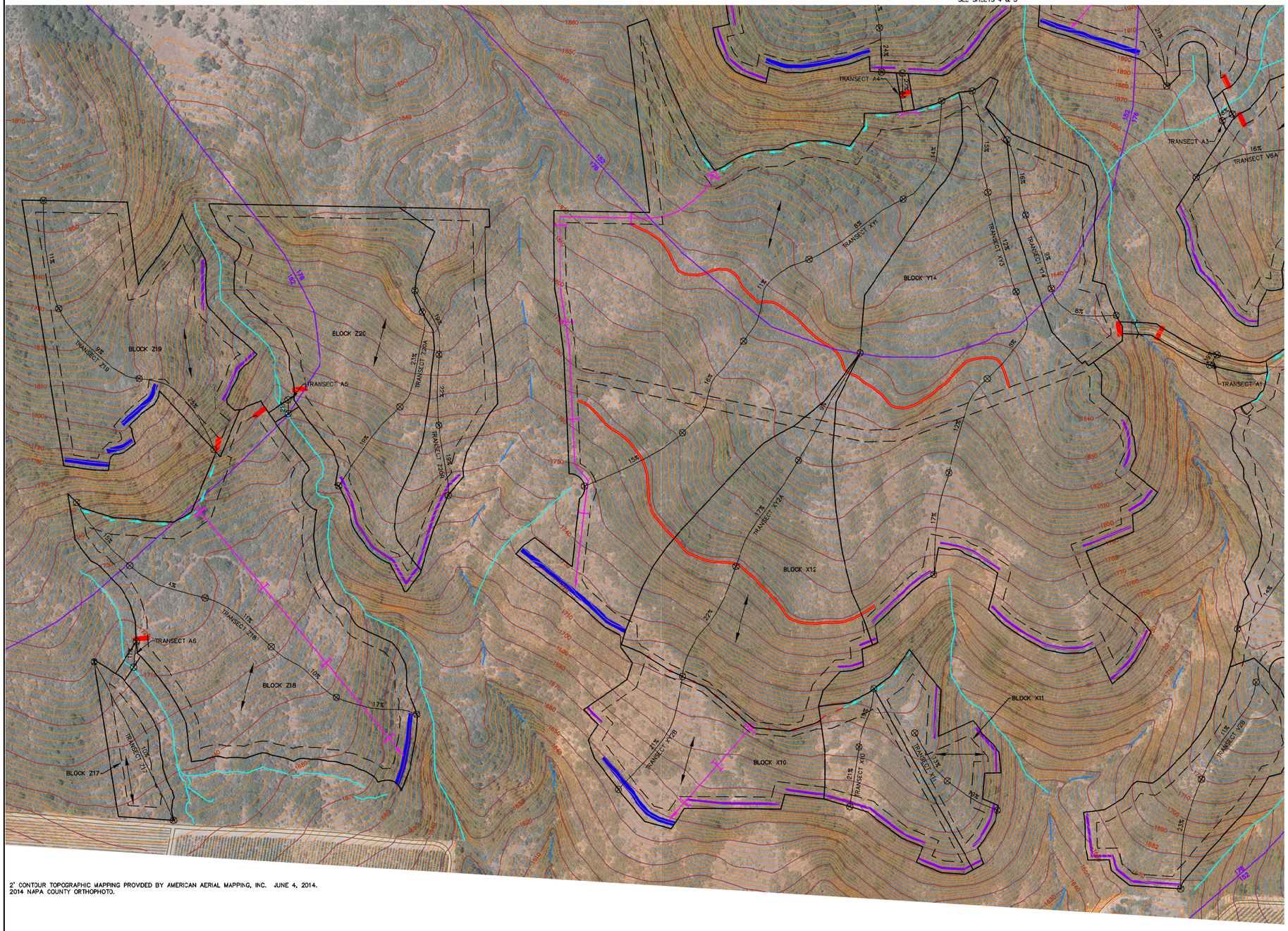

2' CONTOUR TOPOGRAPHIC MAPPING PROVDED BY AMERICAN AERIAL MAPPING, INC. JUNE 4, 2014.
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SEE SHEETS 2 & 3

GRAPHIC SCALE

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(IN FEET)
1 inch = 100 ft.

LEGEND

- U.S.G.S. BLUE LINE STREAM
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STAGECOACH NORTH
SODA CANYON ROAD
POST–PROJECT SOIL LOSS ANALYSIS
BLOCKS Y14, X10–X12, & Z17–Z20

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DESIGN ENGINEER: J. BUSHEY, C. CORSETTI

JOB NO: 11771801	SCALE: AS SHOWN	DRAWN BY: JCJ, CC	DATE: 12–10–18	SHEET: 7 OF: 7
DWG. NO: 11771801B				

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APPENDIX I
HYDROLOGIC ANALYSIS

HYDROLOGIC ANALYSIS OF PROPOSED VINEYARD DEVELOPMENT STAGECOACH NORTH

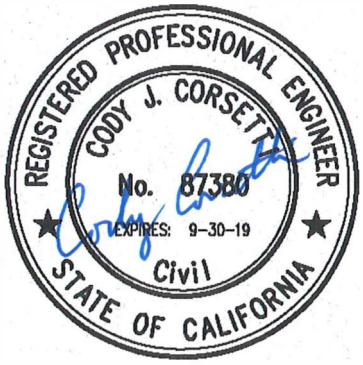
NAPA COUNTY, CALIFORNIA

December 2018

PPI ENGINEERING

2800 Jefferson Street
Napa, CA 94558
(707) 253-1806





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Appendix A – Runoff Curve Number Analysis

Appendix B – Time of Concentration Analysis

Appendix C – Internal Reach Analysis

1.0 INTRODUCTION

1.1 Purpose and Background

This report summarizes the analysis and findings of a hydrologic investigation performed by PPI Engineering for a proposed vineyard land conversion project on the Stagecoach North Property, Assessor's Parcel Number (APN) 032-010-086. The report was written at the request of the Napa County Planning, Building, and Environmental Services Department to supplement the Erosion Control Plan (ECP) prepared for the vineyard project. The ECP proposes to convert approximately 116.2 gross acres (91.3 net acres) of existing grass, brush, and trees to vineyard. The project is located off Soda Canyon Road in Napa County, CA and is within the Rector Reservoir Municipal Watershed, a municipal water supply drainage (see **Figure 1**).

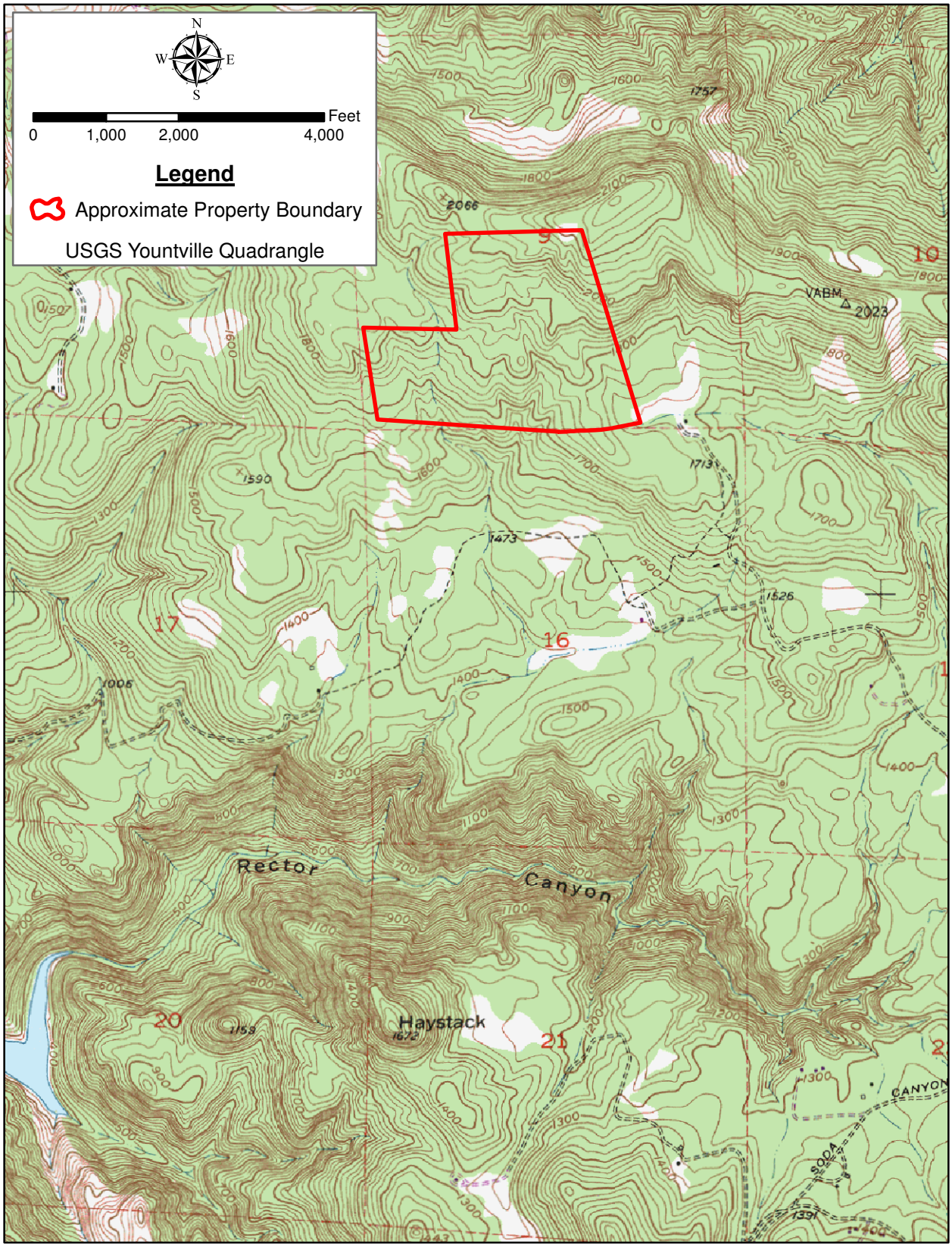
The objective of this analysis is to model existing (pre-project) conditions as well as developed (post-project) conditions to predict present and future runoff values. The primary goal is to remain "flood neutral" or to have no-net-increase in peak runoff post-project. Increases in peak runoff could potentially cause negative effects in natural drainages such as hydro-modification or increased sedimentation. Flood neutrality will chiefly be obtained through standard land use practices. Mitigation measures were designed and incorporated into the ECP for watersheds and subwatersheds that showed increases in runoff as a result of this project.

1.2 Analysis Scope

The scope for the analysis is as follows:

- Obtain topographic maps, aerial photographs, soil survey data, and precipitation data.
- Delineate watersheds and subwatersheds that flow through the project areas.
- Delineate land use polygons using aerial photographs and soil survey data.
- Conduct site visits to confirm land use delineation, existing cover conditions, and drainage patterns.
- Conduct site visits to locate, measure, and document representative stream channel cross sections.
- Develop a computer model for existing hydrologic conditions and run the model for the 2-, 10-, 50- and 100-year storm events.
- Develop a computer model for proposed hydrologic conditions and run the model for the 2-, 10-, 50- and 100-year storm events.
- Analyze and compare pre-project to post-project model results.
- Design and incorporate mitigation measures to neutralize any potential increases in runoff (if required).

Figure 1. Project Vicinity Map



1.3 Hydrologic Model Background & Overview

HydroCAD computer modeling software was used for the Hydrologic Analysis. The program utilizes the Natural Resource Conservation Service (NRCS) Curve Number methodology and procedures for analyzing storm runoff which are based on NRCS unit hydrograph theory. HydroCAD employs the TR-20 approach to runoff modeling along with standard routing and hydraulic procedures.

HydroCAD is a single-event rainfall-runoff, small watershed hydrologic model. The model generates hydrographs from both urban and agricultural areas and at selected points along the stream system. The technical reference for this program is the HydroCAD software Owner's Manual. Additional resources can be found in Part 630 of the NRCS - National Engineering Handbook (NEH) which provides detailed information on Hydrology and the NRCS curve number methodology.

2.0 HYDROLOGIC METHODOLOGY

2.1 Watershed Boundaries

Watersheds for this project were delineated using a combination of two topographic mapping sources. American Aerial Mapping, Inc. provided 2-foot-contour-interval aerial mapping of the site. Where watersheds extended past the limits of the aerial mapping, Napa County 5-foot-LiDAR-generated contours were used to supplement.

Watersheds were drawn to encompass all proposed project areas. Two separate watersheds (Watersheds 1 & 2) were delineated which exit the property at different points of interest, but both remain within the larger Rector Reservoir watershed (see **Figure 2**). Watershed 1 (± 234 acres) is located on the west side of the property and outlets along a blue-line stream that eventually flows to Rector Reservoir. This watershed was divided into five (5) subwatersheds (1A, 1B, 1C, 1D, and 1E) so that the larger, more complex watershed could be analyzed at a smaller scale (see **Figure 3**). Watershed 2 (± 37 acres) is located on the east side of the property. This watershed also outlets to a blue-line stream that eventually flows to Rector Reservoir.

2.2 Land Use and Hydrologic Condition

The Stagecoach North property is comprised of multiple vegetation types, some of which include chamise chaparral, grassland, California bay forest, California black oak forest, and rock outcrops. The adjacent property to the south consists of vineyard along with comparable native vegetation. The terrain is rugged and contains moderate to steep slopes.

Land uses for the hydrologic modeling were classified according to those listed in Chapter 9 of the NEH. Both the existing and proposed land use cover types consisted of six (6) separate land uses as defined by the NEH: Vineyard (annual grass), Brush, Woods-Grass, Woods, Dirt Road, and Gravel Road. Land uses were further classified according to their respective hydrologic

Figure 2. Watershed Boundaries

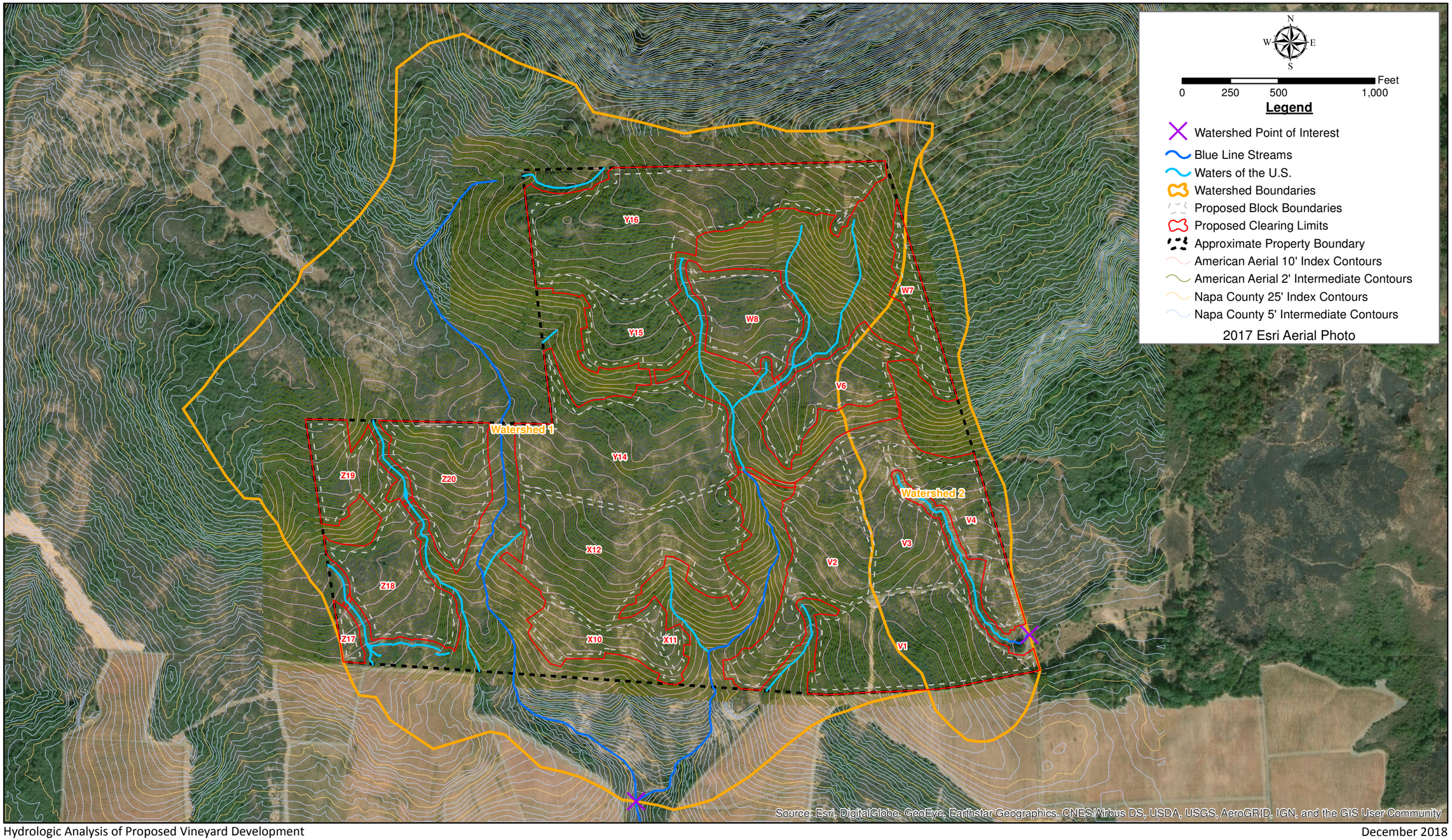
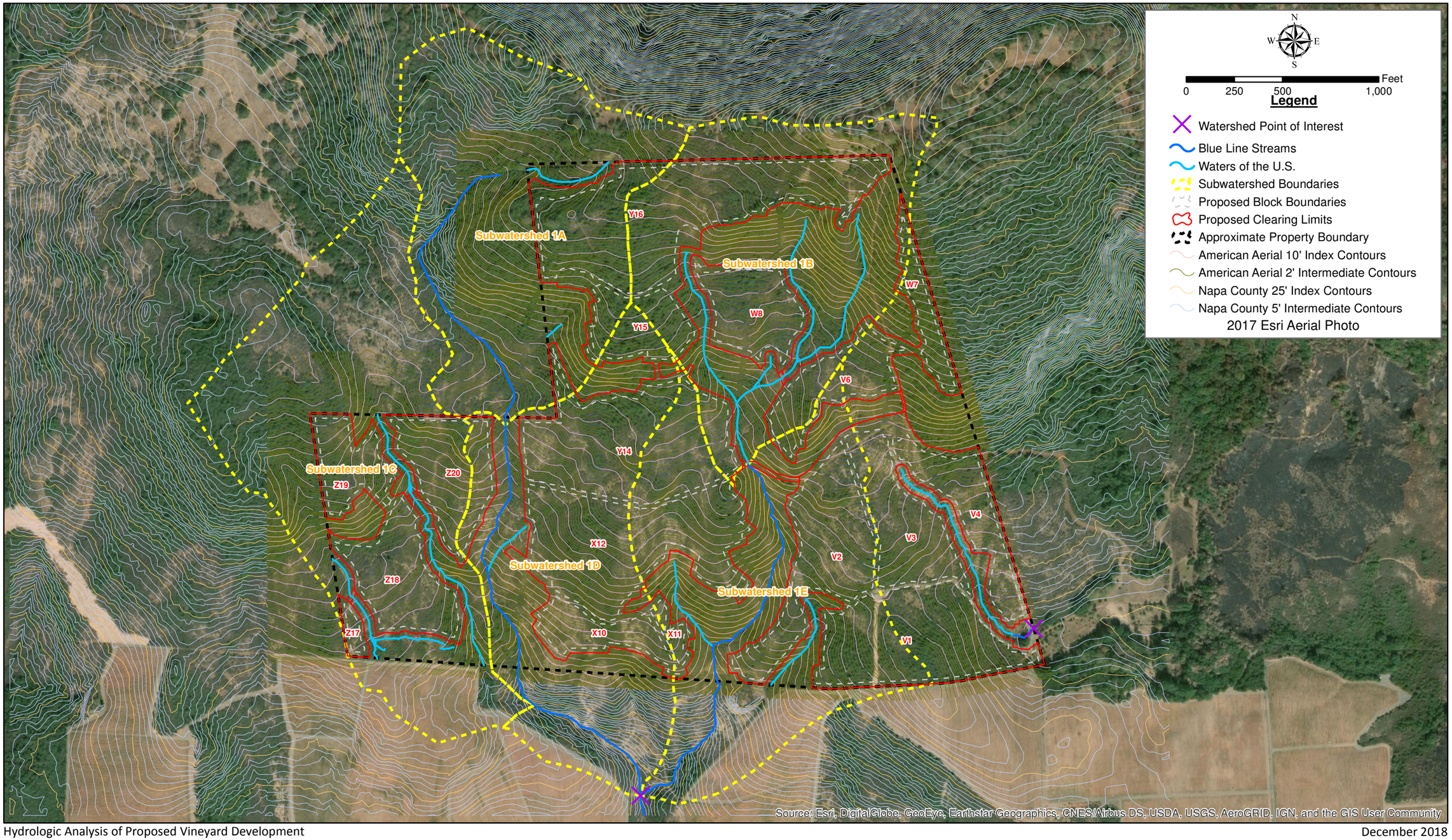


Figure 3. Watershed 1 Subwatershed Boundaries



conditions as either Poor (less than 50% ground cover), Fair (50%-75% ground cover), or Good (greater than or equal to 75% ground cover).

Existing hydrologic conditions were originally verified during a field visit with Jim Bushey of PPI Engineering, Dave Steiner (CPESC), Charles Schembre, formerly of the Napa County Resource Conservation District, and Brian Bordona, Patrick Ryan and Wesley Salter from the Napa County Planning, Building, and Environmental Services Department on December 1, 2015. A more recent inspection was completed by Cody Corsetti of PPI Engineering on November 2, 2018 to verify that the existing hydrologic conditions agreed upon by all at the December 2015 field visit were still accurate and applicable to this analysis. Consequently, existing hydrologic conditions used in this analysis reflect those that were first catalogued in 2015 and should accurately represent the existing site conditions.

Proposed vineyard land use hydrologic conditions were all classified as "Good" condition since all proposed development will maintain a minimum 75% permanent vegetative cover in accordance with the ECP. See **Appendix A** for land use maps and tables by watershed/subwatershed.

2.3 Soil Data

The NRCS Web Soil Survey for Napa County was used to delineate soil boundaries within the project area and to determine their Hydrologic Soil Group (HSG). Hydrologic Soil Groups separate different soil types into categories based on their infiltration and runoff characteristics.

The soil survey delineated four different soil types within the watershed areas:

Guenoc-Rock Outcrop Complex, 30-75% Slopes (Map Unit Symbol 144)
Hambright-Rock Outcrop Complex, 30-75% Slopes (Map Unit Symbol 152)
Rock Outcrop-Hambright Complex, 50-75% Slopes (Map Unit Symbol 176)
Sobrante Loam, 5-30% Slopes (Map Unit Symbol 178)

There are four HSGs defined in the NEH Chapter 7. HSG A is classified as having low runoff potential along with high infiltration rates. HSG B soils have moderately-low runoff potential and moderate infiltration rates. HSG C soils have moderately-high runoff potential with water transmission being somewhat restricted. Lastly, HSG D soils have high runoff potential with water movement through the soil being restricted or very restricted. HSG D soils are also classified as any soil with a shallow depth (less than 20 inches) to an impermeable layer.

The Guenoc-Rock Outcrop Complex (144) and the Sobrante Loam (178) are classified as HSG C, while the Hambright-Rock Outcrop Complex (152) and the Rock Outcrop-Hambright Complex (176) are classified as HSG D. Approximately 98% of the mapped soils within the watersheds are mapped as HSG D. The remaining 2% falls within HSG C. See **Appendix A** for soil and HSG maps by watershed/subwatershed.

2.4 Runoff Curve Number

The Runoff Curve Numbers (RCN) are classified according to the parameters of Chapter 9 of the National Engineering Handbook. The RCN of an area is determined based on Land Use, Hydrologic Condition, and Soil HSG. Runoff Curve Numbers represent the runoff potential from a given site. An increase in RCN is an indication of reduced infiltration and generally associated with higher runoff potential, while a decrease is an indication of increased infiltration and lower runoff potential. **Appendix A** contains the RCNs by watershed/subwatershed.

2.5 Precipitation Data

Precipitation data was obtained from the National Oceanic and Atmospheric Administration (NOAA) Precipitation-Frequency Atlas of the United States. The data for 24-hour storm durations for the given frequencies are summarized in **Table 1**.

Table 1 – Precipitation Data for Stagecoach North

Storm Event	24 Hour Precipitation (inches)
2-Year	4.26
10-Year	6.30
50-Year	8.39
100-Year	9.28

The meteorological data uses the NRCS Hypothetical storm. Given the project's location, it is characterized by a Type 1A Storm Distribution, which indicates relatively low intensity rainfall events that are typical in the Pacific maritime climate. 24-hour storm hydrographs were simulated for 2-, 10-, 50-, and 100-year storm events.

2.6 Time of Concentration

Time of Concentration (Tc) flow paths were delineated for all watersheds/subwatersheds based on the existing topography. The Time of Concentration is defined as the time required for runoff to travel from the hydrologically most distant location in a watershed to its outlet or point of interest.

Time of Concentration was calculated according to the Velocity Method as outlined in Chapter 15 of the National Engineering Handbook. Specifically, three flow patterns were analyzed for each Tc: Sheet Flow, Shallow Concentrated Flow, and Open Channel/Pipe Flow. The total Time of Concentration for a watershed/subwatershed is the sum of the time durations from all three flow patterns.

Sheet flow is over plane surfaces and occurs at the most distant location in the watershed. By definition, sheet flow lengths are less than 100 feet. For this analysis, sheet flow lengths were calculated using the McCuen-Spiess Equation (NEH Chapter 15, Equation 15-9). Shallow concentrated flow occurs after sheet flow has ended up to the point where open channel flow begins. Channel flow occurs after shallow concentrated flow has entered a defined channel or

pipe. The velocity of this flow is calculated according to Manning's Equation (NEH Chapter 15, Equation 15-10). Calculated Tc values along with maps of the three flow patterns by watershed/subwatershed can be found in **Appendix B**.

Note that among other things, the travel time for channel flow is dependent on Manning's Roughness Coefficient (n-value). For pipes, the Manning's n-value is readily available from the pipe manufacturer. For this analysis, dual-wall corrugated polyethylene pipe (DW) was given an n-value of 0.010. Single-wall corrugated polyethylene pipes (SW) were given n-values ranging from 0.016 to 0.020 depending on the pipe diameter. The Manning's n-value for flow through channels and streams were estimated using procedures outlined in the USGS Water-Supply Paper 2339. Field measurements for representative stream cross-sections throughout the project area were collected to allow for accurate flow time calculations and are presented in **Table 2** below. In some instances, channel geometry was best represented with dual side-slope ratios, one for the low-flow channel and a second for the overbank flow area.

Table 2 – Representative Stream Cross-Sections

Stream Cross-Section	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
3	3.5	1.0	5:1	5:1	0.045
4	3.0	1.0	5:1	5:1	0.048
6	4.5	1.0	4:1	4:1	0.053
8	3.5	1.0	3:1	3:1	0.047
9	4.0	1.5	1.5:1, 6:1	1.5:1, 6:1	0.065
12	4.0	1.5	3:1	2:1	0.066
13	5.0	1.5	2.5:1, 6:1	2.5:1, 6:1	0.068
14	2.5	1.0	4:1	4:1	0.049
17	4.0	1.5	4:1	4:1	0.062

* *Note that multiple stream cross-sections were measured throughout the project area, but only those used in the hydrologic calculations are provided here (thus the gaps in the cross-section numbers).*

The locations of the respective measured stream cross-sections can be seen in **Figure 4**.

Proposed stormwater conveyance infrastructure such as diversion ditches, inlets, and pipelines has the potential to change runoff characteristics within a site. In order to analyze these potential increases, Tc flow paths were drawn to pass through proposed conveyance structures where appropriate.

2.7 Reach Routing

Pre-Project Reaches

A reach is a length of stream or valley used as a unit of study. In HydroCAD, a reach is used to perform an independent hydrograph routing through an open channel or through a pipe flowing under open-channel conditions. The model uses the storage-indication plus translation method for routing flows through defined reaches.

As previously mentioned, Watershed 1 was divided into five (5) subwatersheds – 1A, 1B, 1C, 1D, and 1E. Subwatersheds 1A, 1B, and 1C do not outlet directly to the overall Watershed 1 outlet. Consequently, reach routing was used to connect the outlets of Subwatersheds 1A, 1B, and 1C to the Watershed 1 outlet (see **Figure 5**). This routing allowed all five subwatersheds to be connected and simultaneously analyzed in the HydroCAD model.

Runoff from Subwatershed 1A is conveyed by Reach 2 which in turn flows into Reach 1 and eventually to the Watershed 1 outlet. Runoff from Subwatershed 1C is also routed through Reach 1. Reach 3 connects Subwatershed 1B to the Watershed 1 outlet. The cross-sections of these respective reaches can be seen in **Table 3** below.

Table 3 – Subwatershed Reach Cross-Sections

Subwatershed Reach	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
1	5.0	1.5	2.5:1, 6:1	2.5:1, 6:1	0.068
2	4.0	1.5	1.5:1, 6:1	1.5:1, 6:1	0.065
3	4.0	1.5	4:1	4:1	0.062

Watershed 2 was a stand-alone watershed and did not require subwatershed reach routing.

Post-Project Reaches

Internal reaches were used in the post-project analysis to route flows from smaller catchments within a specific watershed/subwatershed to the outlet of said watershed/subwatershed. This allowed for the simultaneous analysis of multiple proposed pipes and/or detention basins within a given subwatershed. Internal reach cross-sections used in this analysis can be found in **Appendix C** along with figures showing these internal reaches by watershed/subwatershed.

Surface runoff exiting a proposed detention basin was modeled as overland flow according to procedures outlined in the HydroCAD Owner's Manual. Specifically, runoff from a detention basin was reach-routed in the model through a wide channel with flat side slopes. This helped to account for the additional distance and time it takes for the water to travel to the appropriate point of interest. The Manning's Roughness Coefficient (n-value) for these "channels" was dependent on the depth of flow that was being routed through it. If the flow depth was below 0.1', a Manning's n-value for sheet flow (i.e. order of magnitude greater than standard n-values) was used. Otherwise, standard Manning's n-values were used in these modeled reaches.

Figure 4. Representative Stream Cross-Sections

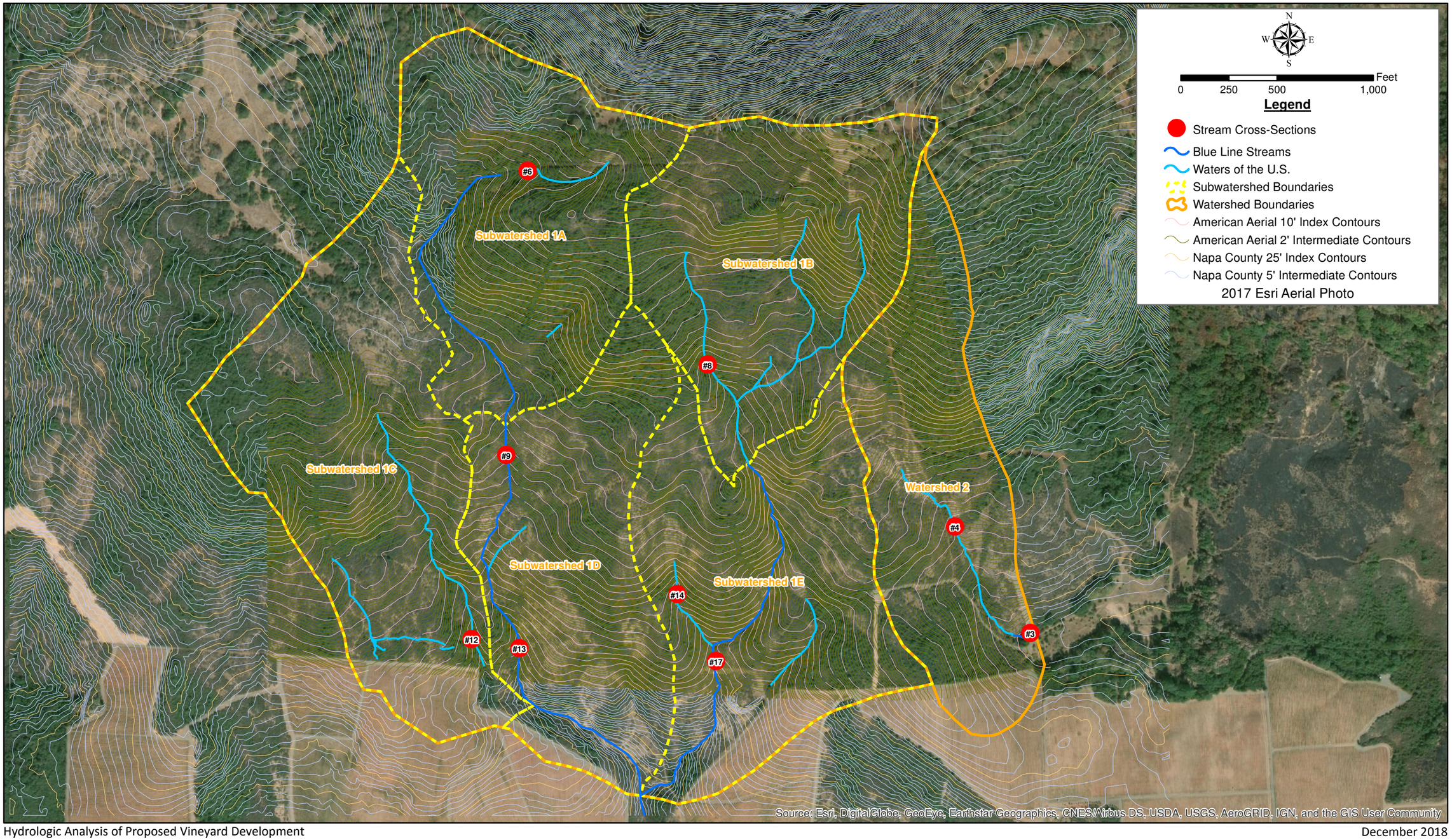
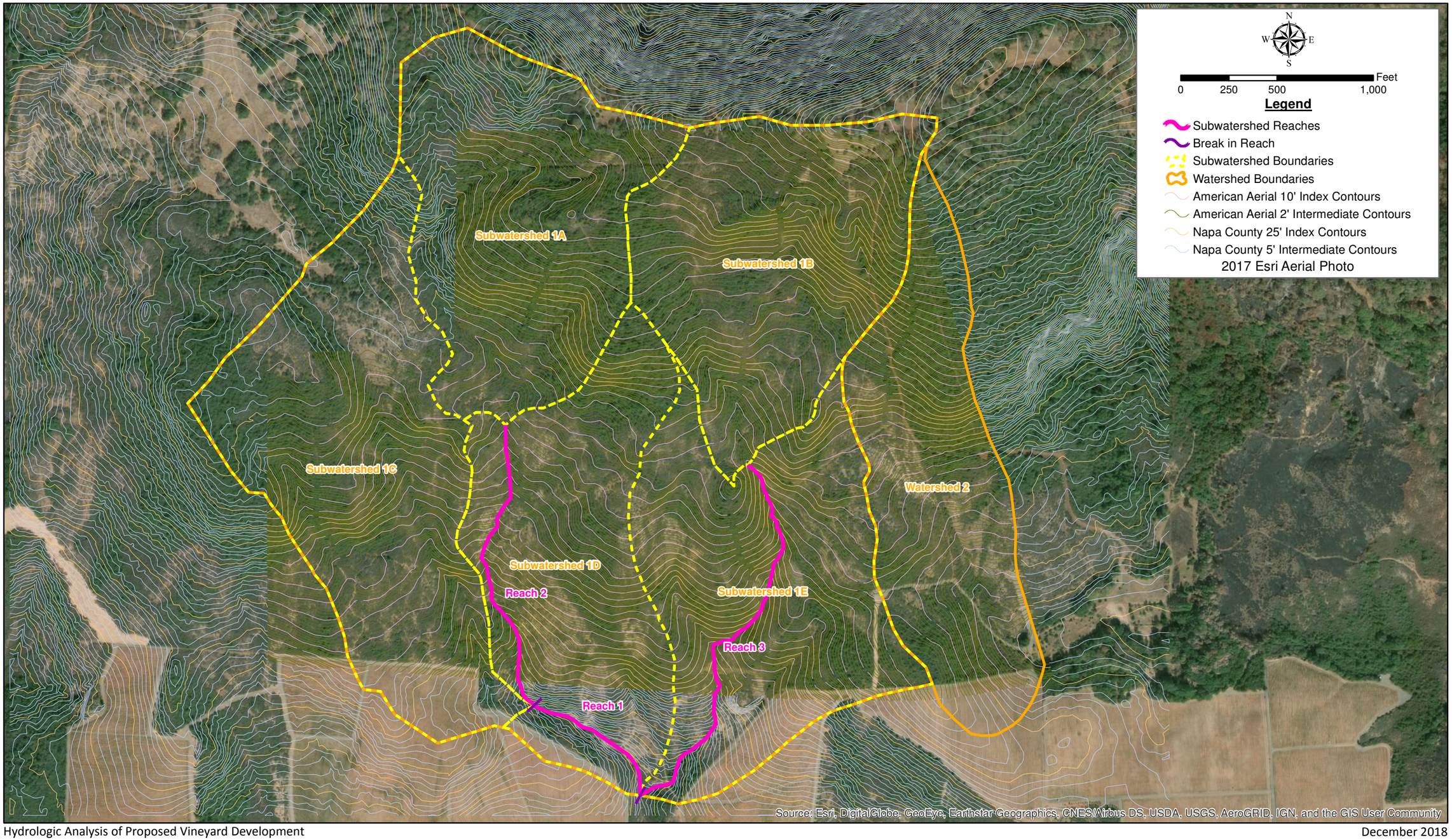


Figure 5. Subwatershed Reaches



3.0 HYDROLOGIC MODELING

3.1 Model Input Data

The peak discharge for each designated watershed and subwatershed was computed using the HydroCAD computer software. Input data for the basin models consisted of the following:

- Surface areas for pre-project and post-project land use
- 24-Hr. rainfall data for each modeled storm
- Rainfall Distribution - Type 1A
- Watershed time of concentration
- Reach data
- Detention basin data (if required)

3.2 Modeling Results

The full results for the modeling of all storm events for each watershed and subwatershed are provided in **Table 4** through **Table 7** below.

The baseline condition, labeled as "existing", is for land use conditions that existed at the time of this study. The developed condition consists of the incorporation of the proposed vineyard blocks and infrastructure as previously described in this report.

Table 4 – 2-Year Storm Peak Runoff Comparison

Watershed	Subwatershed / Reach	Existing Peak Runoff (cfs)	Developed Peak Runoff (cfs)	Increase / Decrease (cfs)	Percent Increase / Decrease
1	**1A**	17.05	16.54	0.51	3.0%
	1B	16.91	16.59	0.32	1.9%
	1C	23.35	22.53	0.82	3.5%
	1D	18.66	18.48	0.18	1.0%
	1E	21.23	25.22	3.99	18.8%
	Reach 1-Inflow	38.96	38.75	0.21	0.5%
	Reach 1-Outflow	38.71	38.54	0.17	0.4%
	Reach 2-Inflow	17.05	16.54	0.51	3.0%
	Reach 2-Outflow	16.74	16.25	0.49	2.9%
	Reach 3-Inflow	16.91	16.59	0.32	1.9%
	Reach 3-Outflow	16.18	16.12	0.06	0.4%
	Watershed 1 Outlet	90.82	87.81	3.01	3.3%
2	**N/A**	15.69	15.50	0.19	1.2%

Table 5 – 10-Year Storm Peak Runoff Comparison

Watershed	Subwatershed / Reach	Existing Peak Runoff (cfs)	Developed Peak Runoff (cfs)	Increase / Decrease (cfs)	Percent Increase / Decrease
1	**1A**	36.70	35.18	1.52	4.1%
	1B	36.29	36.21	0.08	0.2%
	1C	48.13	45.83	2.30	4.8%
	1D	37.68	36.83	0.85	2.3%
	1E	42.76	47.86	5.10	11.9%
	Reach 1-Inflow	83.15	80.61	2.54	3.1%
	Reach 1-Outflow	82.57	80.08	2.49	3.0%
	Reach 2-Inflow	36.70	35.18	1.52	4.1%
	Reach 2-Outflow	36.31	34.80	1.51	4.2%
	Reach 3-Inflow	36.29	36.21	0.08	0.2%
	Reach 3-Outflow	35.39	35.33	0.06	0.2%
	Watershed 1 Outlet	193.30	181.78	11.52	6.0%
2	**N/A**	32.30	31.85	0.45	1.4%

Table 6 – 50-Year Storm Peak Runoff Comparison

Watershed	Subwatershed / Reach	Existing Peak Runoff (cfs)	Developed Peak Runoff (cfs)	Increase / Decrease (cfs)	Percent Increase / Decrease
1	**1A**	58.87	56.88	1.99	3.4%
	1B	58.09	57.08	1.01	1.7%
	1C	75.55	71.48	4.07	5.4%
	1D	58.58	56.78	1.80	3.1%
	1E	66.35	72.23	5.88	8.9%
	Reach 1-Inflow	132.49	127.83	4.66	3.5%
	Reach 1-Outflow	131.91	127.22	4.69	3.6%
	Reach 2-Inflow	58.87	56.88	1.99	3.4%
	Reach 2-Outflow	58.39	56.40	1.99	3.4%
	Reach 3-Inflow	58.09	57.08	1.01	1.7%
	Reach 3-Outflow	57.08	55.91	1.17	2.0%
	Watershed 1 Outlet	308.01	288.00	20.01	6.5%
2	**N/A**	50.70	49.84	0.86	1.7%

Table 7 – 100-Year Storm Peak Runoff Comparison

Watershed	Subwatershed / Reach	Existing Peak Runoff (cfs)	Developed Peak Runoff (cfs)	Increase / Decrease (cfs)	Percent Increase / Decrease
1	**1A**	68.61	66.00	2.61	3.8%
	1B	67.68	65.75	1.93	2.9%
	1C	87.49	82.64	4.85	5.5%
	1D	67.67	65.42	2.25	3.3%
	1E	76.62	82.71	6.09	7.9%
	Reach 1-Inflow	154.16	148.08	6.08	3.9%
	Reach 1-Outflow	153.53	147.47	6.06	3.9%
	Reach 2-Inflow	68.61	66.00	2.61	3.8%
	Reach 2-Outflow	68.11	65.52	2.59	3.8%
	Reach 3-Inflow	67.68	65.75	1.93	2.9%
	Reach 3-Outflow	66.62	64.66	1.96	2.9%
	Watershed 1 Outlet	358.28	333.92	24.36	6.8%
2	**N/A**	58.76	57.22	1.54	2.6%

3.3 Discussion of Results

Watershed 1

Watershed 1 as a whole demonstrated runoff decreases post-project for all storm events. At the subwatershed level, however, the initial modeling predicted runoff increases throughout for post-project conditions. This is attributed to the increase in runoff curve number for the subwatersheds. Runoff in Subwatersheds 1A, 1B, and 1E initially increased for post-project conditions, while runoff in Subwatersheds 1C and 1D decreased for all storm events analyzed. All modeled reaches initially showed runoff increases for post-project conditions as well. In order to attenuate the potential increases, stormwater detention basins were designed as discussed below. Four of the five proposed detention basins are located in Watershed 1. The watershed as a whole shows runoff decreases for all storm events analyzed in the mitigated project. The relative decreases range from 3.3% (3.01 cubic feet per second [cfs]) for the 2-year storm event to 6.8% (24.36 cfs) for the 100-year storm event. Additionally, most subwatersheds (excluding Subwatershed 1E) and all reaches now demonstrate runoff decreases for post-project conditions.

Subwatershed 1A

Initial modeling showed relative runoff increases in Subwatershed 1A ranging from 5.0% (3.46 cfs) for the 100-year storm event to 12.7% (2.17 cfs) for the 2-year storm event. The RCN increased while the Tc did not change from pre- to post-project conditions. In order to attenuate any modeled increases in runoff to pre-project levels or below, two

detention basins were designed for this subwatershed (Detention Basin #1 and Detention Basin #2, see **Figure 6**).

With inclusion of the detention basins, Subwatershed 1A shows runoff decreases post-project for all storm events analyzed. Relative decreases of 3.0% (0.51 cfs) for the 2-year storm event to 4.1% (1.52 cfs) for the 10-year storm event were observed for this subwatershed.

Subwatershed 1B

Initial modeling predicted post-project increases of 7.0% (1.18 cfs) and 1.1% (0.41 cfs) only for the 2- and 10-year storm events, respectively. Subwatershed 1B is similar to 1A in that the runoff increases can be associated with an increase in RCN. The Tc for the subwatershed almost doubled for post-project conditions, which by itself would generally result in runoff decreases for post-project conditions. The proposed ditch and pipe in Block W8 increased the Tc flow path, while the proposed level spreaders on the downhill side of Block Y16 and at the outlet of the pipe in Block W8 introduce additional sheet flow. Similar to Subwatershed 1A, two detention basins were designed for Subwatershed 1B to mitigate predicted increases (Detention Basins #3 and #4, see **Figure 6**).

After inclusion of detention basins, this subwatershed now demonstrates a reduction in runoff for post-project conditions for all modeled storm events. Relative runoff decreases range from 0.2% (0.08 cfs) for the 10-year storm event to 2.9% (1.93 cfs) for the 100-year storm event.

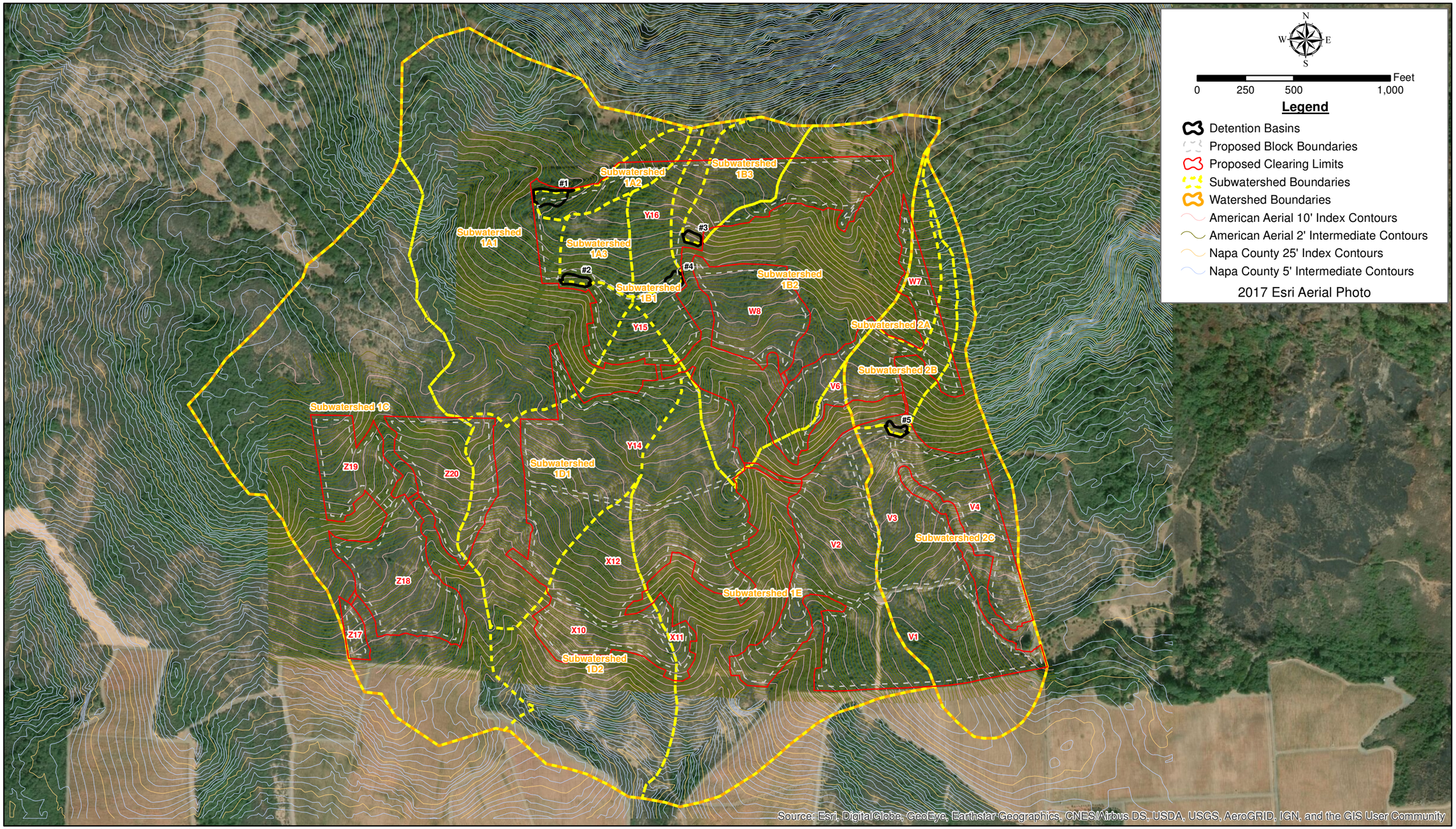
Subwatershed 1C

Subwatershed 1C demonstrated runoff decreases for all storm events post-project. The relative decreases ranged from 3.5% (0.82 cfs) for the 2-year storm event to 5.5% (4.85 cfs) for the 100-year storm event. The RCN in this subwatershed increased due to the proposed development, however the Tc increased as well and offset the increase in RCN. The proposed ditch and pipe in Block Z18 increase the travel distance for the Tc flow path. Additionally, the proposed level spreaders on the downhill sides of both Blocks Z18 and Z19 help to promote additional sheet flow. The end result is runoff that now has to travel a longer distance at a slower rate.

Subwatershed 1D

Subwatershed 1D had to be further subdivided for the post-project analysis. There are two (2) proposed pipes in this subwatershed. The first pipe originates at the top of Block Y14 and outlets to a proposed level spreader at the southwest corner of Block X12. The other originates at the top of Block X10 and outlets to a level spreader on the downhill side of this block. To analyze the effects these proposed pipes would have on the surrounding watershed, Subwatershed 1D was subdivided into Subwatersheds 1D1 and 1D2 for post-project conditions. Subwatershed 1D1 contained the proposed pipe in Blocks Y14 and X12 and was delineated based on the outlet location of this pipe.

Figure 6. Proposed Detention Basin Locations



Subwatershed 1D2 contained the proposed pipe in Block X10 and was comprised of the remaining area of the original Subwatershed 1D.

The RCN increased for post-project conditions in Subwatersheds 1D1 and 1D2. The Tc in both of these subwatersheds increased as well due to the proposed network of ditches and pipes in the respective subwatersheds. Additionally, the proposed level spreaders at the downhill side of Block Y15 and at the outlet of the respective pipes introduces additional sheet flow. The end result is an overall runoff decrease post-project at the outlet of Subwatershed 1D. The relative runoff decreases ranged from 1.0% (0.18 cfs) for the 2-year storm event to 3.3% (2.25 cfs) for the 100-year storm event.

Subwatershed 1E

Subwatershed 1E initially predicted post-project runoff increases for all storm events analyzed. The relative increases ranged from 7.9% (6.09 cfs) for the 100-year storm event to 18.8% (3.99 cfs) for the 2-year storm event. The calculated increases in Subwatershed 1E can be attributed to both an RCN increase and a Tc decrease for post-project conditions. Subwatershed 1E outlets at the overall Watershed 1 outlet, which demonstrates overall runoff decreases for all storm events after incorporation of detention basins for mitigation. The upstream decreases in the subwatersheds will offset the predicted increase from Subwatershed 1E, and resultant flows will still be below pre-project levels. The net result is a reduction in peak flows at the Subwatershed 1E outlet (i.e. the Watershed 1 outlet). Therefore, the calculated runoff increases at the Subwatershed 1E level are offset by the runoff decreases throughout the other subwatersheds.

Reaches 1, 2, and 3

All modeled reaches demonstrated an increase in runoff for post-project conditions without the incorporation of mitigation. Reach 1 had increases for all but the 100-year storm event. Reach 2 had increases for all storm events, while Reach 3 only showed increases for the 2- and 10-year storm events. After inclusion of the detention basins in the subwatersheds, however, all reaches now show runoff decreases post-project.

Watershed 2

Watershed 2 initially showed a post-project runoff increase only for the 2-year storm event (4.2% relative increase). The Tc for this watershed almost doubled for post-project conditions. The proposed network of ditches and pipes throughout the watershed increased the travel distance, while proposed level spreaders helped introduce additional sheet flow and slow potential runoff. The Tc increase, however, was not large enough to offset the increase in RCN for post-project conditions. Therefore, Detention Basin #5 (see **Figure 6**) was designed and incorporated into the project to reduce potential increases in runoff to at or below pre-project levels.

For the post-project analysis, Watershed 2 was subdivided into Subwatersheds 2A, 2B, and 2C. Watershed 2B contains the proposed basin, and all subwatersheds were connected via internal reach routing. With the incorporation of the basin design, Watershed 2 now shows relative

runoff decreases ranging from 1.2% (0.19 cfs) for the 2-year storm event to 2.6% (1.54 cfs) for the 100-year storm event.

4.0 CONCLUSION

Hydrologic modeling results for the proposed vineyard conversion predict net decreases in peak flow rates for all watersheds with the inclusion of detention basins, level spreaders, and other water conveyance infrastructure that is shown in the engineered ECP.

In Watershed 1, a total of four (4) detention basins were designed to detain excess runoff and release it at or below pre-project levels. With the incorporation of these basins into the hydrologic model, the analysis now shows decreases for all storm events for almost all subwatersheds and all reaches. Subwatershed 1E still shows an increase post-project at the subwatershed level, but this increase is offset by reduced runoff from other subwatersheds upstream (as evidenced by an overall runoff reduction modeled at the Watershed 1 outlet).

Watershed 2 demonstrates no runoff increases post-project with the inclusion of Detention Basin #5.

Proposed stormwater conveyance infrastructure such as inlets and pipes have been included in this analysis. The potential effects of conveyance infrastructure on the individual watersheds/ subwatersheds was determined via the time of concentration. The Tc flow paths were purposely routed through proposed infrastructure to allow the model to analyze their individual hydrologic effects on the surrounding watershed/subwatershed.

Based on this analysis, there are no predicted increases in net runoff, and no negative hydrologic impacts are expected as a result of this project. The project as proposed is in compliance with Napa County's General Plan policy requiring no net increase in runoff.

5.0 REFERENCES

1. HydroCAD Stormwater Modeling System, Owner's Manual, Version 10

2. United States Department of Agriculture, Natural Resource Conservation Service, *Web Soil Survey of Napa County, California*, 2017.

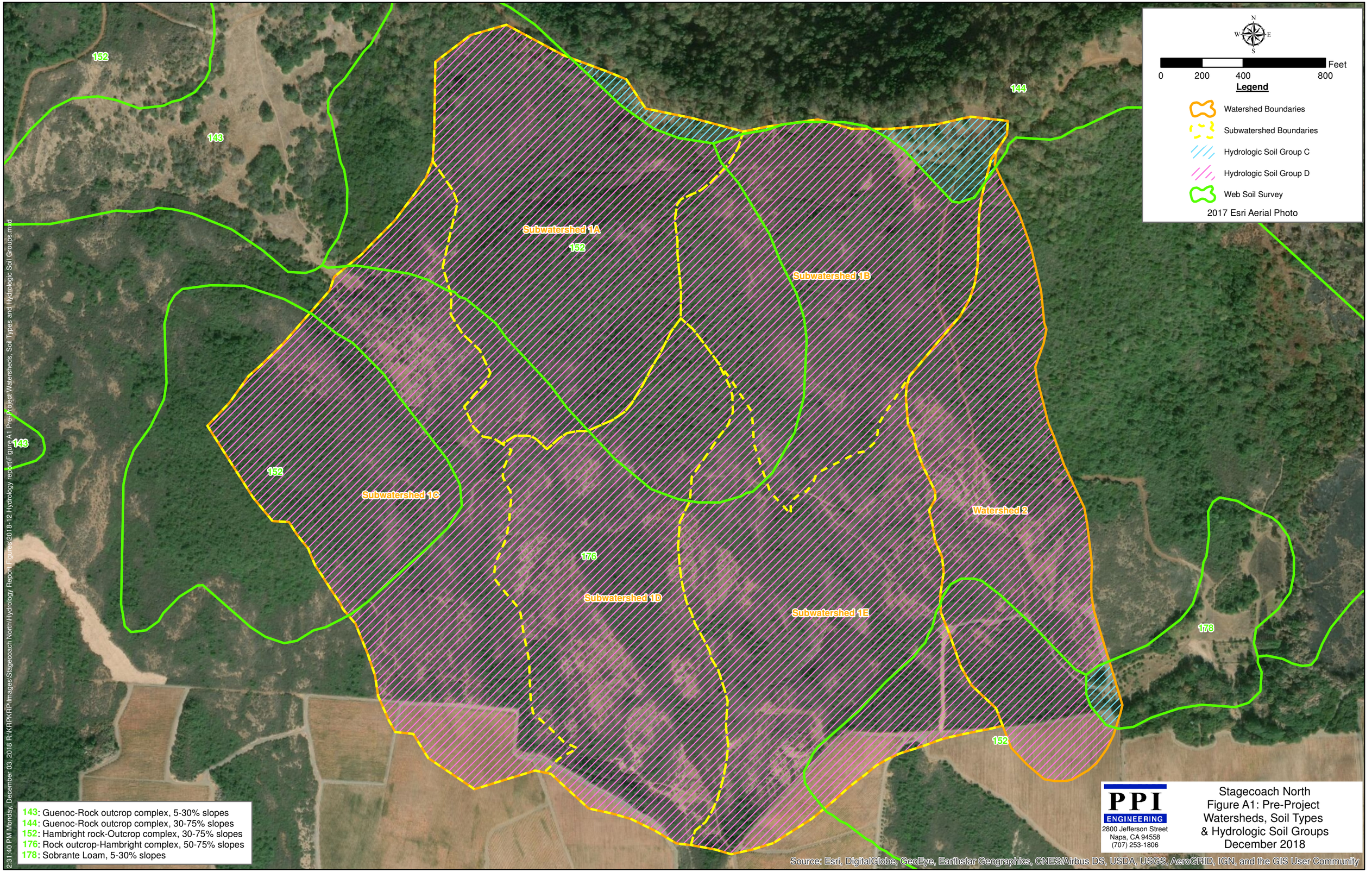
3. United States Department of Commerce, National Oceanic and Atmospheric Administration, *Precipitation-Frequency Atlas of the United States*, Volume 6, Version 2.3: California, 2014.

4. United States Department of Agriculture, Natural Resources Conservation Service, *National Engineering Handbook Part 630, Chapters 7, 9, & 15*, updated 2002-2010.

5. United States Geological Survey *Water-Supply Paper 2339*, 1989.

Appendix A

Runoff Curve Number (RCN) Analysis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Feet
Legend
Watershed Boundaries
Subwatershed Boundaries
Hydrologic Soil Group C
Hydrologic Soil Group D
Web Soil Survey
2017 Esri Aerial Photo
152
143
144
Subwatershed 1A
152
Subwatershed 1B
143
152
Subwatershed 1C
176
Subwatershed 1D
Subwatershed 1E
Watershed 2
178
152
143: Guenoc-Rock outcrop complex, 5-30% slopes
144: Guenoc-Rock outcrop complex, 30-75% slopes
152: Hambright rock-Outcrop complex, 30-75% slopes
176: Rock outcrop-Hambright complex, 50-75% slopes
178: Sobrante Loam, 5-30% slopes
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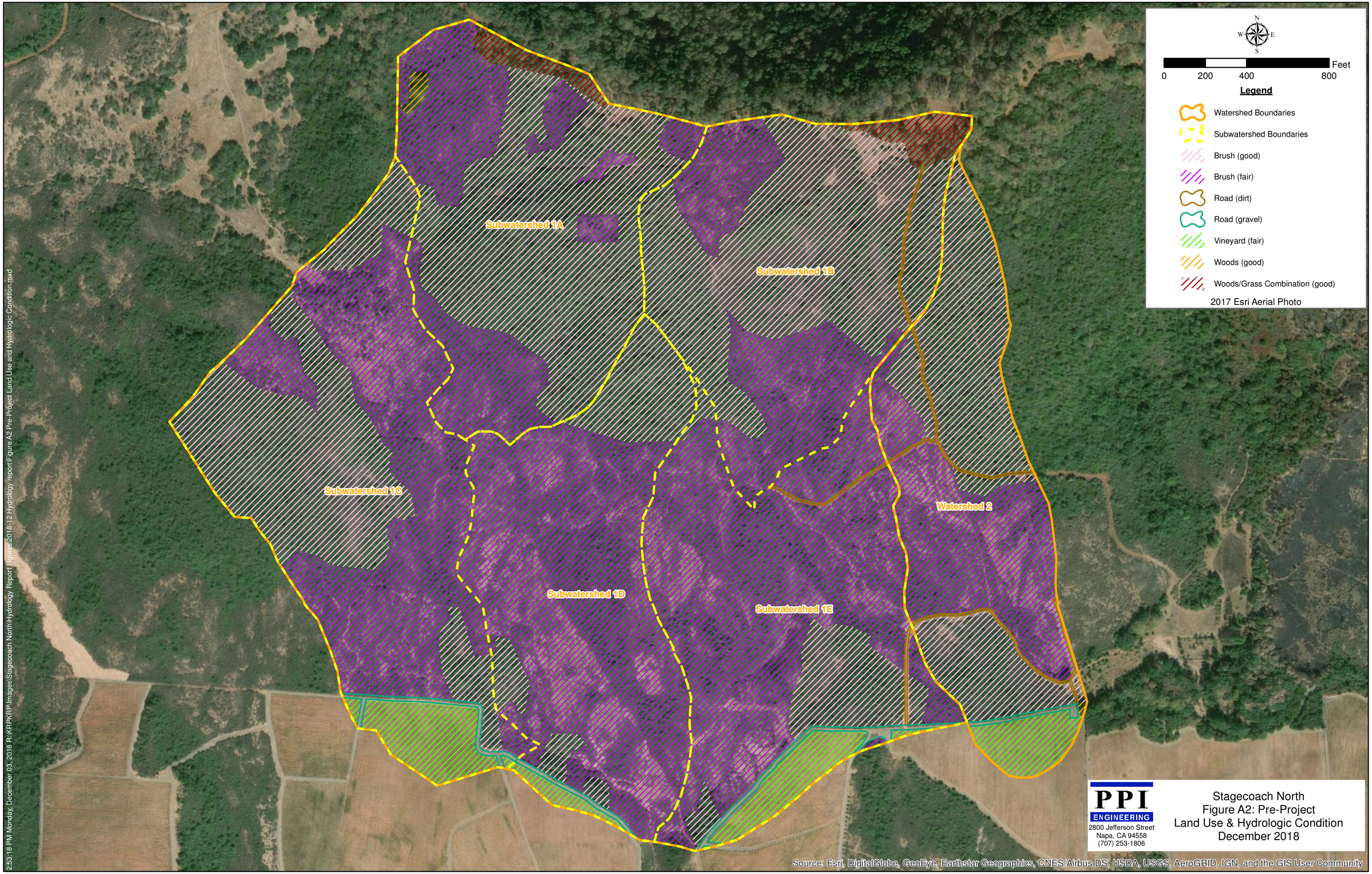
Stagecoach North
Figure A1: Pre-Project
Watersheds, Soil Types
& Hydrologic Soil Groups
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
2:31:40 PM Monday, December 03, 2018 R:\KPK\KPK\Images\Stagecoach North\Hydrology Report\Figures\2018-12 Hydrology report\Figure A1 Pre-Project Watersheds, Soil Types and Hydrologic Soil Groups.mxd


Subwatershed 1A
Subwatershed 1B
Subwatershed 1C
Subwatershed 1D
Subwatershed 1E
Watershed 2
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Watershed Boundaries
Subwatershed Boundaries
Brush (good)
Brush (fair)
Road (dirt)
Road (gravel)
Vineyard (fair)
Woods (good)
Woods/Grass Combination (good)
2017 Esri Aerial Photo
2:53:18 PM Monday, December 03, 2018 R:\KRP\KRP Images\Stagecoach North\Hydrology Report Figures\2018-12 Hydrology report\Figure A2 Pre-Project Land Use and Hydrologic Condition.mxd
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Napa, CA 94558
(707) 253-1806
Stagecoach North
Figure A2: Pre-Project
Land Use & Hydrologic Condition
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PRE-PROJECT LAND USE AND CURVE NUMBERS

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1A	Brush, Fair	C	70	0.315
	Brush, Fair	D	77	16.730
	Brush, Good	C	65	0.763
	Brush, Good	D	73	25.943
	Woods, Good	D	77	0.346
	Woods/grass comb., Good	C	72	0.560
	Woods/grass comb., Good	D	79	0.959
			74	45.62

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1B	Brush, Fair	C	70	0.054
	Brush, Fair	D	77	13.810
	Brush, Good	C	65	1.268
	Brush, Good	D	73	27.065
	Dirt roads	C	87	0.033
	Dirt roads	D	89	0.151
	Woods/grass comb., Good	C	72	2.037
			74	44.42

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1C	Brush, Fair	D	77	27.578
	Brush, Good	D	73	23.133
	Gravel roads	D	91	0.591
	Vineyard, Fair	D	84	4.243
			76	55.55

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1D	Brush, Fair	D	77	33.600
	Brush, Good	D	73	7.152
	Gravel roads	D	91	0.309
	Vineyard, Fair	D	84	0.832
			77	41.89

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1E	Brush, Fair	D	77	35.879
	Brush, Good	D	73	6.731
	Dirt roads	D	89	0.260
	Gravel roads	D	91	0.854
	Vineyard, Fair	D	84	3.198
			77	46.92

Watershed	Land Use, Condition	Soil Group	RCN	Area (acres)
2	Brush, Fair	C	70	0.201
	Brush, Fair	D	77	14.845
	Brush, Good	C	65	0.451
	Brush, Good	D	73	17.983
	Dirt roads	C	87	0.077
	Dirt roads	D	89	0.584
	Gravel roads	C	89	0.080
	Gravel roads	D	91	0.209
	Vineyard, Fair	C	79	0.059
	Vineyard, Fair	D	84	2.585
	Woods, Good	C	70	0.057
			76	37.13

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Legend

- Watershed Boundaries
- Subwatershed Boundaries
- Hydrologic Soil Group C
- Hydrologic Soil Group D
- Web Soil Survey

2017 Esri Aerial Photo

152
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Subwatershed 1A1
Subwatershed 1A2
Subwatershed 1A3
Subwatershed 1B1
Subwatershed 1B2
Subwatershed 1B3
Subwatershed 1C
Subwatershed 1D1
Subwatershed 1D2
Subwatershed 1E
Subwatershed 2A
Subwatershed 2B
Subwatershed 2C
176
178

143: Guenoc-Rock outcrop complex, 5-30% slopes
144: Guenoc-Rock outcrop complex, 30-75% slopes
152: Hambright rock-Outcrop complex, 30-75% slopes
176: Rock outcrop-Hambright complex, 50-75% slopes
178: Sobrante Loam, 5-30% slopes

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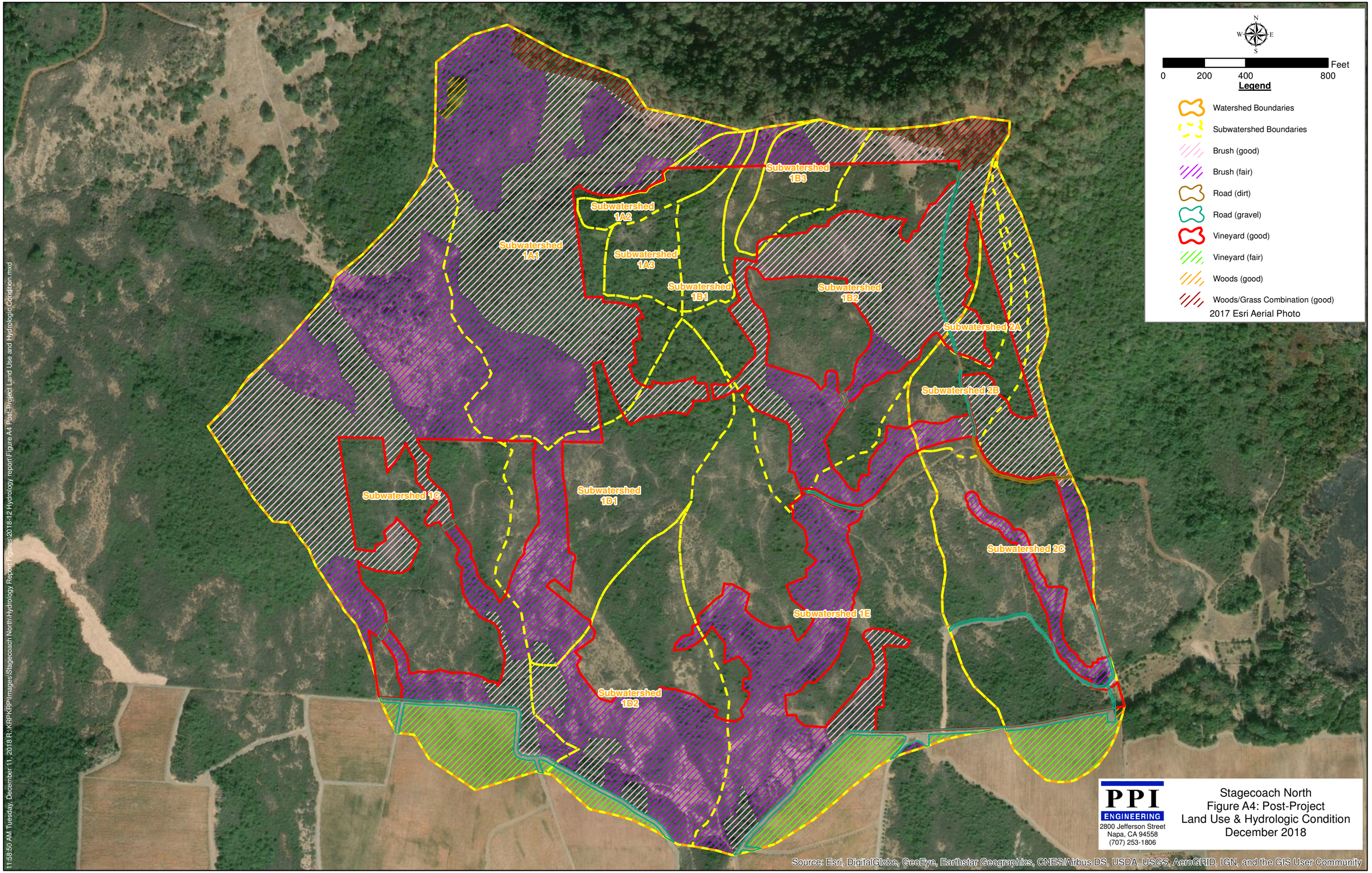
Figure A3: Post-Project
Watersheds, Soil Types &
Hydrologic Soil Groups
December 2018

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

11:56:39 AM Tuesday, December 11, 2018 R:\KPK\PI\Images\Stagecoach North\Hydrology Report Figures\20181212 Hydrology report\Figure A3 Post Project Watersheds, Soil Types and Hydrologic Soil Groups.mxd


Subwatershed 1A1
Subwatershed 1A2
Subwatershed 1A3
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Subwatershed 1C
Subwatershed 1D1
Subwatershed 1D2
Subwatershed 1E
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Watershed Boundaries
Subwatershed Boundaries
Brush (good)
Brush (fair)
Road (dirt)
Road (gravel)
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Vineyard (fair)
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11:58:50 AM Tuesday, December 11, 2018 R:\KPK\KPI\Images\Stagecoach North\Hydrology Report Figures\2018-12 Hydrology report\Figure A4 Post-Project Land Use and Hydrologic Condition.mxd
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(707) 253-1806
Stagecoach North
Figure A4: Post-Project
Land Use & Hydrologic Condition
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

POST-PROJECT LAND USE AND CURVE NUMBERS

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1A1	Brush, Fair	C	70	0.211
	Brush, Fair	D	77	15.659
	Brush, Good	C	65	0.763
	Brush, Good	D	73	17.770
	Vineyard, Good	D	81	3.175
	Woods, Good	D	77	0.346
	Woods/grass comb., Good	C	72	0.560
	Woods/grass comb., Good	D	79	0.959
			75	39.44
1A2	Brush, Fair	C	70	0.104
	Brush, Fair	D	77	0.434
	Brush, Good	D	73	0.249
	Vineyard, Good	D	81	2.073
			79	2.86
1A3	Vineyard, Good	D	81	3.312
			81	3.31
			N/A	45.62

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1B1	Brush, Fair	C	70	0.018
	Brush, Fair	D	77	0.244
	Vineyard, Good	D	81	3.155
			81	3.42
1B2	Brush, Fair	C	70	0.036
	Brush, Fair	D	77	4.012
	Brush, Good	C	65	0.929
	Brush, Good	D	73	12.934
	Gravel roads	C	89	0.033
	Gravel roads	D	91	0.186
	Vineyard, Good	C	75	0.402
	Vineyard, Good	D	81	15.665
	Woods/grass comb., Good	C	72	1.960
			77	36.16
1B3	Brush, Fair	D	77	0.809
	Brush, Good	C	65	0.014
	Brush, Good	D	73	1.122
	Vineyard, Good	D	81	2.899
			78	4.84
			N/A	44.42

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1C	Brush, Fair	D	77	17.012
	Brush, Good	D	73	18.484
	Gravel roads	D	91	0.659
	Vineyard, Fair	D	84	4.243
	Vineyard, Good	D	81	15.148
			77	55.55

POST-PROJECT LAND USE AND CURVE NUMBERS

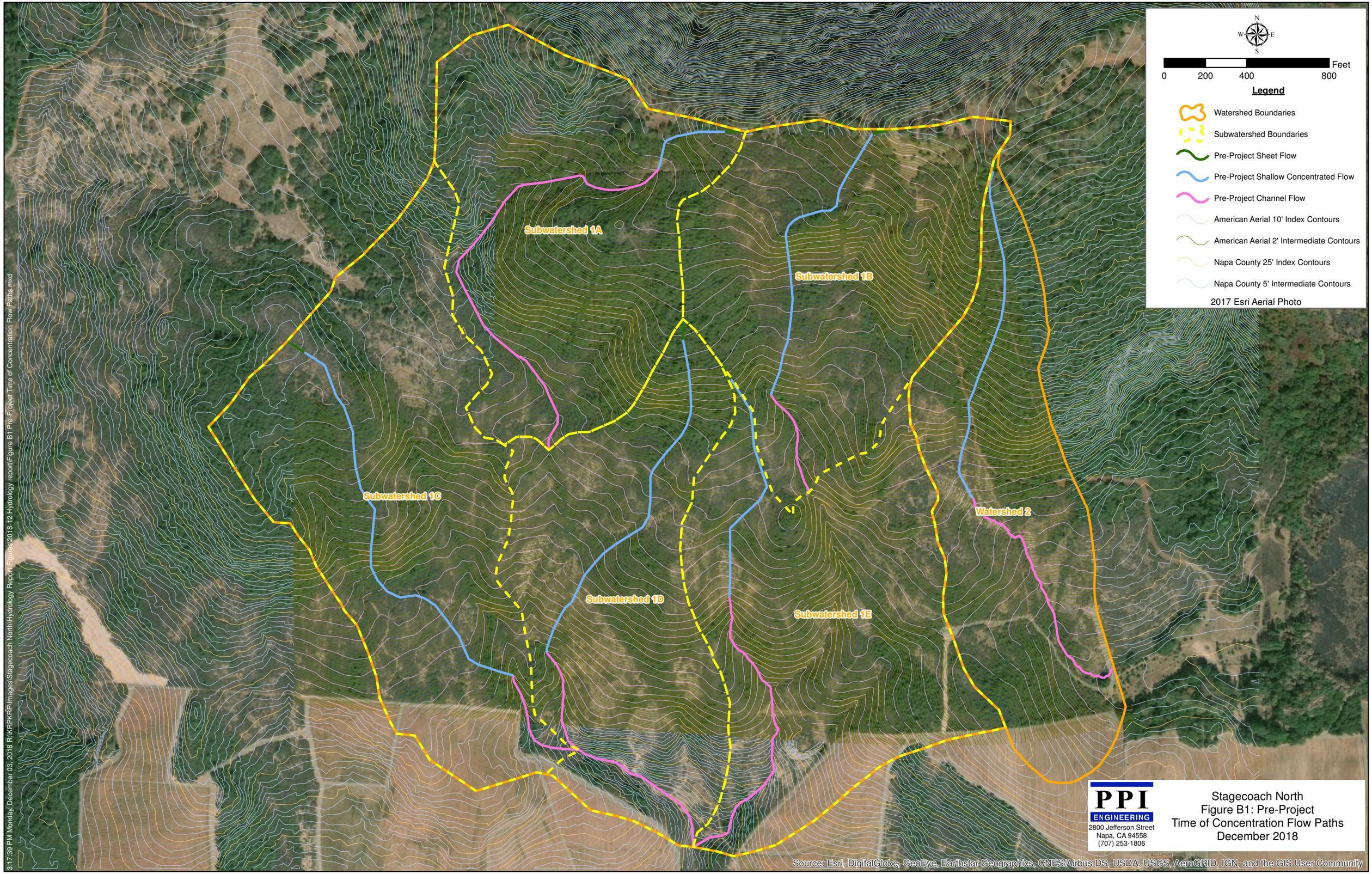
Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1D1	Brush, Fair	D	77	5.092
	Brush, Good	D	73	1.543
	Vineyard, Good	D	81	14.276
			79	20.91
1D2	Brush, Fair	D	77	9.698
	Brush, Good	D	73	1.900
	Gravel roads	D	91	0.309
	Vineyard, Fair	D	84	0.832
	Vineyard, Good	D	81	8.244
			79	20.98
			N/A	41.89

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
1E	Brush, Fair	D	77	14.817
	Brush, Good	D	73	2.273
	Gravel roads	D	91	0.919
	Vineyard, Fair	D	84	3.198
	Vineyard, Good	D	81	25.714
			80	46.92

Subwatershed	Land Use, Condition	Soil Group	RCN	Area (acres)
2A	Brush, Good	C	65	0.042
	Brush, Good	D	73	1.914
	Gravel Roads	D	91	0.025
	Vineyard, Good	D	81	1.197
			76	3.18
2B	Brush, Fair	D	77	0.561
	Brush, Good	D	73	2.010
	Dirt roads	D	89	0.018
	Gravel Roads	D	91	0.075
	Vineyard, Good	D	81	3.184
			78	5.85
2C	Brush, Fair	C	70	0.196
	Brush, Fair	D	77	2.651
	Brush, Good	C	65	0.059
	Brush, Good	D	73	4.619
	Dirt roads	D	89	0.119
	Gravel Roads	C	89	0.156
	Gravel Roads	D	91	0.473
	Vineyard, Fair	C	79	0.059
	Vineyard, Fair	D	84	2.585
	Vineyard, Good	C	75	0.354
	Vineyard, Good	D	81	16.775
	Woods, Good	C	70	0.057
			80	28.10
			N/A	37.13

Appendix B

Time of Concentration (Tc) Analysis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Watershed Boundaries
Subwatershed Boundaries
Pre-Project Sheet Flow
Pre-Project Shallow Concentrated Flow
Pre-Project Channel Flow
American Aerial 10' Index Contours
American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
Subwatershed 1A
Subwatershed 1B
Subwatershed 1C
Subwatershed 1D
Subwatershed 1E
Watershed 2
3:17:39 PM Monday, December 03, 2018 R:\KPK\KP Images\Stagecoach North\Hydrology Report Figures\2018-12 Hydrology report\Figure B1 Pre-Project Time of Concentration Flow Paths.mxd
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2800 Jefferson Street
Napa, CA 94558
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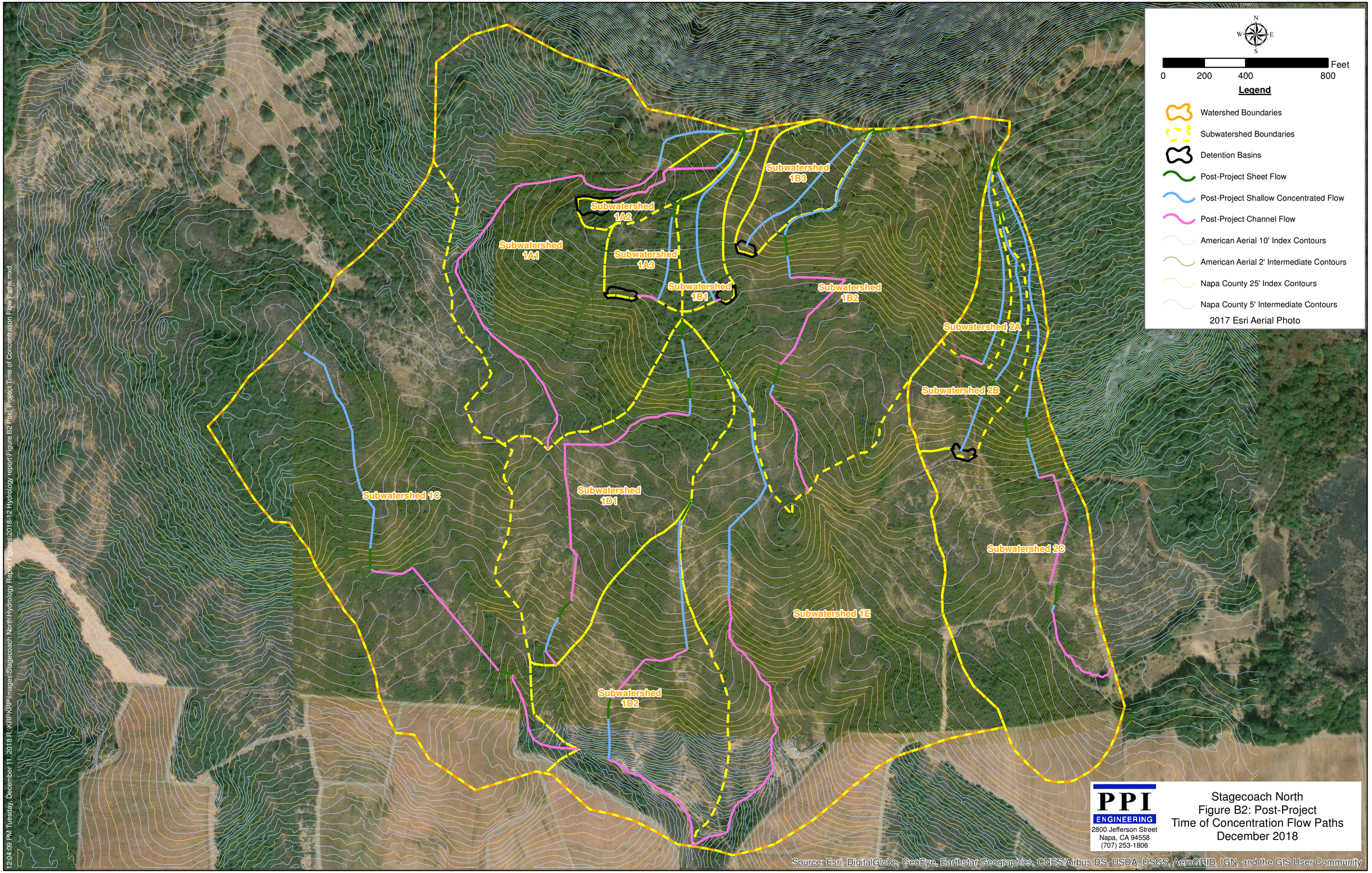
Figure B1: Pre-Project
Time of Concentration Flow Paths
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Subwatershed 1A1
Subwatershed 1A2
Subwatershed 1A3
Subwatershed 1B1
Subwatershed 1B2
Subwatershed 1B3
Subwatershed 1C
Subwatershed 1D1
Subwatershed 1D2
Subwatershed 1E
Subwatershed 2A
Subwatershed 2B
Subwatershed 2C
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W
E
S
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200
400
800
Feet
Legend
Watershed Boundaries
Subwatershed Boundaries
Detention Basins
Post-Project Sheet Flow
Post-Project Shallow Concentrated Flow
Post-Project Channel Flow
American Aerial 10' Index Contours
American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
12:04:09 PM Tuesday, December 11, 2018 P:\KRP\Images\Stagecoach North\Hydrology Report Figures\2018-12 Hydrology report\Figure B2 Post-Project Time of Concentration Flow Paths.mxd
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Napa, CA 94558
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Stagecoach North
Figure B2: Post-Project
Time of Concentration Flow Paths
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TIME OF CONCENTRATION BY DEVELOPMENT PHASE AND WATERSHED / SUBWATERSHED

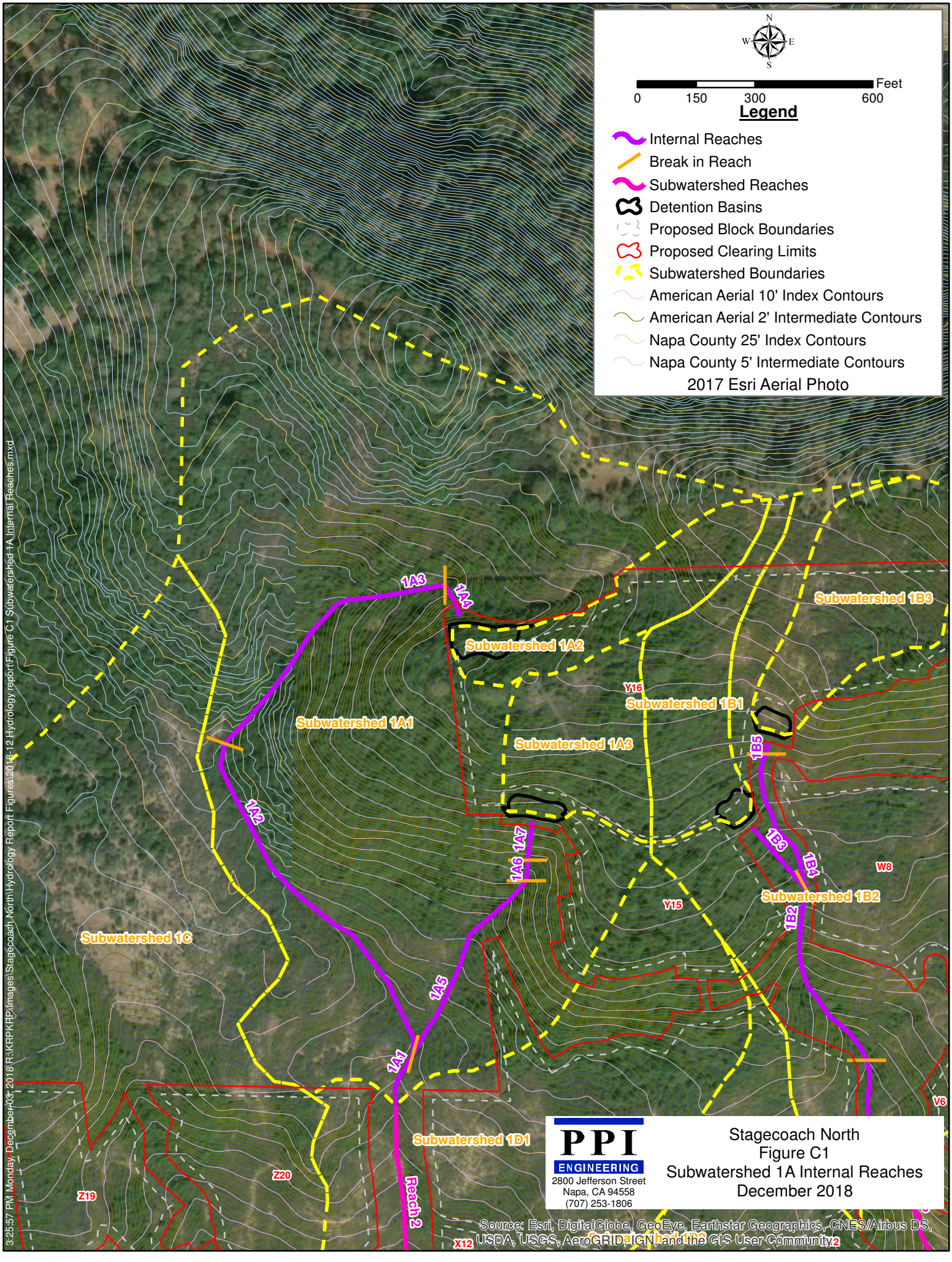
Pre-Project		
Watershed	Subwatershed	Tc (min.)
1	1A	15.6
	1B	13.3
	1C	15.9
	1D	15.8
	1E	13.8
2	N/A	15.3

Post-Project		
Watershed	Subwatershed	Tc (min.)
1	1A1	15.6
	1A2	9.5
	1A3	8.5
	1B1	10.7
	1B2	25.8
	1B3	10.1
	1C	25.9
	1D1	23.4
	1D2	18.7
	1E	11.2
2	2A	10.8
	2B	17.0
	2C	28.1

Watershed	Subwatershed	Pre-Project	Post-Project	Increase / Decrease (min.)
		Tc (min.)		
1	1A	15.6	N/A	N/A
	1B	13.3	N/A	N/A
	1C	15.9	25.9	10.0
	1D	15.8	N/A	N/A
	1E	13.8	11.2	2.6
2	N/A	15.3	N/A	N/A

Appendix C

Internal Reach Analysis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Legend
Internal Reaches
Break in Reach
Subwatershed Reaches
Detention Basins
Proposed Block Boundaries
Proposed Clearing Limits
Subwatershed Boundaries
American Aerial 10' Index Contours
American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
1A3
1A4
Subwatershed 1A2
Subwatershed 1A1
Subwatershed 1A3
Subwatershed 1B3
Y16
Subwatershed 1B1
1B5
1A2
1A7
1A6
1B3
1B4
W8
Y15
Subwatershed 1B2
1B2
Subwatershed 1C
1A5
1A1
V6
Subwatershed 1D1
Z20
Z19
Reach 2
X12
Subwatershed 1D2
Y2
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Figure C1
Subwatershed 1A Internal Reaches
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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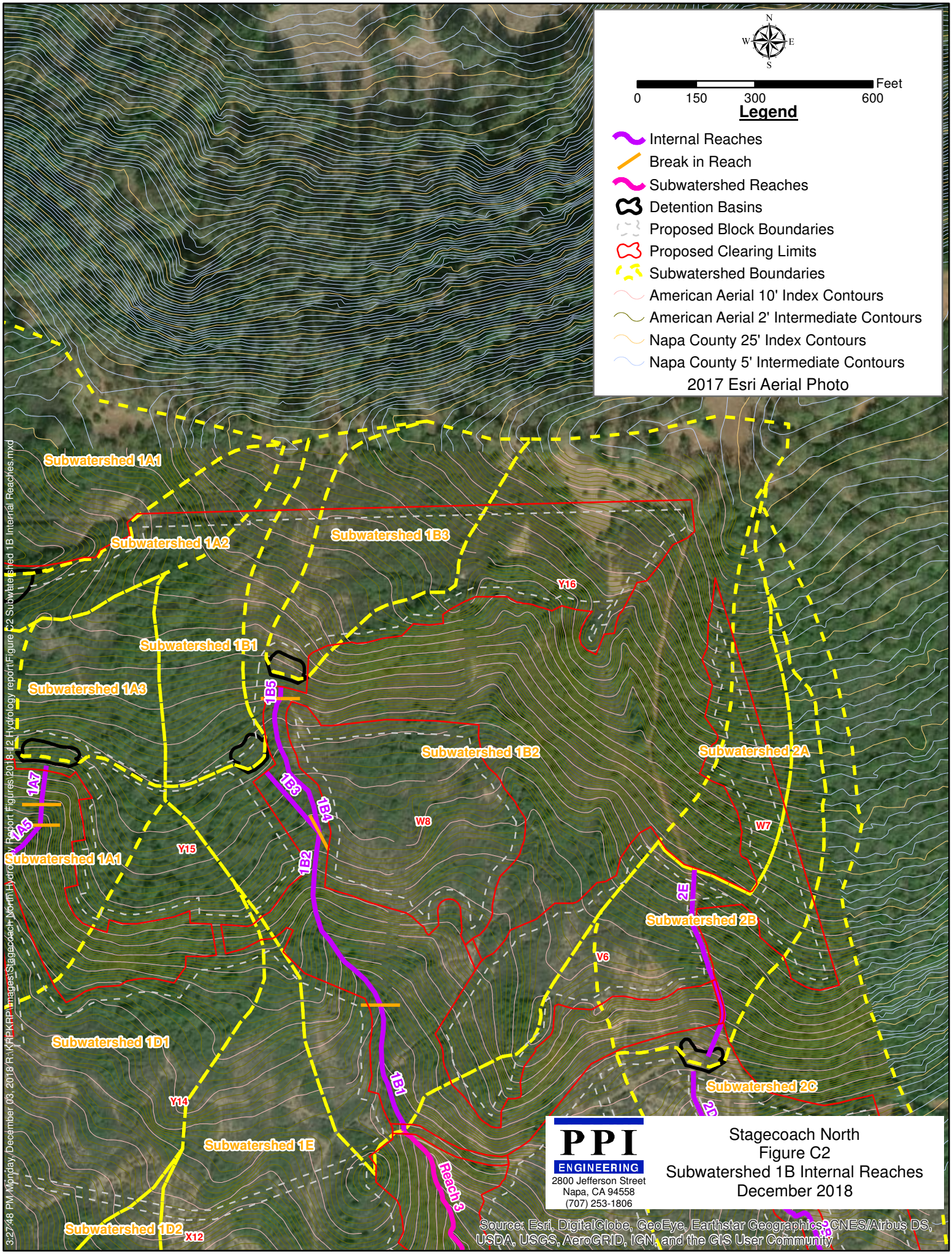
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Detention Basins
Proposed Block Boundaries
Proposed Clearing Limits
Subwatershed Boundaries
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American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
Subwatershed 1A1
Subwatershed 1A2
Subwatershed 1A3
Subwatershed 1B1
Subwatershed 1B2
Subwatershed 1B3
Subwatershed 1D1
Subwatershed 1D2
Subwatershed 1E
Subwatershed 2A
Subwatershed 2B
Subwatershed 2C
1A5
1A7
1B1
1B2
1B3
1B4
1B5
2E
Y14
Y15
Y16
W7
W8
V6
X12
Reach 3
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Figure C2
Subwatershed 1B Internal Reaches
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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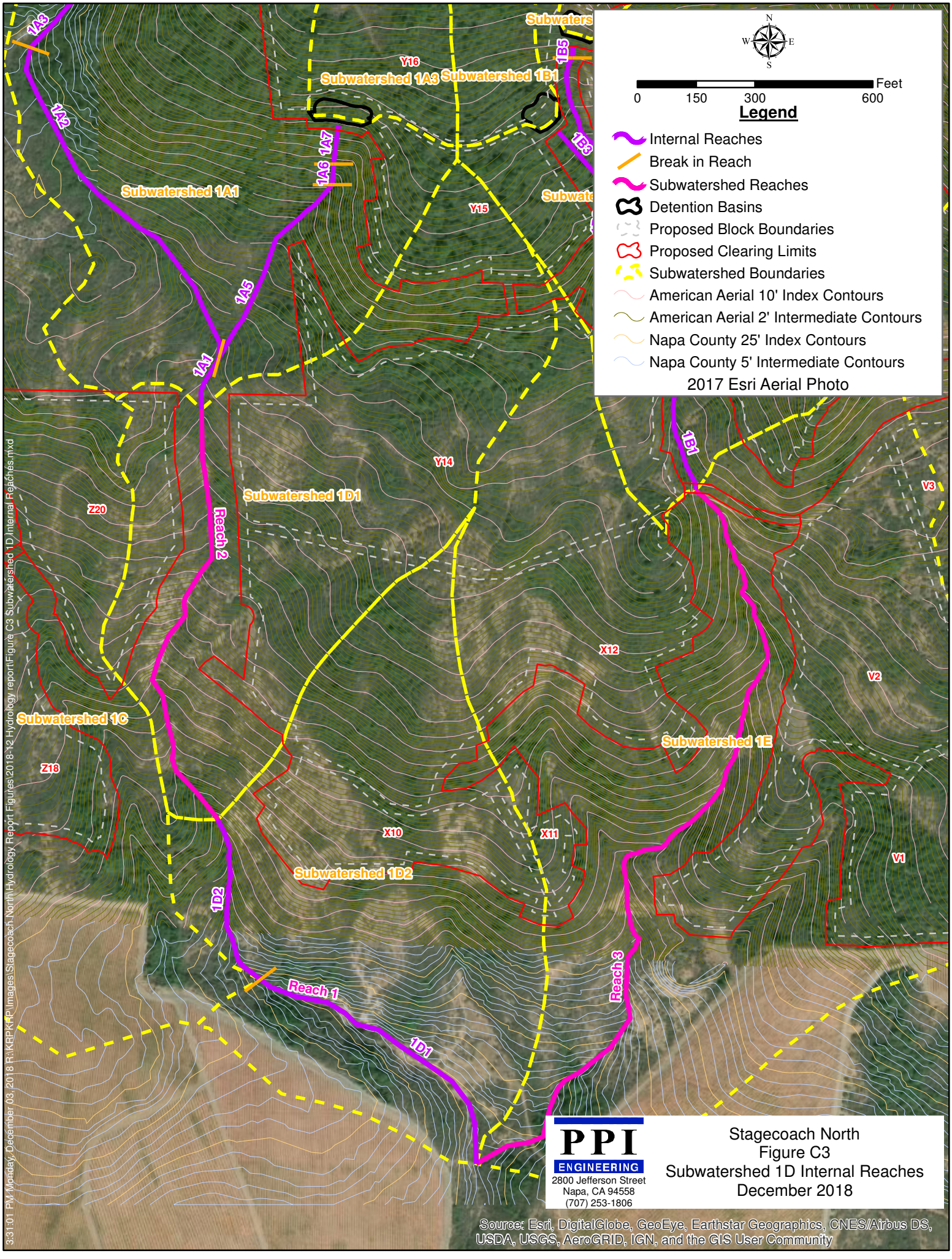
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Subwatershed Reaches
Detention Basins
Proposed Block Boundaries
Proposed Clearing Limits
Subwatershed Boundaries
American Aerial 10' Index Contours
American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
Subwatershed 1A1
Subwatershed 1A3
Subwatershed 1B1
Subwatershed 1C
Subwatershed 1D1
Subwatershed 1D2
Subwatershed 1E
Reach 1
Reach 2
Reach 3
1A1
1A2
1A3
1A5
1A6
1A7
1B1
1B3
1B5
1D1
1D2
Y14
Y15
Y16
Z18
Z20
X10
X11
X12
V1
V2
V3
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Figure C3
Subwatershed 1D Internal Reaches
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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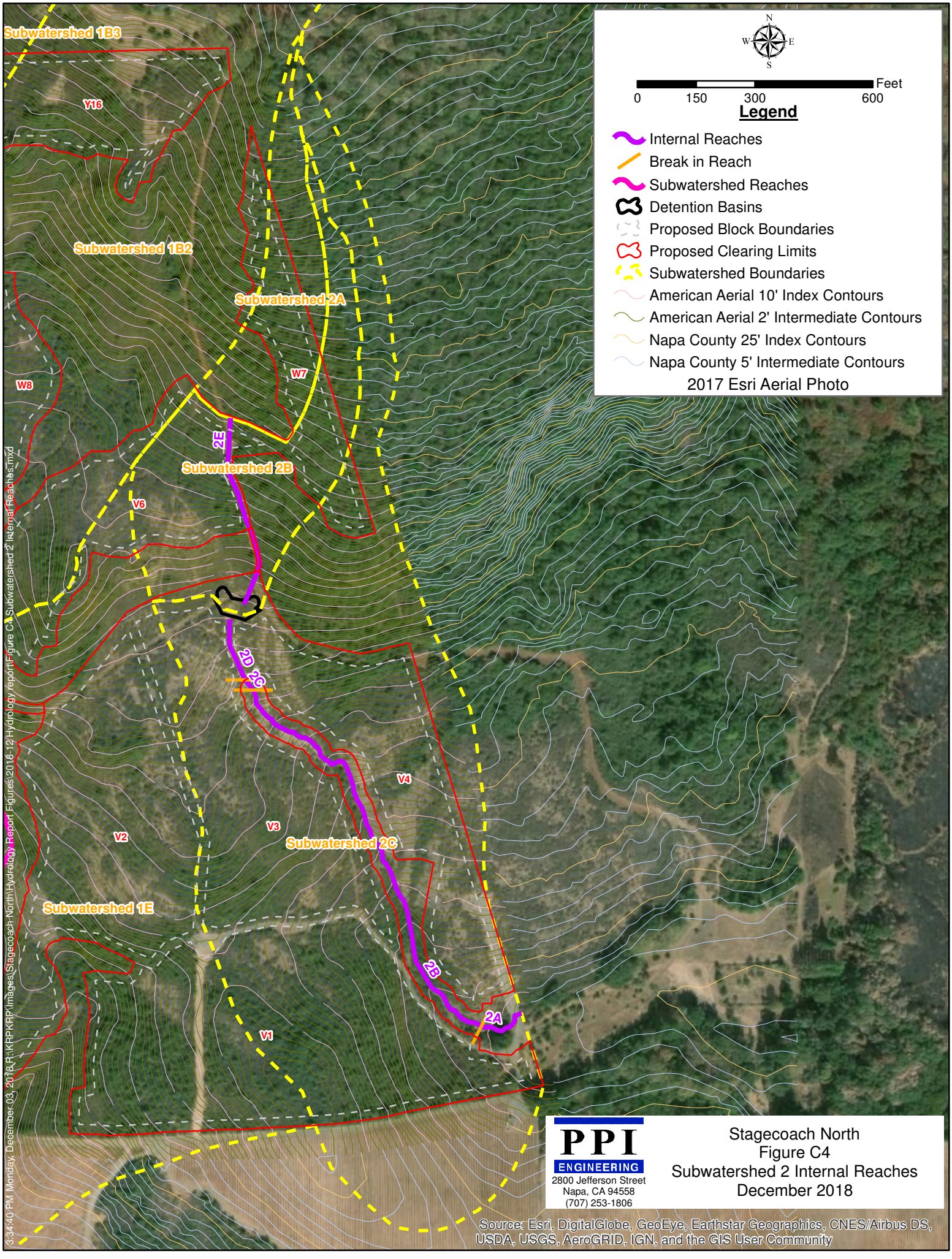
Subwatershed 1B3
Y16
Subwatershed 1B2
Subwatershed 2A
W8
W7
2E
Subwatershed 2B
V6
2D
2C
V4
V3
V2
Subwatershed 2C
Subwatershed 1E
2B
2A
V1
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Legend
Internal Reaches
Break in Reach
Subwatershed Reaches
Detention Basins
Proposed Block Boundaries
Proposed Clearing Limits
Subwatershed Boundaries
American Aerial 10' Index Contours
American Aerial 2' Intermediate Contours
Napa County 25' Index Contours
Napa County 5' Intermediate Contours
2017 Esri Aerial Photo
3:34:40 PM, Monday, December 03, 2018 R:\KRP\KRP\Images\Stagecoach North\Hydrology Report Figures\2018-12 Hydrology report\Figure C4 Subwatershed 2 Internal Reaches.mxd
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Stagecoach North
Figure C4
Subwatershed 2 Internal Reaches
December 2018
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

INTERNAL REACHES BY WATERSHED / SUBWATERSHED

Subwatershed 1A

Internal Reach	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
1A1	4	1.5	1.5:1	1.5:1	0.065
1A2	4	1.5	1.5:1	1.5:1	0.065
1A3	5	1.0	4:1	4:1	0.053
1A4*	70	1.0	100:1	100:1	0.400
1A5	4	1.5	1.5:1	1.5:1	0.065
1A6*	139	1.0	100:1	100:1	0.040
1A7*	139	1.0	100:1	100:1	0.400

* Internal reach modeled as overland flow. Channel width set to width of proposed level spreader at the toe of the proposed detention basin. Channel side slopes set flat per guidelines in the HydroCAD Owner's Manual. Manning's Roughness Coefficient n-value adjusted according to flow depth through the internal reach per guidelines in the HydroCAD Owner's Manual.

Subwatershed 1B

Internal Reach	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
1B1	3.5	1.0	3:1	3:1	0.047
1B2	3.5	1.0	3:1	3:1	0.047
1B3*	10	1.0	100:1	100:1	0.040
1B4	4	1.0	3:1	3:1	0.047
1B5*	10	1.0	100:1	100:1	0.040

* Internal reach modeled as overland flow. Channel width set to width of proposed rock energy dissipater at the toe of the proposed detention basin. Channel side slopes set flat per guidelines in the HydroCAD Owner's Manual. Manning's Roughness Coefficient n-value adjusted according to flow depth through the internal reach per guidelines in the HydroCAD Owner's Manual.

Subwatershed 1D

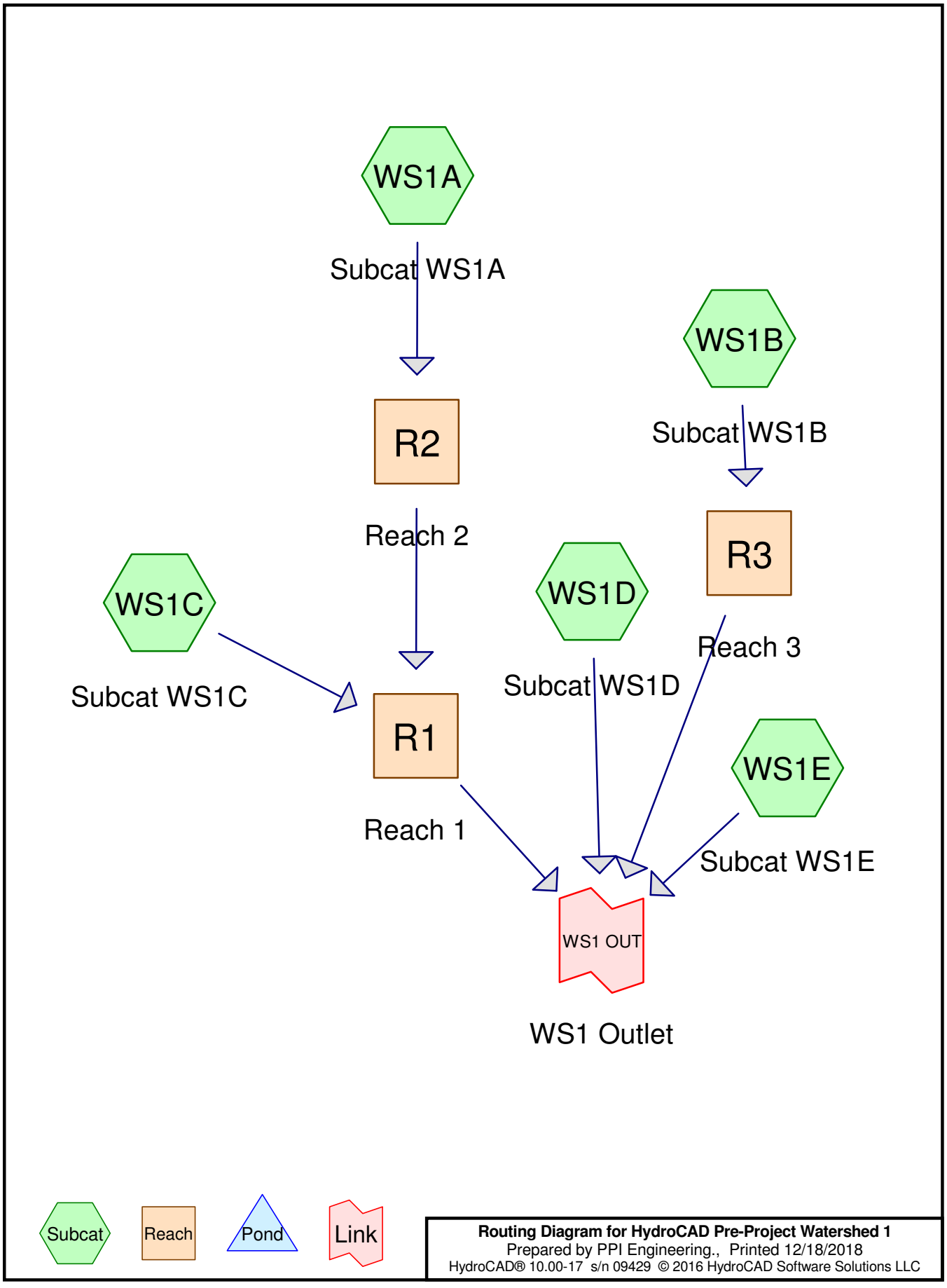
Internal Reach	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
1D1	5.0	1.5	2.5:1, 6:1	2.5:1, 6:1	0.068
1D2	4.0	1.5	1.5:1, 6:1	1.5:1, 6:1	0.065

INTERNAL REACHES BY WATERSHED / SUBWATERSHED

Watershed 2

Internal Reach	Channel Width (ft.)	Channel Depth (ft.)	Left Side Slope	Right Side Slope	Manning's Roughness Coefficeint, n-value
2A	3.5	1.0	5:1	5:1	0.045
2B	3.0	1.0	5:1	5:1	0.048
2C*	10	1.0	100:1	100:1	0.040
2D (15" DW Pipe)	N/A	N/A	N/A	N/A	0.010
2E (10" SW Pipe)	N/A	N/A	N/A	N/A	0.018

* Internal reach modeled as overland flow. Channel width set to width of proposed rock energy dissipater at the outlet of the proposed detention basin pipe. Channel side slopes set flat per guidelines in the HydroCAD Owner's Manual. Manning's Roughness Coefficient n-value adjusted according to flow depth through the internal reach per guidelines in the HydroCAD Owner's Manual.



Routing Diagram for HydroCAD Pre-Project Watershed 1
Prepared by PPI Engineering., Printed 12/18/2018
HydroCAD® 10.00-17 s/n 09429 © 2016 HydroCAD Software Solutions LLC

Summary for Subcatchment WS1A: Subcat WS1A

Runoff = 17.05 cfs @ 8.09 hrs, Volume= 6.803 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.315	70	Brush, Fair, HSG C
16.730	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
25.943	73	Brush, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
45.616	74	Weighted Average
45.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1B: Subcat WS1B

Runoff = 16.91 cfs @ 8.06 hrs, Volume= 6.624 af, Depth= 1.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.054	70	Brush, Fair, HSG C
13.810	77	Brush, Fair, HSG D
1.268	65	Brush, Good, HSG C
27.065	73	Brush, Good, HSG D
0.033	87	Dirt roads, HSG C
0.151	89	Dirt roads, HSG D
2.037	72	Woods/grass comb., Good, HSG C
44.418	74	Weighted Average
44.418		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.26"
4.0	1,537	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
13.3	2,122	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 23.35 cfs @ 8.08 hrs, Volume= 8.980 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	27.578	77	Brush, Fair, HSG D
	23.133	73	Brush, Good, HSG D
	0.591	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	55.546	76	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
6.6	2,128	0.1100	5.34		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	563	0.1200	7.60	88.29	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
15.9	2,747	Total			

Summary for Subcatchment WS1D: Subcat WS1D

Runoff = 18.66 cfs @ 8.09 hrs, Volume= 7.043 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
33.600	77	Brush, Fair, HSG D
7.152	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
41.892	77	Weighted Average
41.892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	75	0.0900	0.15		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
4.5	1,796	0.1700	6.64		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
3.2	1,320	0.1000	6.93	90.92	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
15.8	3,191	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 21.23 cfs @ 8.05 hrs, Volume= 7.888 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
35.879	77	Brush, Fair, HSG D
6.731	73	Brush, Good, HSG D
0.260	89	Dirt roads, HSG D
0.854	91	Gravel roads, HSG D
3.198	84	Vineyard, Fair, HSG D
46.921	77	Weighted Average
46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.1800	0.22		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
13.8	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 1.87" for 2 Year event
Inflow = 38.96 cfs @ 8.12 hrs, Volume= 15.783 af
Outflow = 38.71 cfs @ 8.20 hrs, Volume= 15.783 af, Atten= 1%, Lag= 4.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.80 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 2.64 fps, Avg. Travel Time= 5.0 min

Peak Storage= 6,370 cf @ 8.16 hrs
Average Depth at Peak Storage= 1.06'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 1.79" for 2 Year event
Inflow = 17.05 cfs @ 8.09 hrs, Volume= 6.803 af
Outflow = 16.74 cfs @ 8.21 hrs, Volume= 6.803 af, Atten= 2%, Lag= 7.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.50 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 9.0 min

Peak Storage= 4,843 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.62'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

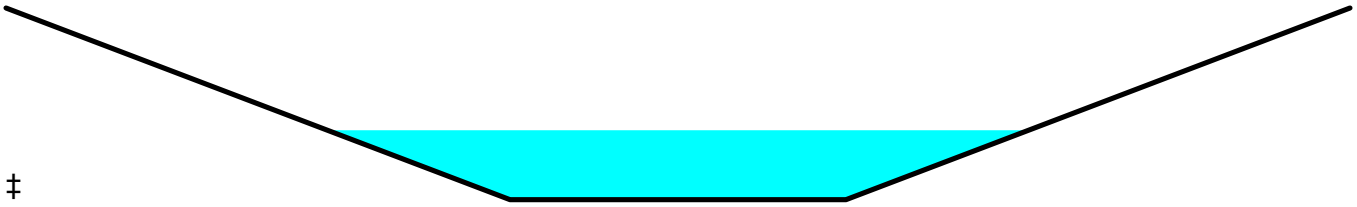
Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 1.79" for 2 Year event
Inflow = 16.91 cfs @ 8.06 hrs, Volume= 6.624 af
Outflow = 16.18 cfs @ 8.25 hrs, Volume= 6.624 af, Atten= 4%, Lag= 11.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.83 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 2.69 fps, Avg. Travel Time= 13.4 min

Peak Storage= 7,241 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



‡

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 1.91" for 2 Year event
Inflow = 90.82 cfs @ 8.14 hrs, Volume= 37.338 af
Primary = 90.82 cfs @ 8.14 hrs, Volume= 37.338 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A: Subcat WS1A

Runoff = 36.70 cfs @ 8.06 hrs, Volume= 13.072 af, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.315	70	Brush, Fair, HSG C
16.730	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
25.943	73	Brush, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
45.616	74	Weighted Average
45.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1B: Subcat WS1B

Runoff = 36.29 cfs @ 8.05 hrs, Volume= 12.729 af, Depth= 3.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.054	70	Brush, Fair, HSG C
	13.810	77	Brush, Fair, HSG D
	1.268	65	Brush, Good, HSG C
	27.065	73	Brush, Good, HSG D
	0.033	87	Dirt roads, HSG C
	0.151	89	Dirt roads, HSG D
	2.037	72	Woods/grass comb., Good, HSG C
	44.418	74	Weighted Average
	44.418		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.26"
4.0	1,537	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
13.3	2,122	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 48.13 cfs @ 8.07 hrs, Volume= 16.851 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	27.578	77	Brush, Fair, HSG D
	23.133	73	Brush, Good, HSG D
	0.591	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	55.546	76	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
6.6	2,128	0.1100	5.34		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	563	0.1200	7.60	88.29	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
15.9	2,747	Total			

Summary for Subcatchment WS1D: Subcat WS1D

Runoff = 37.68 cfs @ 8.06 hrs, Volume= 13.065 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
33.600	77	Brush, Fair, HSG D
7.152	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
41.892	77	Weighted Average
41.892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	75	0.0900	0.15		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
4.5	1,796	0.1700	6.64		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
3.2	1,320	0.1000	6.93	90.92	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
15.8	3,191	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 42.76 cfs @ 8.05 hrs, Volume= 14.633 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
35.879	77	Brush, Fair, HSG D
6.731	73	Brush, Good, HSG D
0.260	89	Dirt roads, HSG D
0.854	91	Gravel roads, HSG D
3.198	84	Vineyard, Fair, HSG D
46.921	77	Weighted Average
46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.1800	0.22		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
13.8	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 3.55" for 10 Year event
Inflow = 83.15 cfs @ 8.11 hrs, Volume= 29.923 af
Outflow = 82.57 cfs @ 8.17 hrs, Volume= 29.923 af, Atten= 1%, Lag= 4.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.81 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 3.14 fps, Avg. Travel Time= 4.2 min

Peak Storage= 11,207 cf @ 8.13 hrs
Average Depth at Peak Storage= 1.58'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 3.44" for 10 Year event
Inflow = 36.70 cfs @ 8.06 hrs, Volume= 13.072 af
Outflow = 36.31 cfs @ 8.17 hrs, Volume= 13.072 af, Atten= 1%, Lag= 6.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.97 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 3.56 fps, Avg. Travel Time= 7.4 min

Peak Storage= 8,281 cf @ 8.11 hrs
Average Depth at Peak Storage= 0.96'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

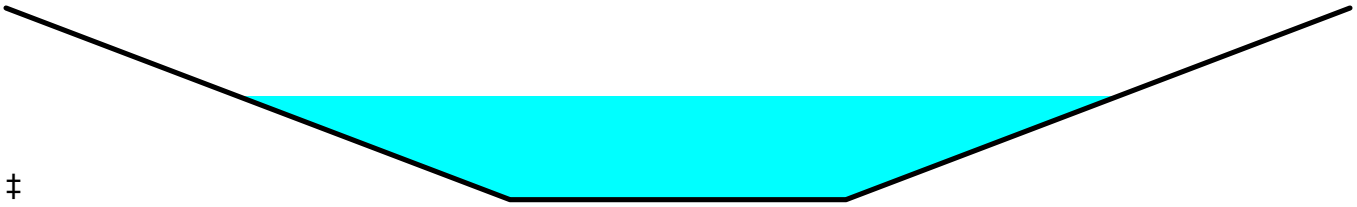
Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 3.44" for 10 Year event
Inflow = 36.29 cfs @ 8.05 hrs, Volume= 12.729 af
Outflow = 35.39 cfs @ 8.20 hrs, Volume= 12.728 af, Atten= 2%, Lag= 9.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.02 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 3.21 fps, Avg. Travel Time= 11.2 min

Peak Storage= 12,705 cf @ 8.10 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



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Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 3.60" for 10 Year event
Inflow = 193.30 cfs @ 8.11 hrs, Volume= 70.348 af
Primary = 193.30 cfs @ 8.11 hrs, Volume= 70.348 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A: Subcat WS1A

Runoff = 58.87 cfs @ 8.06 hrs, Volume= 20.056 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.315	70	Brush, Fair, HSG C
16.730	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
25.943	73	Brush, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
45.616	74	Weighted Average
45.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1B: Subcat WS1B

Runoff = 58.09 cfs @ 8.03 hrs, Volume= 19.529 af, Depth= 5.28"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.054	70	Brush, Fair, HSG C
	13.810	77	Brush, Fair, HSG D
	1.268	65	Brush, Good, HSG C
	27.065	73	Brush, Good, HSG D
	0.033	87	Dirt roads, HSG C
	0.151	89	Dirt roads, HSG D
	2.037	72	Woods/grass comb., Good, HSG C
	44.418	74	Weighted Average
	44.418		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.26"
4.0	1,537	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
13.3	2,122	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 75.55 cfs @ 8.07 hrs, Volume= 25.524 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	27.578	77	Brush, Fair, HSG D
	23.133	73	Brush, Good, HSG D
	0.591	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	55.546	76	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
6.6	2,128	0.1100	5.34		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	563	0.1200	7.60	88.29	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
15.9	2,747	Total			

Summary for Subcatchment WS1D: Subcat WS1D

Runoff = 58.58 cfs @ 8.06 hrs, Volume= 19.666 af, Depth= 5.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
33.600	77	Brush, Fair, HSG D
7.152	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
41.892	77	Weighted Average
41.892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	75	0.0900	0.15		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
4.5	1,796	0.1700	6.64		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
3.2	1,320	0.1000	6.93	90.92	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
15.8	3,191	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 66.35 cfs @ 8.04 hrs, Volume= 22.027 af, Depth= 5.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
35.879	77	Brush, Fair, HSG D
6.731	73	Brush, Good, HSG D
0.260	89	Dirt roads, HSG D
0.854	91	Gravel roads, HSG D
3.198	84	Vineyard, Fair, HSG D
46.921	77	Weighted Average
46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.1800	0.22		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
13.8	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 5.41" for 50 Year event
Inflow = 132.49 cfs @ 8.09 hrs, Volume= 45.579 af
Outflow = 131.91 cfs @ 8.15 hrs, Volume= 45.579 af, Atten= 0%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.15 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 3.51 fps, Avg. Travel Time= 3.7 min

Peak Storage= 16,917 cf @ 8.12 hrs
Average Depth at Peak Storage= 2.03'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 5.28" for 50 Year event
Inflow = 58.87 cfs @ 8.06 hrs, Volume= 20.056 af
Outflow = 58.39 cfs @ 8.15 hrs, Volume= 20.056 af, Atten= 1%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.01 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 4.04 fps, Avg. Travel Time= 6.6 min

Peak Storage= 11,598 cf @ 8.09 hrs
Average Depth at Peak Storage= 1.24'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 5.28" for 50 Year event
Inflow = 58.09 cfs @ 8.03 hrs, Volume= 19.529 af
Outflow = 57.08 cfs @ 8.17 hrs, Volume= 19.528 af, Atten= 2%, Lag= 8.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.85 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 3.60 fps, Avg. Travel Time= 10.0 min

Peak Storage= 18,002 cf @ 8.09 hrs
Average Depth at Peak Storage= 1.03'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



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Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 5.47" for 50 Year event
Inflow = 308.01 cfs @ 8.10 hrs, Volume= 106.800 af
Primary = 308.01 cfs @ 8.10 hrs, Volume= 106.800 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A: Subcat WS1A

Runoff = 68.61 cfs @ 8.06 hrs, Volume= 23.131 af, Depth= 6.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.315	70	Brush, Fair, HSG C
16.730	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
25.943	73	Brush, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
45.616	74	Weighted Average
45.616		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1B: Subcat WS1B

Runoff = 67.68 cfs @ 8.03 hrs, Volume= 22.523 af, Depth= 6.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.054	70	Brush, Fair, HSG C
13.810	77	Brush, Fair, HSG D
1.268	65	Brush, Good, HSG C
27.065	73	Brush, Good, HSG D
0.033	87	Dirt roads, HSG C
0.151	89	Dirt roads, HSG D
2.037	72	Woods/grass comb., Good, HSG C
44.418	74	Weighted Average
44.418		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet** Woods: Dense underbrush n= 0.800 P2= 4.26"
4.0	1,537	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
13.3	2,122	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 87.49 cfs @ 8.06 hrs, Volume= 29.325 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	27.578	77	Brush, Fair, HSG D
	23.133	73	Brush, Good, HSG D
	0.591	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	55.546	76	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
6.6	2,128	0.1100	5.34		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.2	563	0.1200	7.60	88.29	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
15.9	2,747	Total			

Summary for Subcatchment WS1D: Subcat WS1D

Runoff = 67.67 cfs @ 8.06 hrs, Volume= 22.553 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
33.600	77	Brush, Fair, HSG D
7.152	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
41.892	77	Weighted Average
41.892		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	75	0.0900	0.15		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
4.5	1,796	0.1700	6.64		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
3.2	1,320	0.1000	6.93	90.92	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
15.8	3,191	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 76.62 cfs @ 8.04 hrs, Volume= 25.260 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
35.879	77	Brush, Fair, HSG D
6.731	73	Brush, Good, HSG D
0.260	89	Dirt roads, HSG D
0.854	91	Gravel roads, HSG D
3.198	84	Vineyard, Fair, HSG D
46.921	77	Weighted Average
46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.7	100	0.1800	0.22		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
13.8	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 6.22" for 100 Year event
Inflow = 154.16 cfs @ 8.08 hrs, Volume= 52.455 af
Outflow = 153.53 cfs @ 8.15 hrs, Volume= 52.455 af, Atten= 0%, Lag= 3.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.32 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 3.65 fps, Avg. Travel Time= 3.6 min

Peak Storage= 19,185 cf @ 8.11 hrs
Average Depth at Peak Storage= 2.18'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

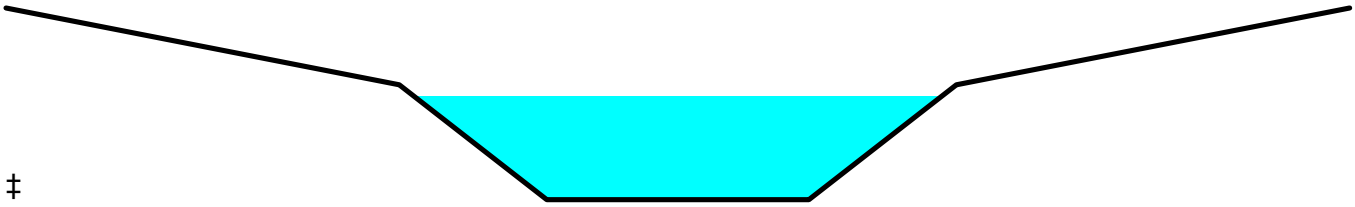
Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 6.08" for 100 Year event
Inflow = 68.61 cfs @ 8.06 hrs, Volume= 23.131 af
Outflow = 68.11 cfs @ 8.14 hrs, Volume= 23.131 af, Atten= 1%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.36 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 4.21 fps, Avg. Travel Time= 6.3 min

Peak Storage= 12,950 cf @ 8.09 hrs
Average Depth at Peak Storage= 1.35'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



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Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 6.08" for 100 Year event
Inflow = 67.68 cfs @ 8.03 hrs, Volume= 22.523 af
Outflow = 66.62 cfs @ 8.17 hrs, Volume= 22.522 af, Atten= 2%, Lag= 8.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.14 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 3.74 fps, Avg. Travel Time= 9.6 min

Peak Storage= 20,162 cf @ 8.08 hrs
Average Depth at Peak Storage= 1.11'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'

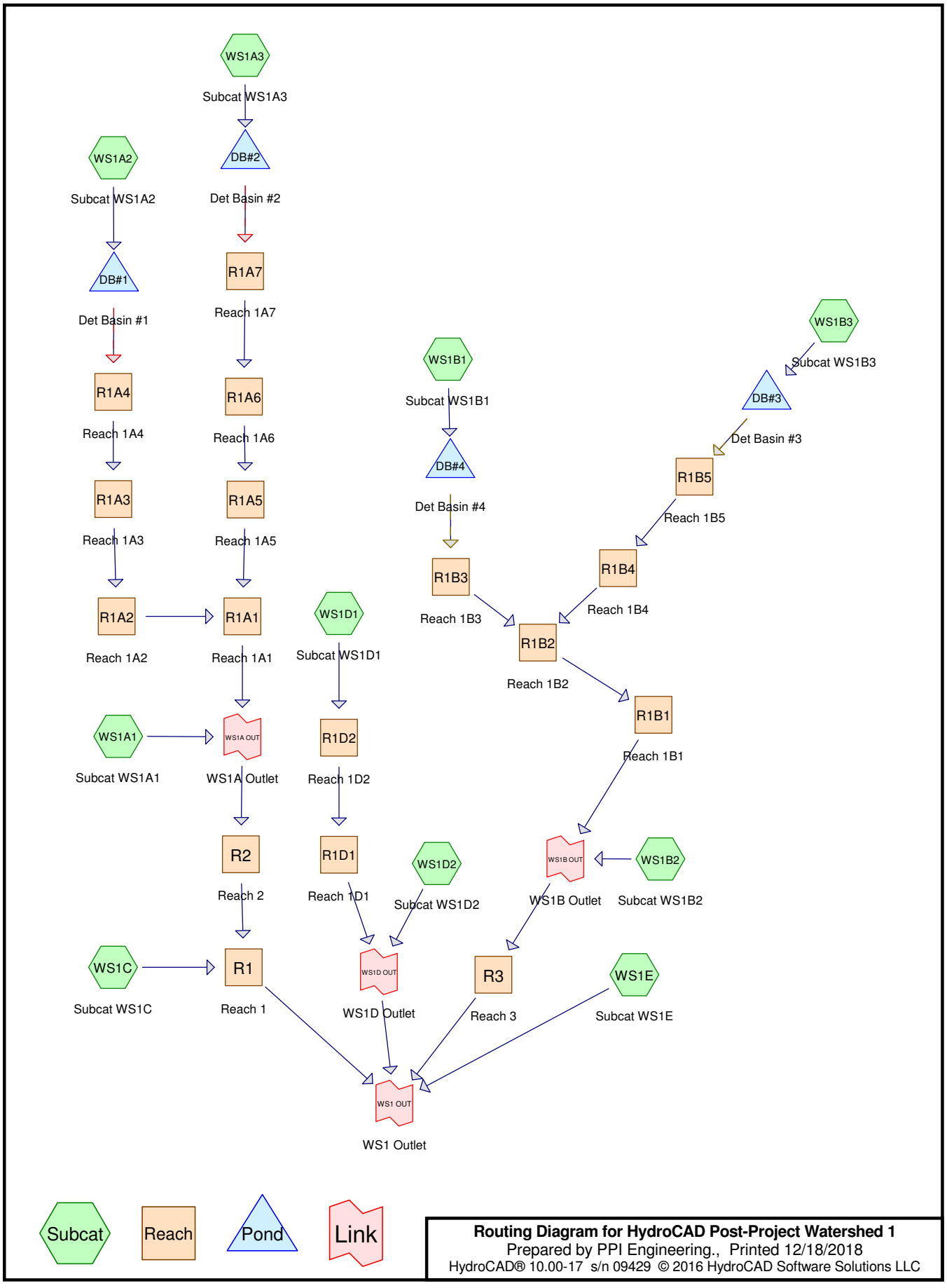


‡

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 6.29" for 100 Year event
Inflow = 358.28 cfs @ 8.10 hrs, Volume= 122.790 af
Primary = 358.28 cfs @ 8.10 hrs, Volume= 122.790 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs



Routing Diagram for HydroCAD Post-Project Watershed 1
Prepared by PPI Engineering., Printed 12/18/2018
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Summary for Subcatchment WS1A1: Subcat WS1A1

Runoff = 15.68 cfs @ 8.09 hrs, Volume= 6.127 af, Depth= 1.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.211	70	Brush, Fair, HSG C
15.659	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
17.770	73	Brush, Good, HSG D
3.175	81	Vineyard, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
39.444	75	Weighted Average
39.444		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1A2: Subcat WS1A2

Runoff = 1.47 cfs @ 8.01 hrs, Volume= 0.519 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.104	70	Brush, Fair, HSG C
0.434	77	Brush, Fair, HSG D
0.249	73	Brush, Good, HSG D
2.073	81	Vineyard, Good, HSG D
2.861	79	Weighted Average
2.861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	87	0.1200	0.18		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	141	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.0	576	0.0900	9.76	43.92	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
9.5	804	Total			

Summary for Subcatchment WS1A3: Subcat WS1A3

Runoff = 1.89 cfs @ 8.00 hrs, Volume= 0.646 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
3.312	81	Vineyard, Good, HSG D
3.312		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0800	0.23		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
1.2	417	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.2	104	0.0900	10.46	188.28	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
8.5	621	Total			

Summary for Subcatchment WS1B1: Subcat WS1B1

Runoff = 1.93 cfs @ 8.02 hrs, Volume= 0.667 af, Depth= 2.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.018	70	Brush, Fair, HSG C
0.244	77	Brush, Fair, HSG D
3.155	81	Vineyard, Good, HSG D
3.417	81	Weighted Average
3.417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	79	0.1000	0.16		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.5	835	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.1	31	0.0300	6.04	108.70	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
10.7	945	Total			

Summary for Subcatchment WS1B2: Subcat WS1B2

Runoff = 14.73 cfs @ 8.20 hrs, Volume= 6.079 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.036	70	Brush, Fair, HSG C
	4.012	77	Brush, Fair, HSG D
	0.929	65	Brush, Good, HSG C
	12.934	73	Brush, Good, HSG D
	0.033	89	Gravel roads, HSG C
	0.186	91	Gravel roads, HSG D
	0.402	75	Vineyard, Good, HSG C
	15.665	81	Vineyard, Good, HSG D
	1.960	72	Woods/grass comb., Good, HSG C
	36.158	77	Weighted Average
	36.158		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet-1** Woods: Dense underbrush n= 0.800 P2= 4.26"
2.3	749	0.1100	5.34		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.6	100	0.4100	0.30		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	110	0.3000	8.82		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.8	270	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.1	529	0.0800	8.21	4.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.5	100	0.2800	0.26		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	50	0.2600	8.21		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
25.9	2,493	Total			

Summary for Subcatchment WS1B3: Subcat WS1B3

Runoff = 2.36 cfs @ 8.02 hrs, Volume= 0.846 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.809	77	Brush, Fair, HSG D
0.014	65	Brush, Good, HSG C
1.122	73	Brush, Good, HSG D
2.899	81	Vineyard, Good, HSG D
0.000	72	Woods/grass comb., Good, HSG C
4.843	78	Weighted Average
4.843		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.0	760	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
10.1	857	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 22.53 cfs @ 8.18 hrs, Volume= 9.338 af, Depth= 2.02"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	17.012	77	Brush, Fair, HSG D
	18.484	73	Brush, Good, HSG D
	0.659	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	15.148	81	Vineyard, Good, HSG D
	55.546	77	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
4.1	1,107	0.0800	4.55		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.7	100	0.3800	0.29		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.0	9	0.2200	7.55		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.4	206	0.0700	8.61	38.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.2	652	0.1000	9.17	5.00	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
5.3	68	0.2100	0.21		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
1.2	563	0.1300	7.91	91.90	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
26.0	2,761	Total			

Summary for Subcatchment WS1D1: Subcat WS1D1

Runoff = 9.70 cfs @ 8.17 hrs, Volume= 3.793 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	5.092	77	Brush, Fair, HSG D
	1.543	73	Brush, Good, HSG D
	14.276	81	Vineyard, Good, HSG D
	20.910	79	Weighted Average
	20.910		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
0.5	190	0.1400	6.02		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
6.2	100	0.3100	0.27		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	83	0.2700	8.37		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
0.7	299	0.0500	7.28	32.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.9	1,129	0.1200	10.05	5.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.6	100	0.2700	0.25		**Sheet Flow, Sheet 3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	179	0.2600	8.21		**Shallow Concentrated Flow, Shallow 3** Unpaved Kv= 16.1 fps
0.2	85	0.1600	8.76	115.00	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
23.5	2,265	Total			

Summary for Subcatchment WS1D2: Subcat WS1D2

Runoff = 10.15 cfs @ 8.11 hrs, Volume= 3.806 af, Depth= 2.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
9.698	77	Brush, Fair, HSG D
1.900	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
8.244	81	Vineyard, Good, HSG D
20.982	79	Weighted Average
20.982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
1.6	634	0.1600	6.44		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
0.1	79	0.1000	10.29	46.30	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.3	141	0.0500	7.80	140.34	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
0.3	251	0.1800	16.13	19.79	**Pipe Channel, 15" SW** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.018
7.3	100	0.2100	0.23		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	203	0.4400	10.68		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
2.0	633	0.0600	5.37	70.43	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
18.7	2,141	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 25.22 cfs @ 8.03 hrs, Volume= 8.831 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	14.817	77	Brush, Fair, HSG D
	2.273	73	Brush, Good, HSG D
	0.919	91	Gravel roads, HSG D
	3.198	84	Vineyard, Fair, HSG D
	25.714	81	Vineyard, Good, HSG D
	46.921	80	Weighted Average
	46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1800	0.32		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
11.2	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 1.97" for 2 Year event
Inflow = 38.75 cfs @ 8.21 hrs, Volume= 16.621 af
Outflow = 38.54 cfs @ 8.28 hrs, Volume= 16.621 af, Atten= 1%, Lag= 4.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.79 fps, Min. Travel Time= 2.7 min
Avg. Velocity = 2.52 fps, Avg. Travel Time= 5.2 min

Peak Storage= 6,350 cf @ 8.24 hrs
Average Depth at Peak Storage= 1.05'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R1A1: Reach 1A1

Inflow Area = 6.172 ac, 0.00% Impervious, Inflow Depth > 2.25" for 2 Year event
Inflow = 1.70 cfs @ 8.73 hrs, Volume= 1.155 af
Outflow = 1.70 cfs @ 8.76 hrs, Volume= 1.155 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.54 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 1.6 min

Peak Storage= 95 cf @ 8.74 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 85.53 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 142.0' Slope= 0.1600 '/'
Inlet Invert= 0.00', Outlet Invert= -22.72'



Summary for Reach R1A2: Reach 1A2

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 2.14" for 2 Year event
Inflow = 0.70 cfs @ 8.88 hrs, Volume= 0.509 af
Outflow = 0.70 cfs @ 9.34 hrs, Volume= 0.509 af, Atten= 0%, Lag= 27.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.27 fps, Min. Travel Time= 12.7 min
Avg. Velocity = 0.80 fps, Avg. Travel Time= 20.1 min

Peak Storage= 532 cf @ 9.12 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 47.81 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 966.0' Slope= 0.0500 '/'
Inlet Invert= 0.00', Outlet Invert= -48.30'



Summary for Reach R1A3: Reach 1A3

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 2.14" for 2 Year event
Inflow = 0.70 cfs @ 8.67 hrs, Volume= 0.509 af
Outflow = 0.70 cfs @ 8.88 hrs, Volume= 0.509 af, Atten= 0%, Lag= 12.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.80 fps, Min. Travel Time= 6.8 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 10.3 min

Peak Storage= 286 cf @ 8.76 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 65.59 cfs

4.50' x 1.00' deep channel, n= 0.053
Side Slope Z-value= 4.0 '/' Top Width= 12.50'
Length= 737.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -95.81'



‡

Summary for Reach R1A4: Reach 1A4

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 2.14" for 2 Year event
Inflow = 0.70 cfs @ 8.46 hrs, Volume= 0.509 af
Outflow = 0.70 cfs @ 8.67 hrs, Volume= 0.509 af, Atten= 0%, Lag= 12.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.21 fps, Min. Travel Time= 7.2 min
Avg. Velocity = 0.14 fps, Avg. Travel Time= 10.5 min

Peak Storage= 303 cf @ 8.55 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 170.0 sf, Capacity= 207.48 cfs

70.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 270.00'
Length= 89.0' Slope= 0.2000 '/'
Inlet Invert= 0.00', Outlet Invert= -17.80'



‡

Summary for Reach R1A5: Reach 1A5

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 2.34" for 2 Year event
Inflow = 1.05 cfs @ 8.55 hrs, Volume= 0.646 af
Outflow = 1.04 cfs @ 8.67 hrs, Volume= 0.646 af, Atten= 0%, Lag= 7.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.03 fps, Min. Travel Time= 4.4 min
Avg. Velocity = 1.17 fps, Avg. Travel Time= 7.7 min

Peak Storage= 276 cf @ 8.60 hrs
Average Depth at Peak Storage= 0.12'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 80.00 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 538.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -75.32'



Summary for Reach R1A6: Reach 1A6

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 2.34" for 2 Year event
Inflow = 1.05 cfs @ 8.51 hrs, Volume= 0.646 af
Outflow = 1.05 cfs @ 8.55 hrs, Volume= 0.646 af, Atten= 0%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.86 fps, Min. Travel Time= 1.0 min
Avg. Velocity = 0.86 fps, Avg. Travel Time= 1.0 min

Peak Storage= 65 cf @ 8.53 hrs
Average Depth at Peak Storage= 0.01'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 3,516.55 cfs

139.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 53.0' Slope= 0.2500 '/'
Inlet Invert= 0.00', Outlet Invert= -13.25'



‡

Summary for Reach R1A7: Reach 1A7

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 2.34" for 2 Year event
Inflow = 1.06 cfs @ 8.30 hrs, Volume= 0.646 af
Outflow = 1.05 cfs @ 8.51 hrs, Volume= 0.646 af, Atten= 1%, Lag= 12.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.22 fps, Min. Travel Time= 7.6 min
Avg. Velocity = 0.14 fps, Avg. Travel Time= 12.2 min

Peak Storage= 475 cf @ 8.38 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 404.02 cfs

139.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 100.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -33.00'



‡

Summary for Reach R1B1: Reach 1B1

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 2.18" for 2 Year event
Inflow = 2.50 cfs @ 8.44 hrs, Volume= 1.504 af
Outflow = 2.50 cfs @ 8.50 hrs, Volume= 1.504 af, Atten= 0%, Lag= 3.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.73 fps, Min. Travel Time= 2.0 min
Avg. Velocity = 1.57 fps, Avg. Travel Time= 3.5 min

Peak Storage= 303 cf @ 8.46 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 41.28 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 332.0' Slope= 0.0700 '/'
Inlet Invert= 0.00', Outlet Invert= -23.24'



‡

Summary for Reach R1B2: Reach 1B2

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 2.18" for 2 Year event
Inflow = 2.50 cfs @ 8.37 hrs, Volume= 1.504 af
Outflow = 2.50 cfs @ 8.44 hrs, Volume= 1.504 af, Atten= 0%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.66 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 2.10 fps, Avg. Travel Time= 3.9 min

Peak Storage= 338 cf @ 8.40 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 64.34 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 496.0' Slope= 0.1700 '/'
Inlet Invert= 0.00', Outlet Invert= -84.32'



‡

Summary for Reach R1B3: Reach 1B3

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth > 2.33" for 2 Year event
Inflow = 1.19 cfs @ 8.29 hrs, Volume= 0.663 af
Outflow = 1.19 cfs @ 8.36 hrs, Volume= 0.663 af, Atten= 0%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.39 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 3.9 min

Peak Storage= 176 cf @ 8.32 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 839.69 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 207.0' Slope= 0.1000 '/'
Inlet Invert= 0.00', Outlet Invert= -20.70'



‡

Summary for Reach R1B4: Reach 1B4

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 2.08" for 2 Year event
Inflow = 1.31 cfs @ 8.36 hrs, Volume= 0.841 af
Outflow = 1.31 cfs @ 8.43 hrs, Volume= 0.841 af, Atten= 0%, Lag= 4.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.61 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.61 fps, Avg. Travel Time= 3.9 min

Peak Storage= 189 cf @ 8.39 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 54.05 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 376.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -45.12'



‡

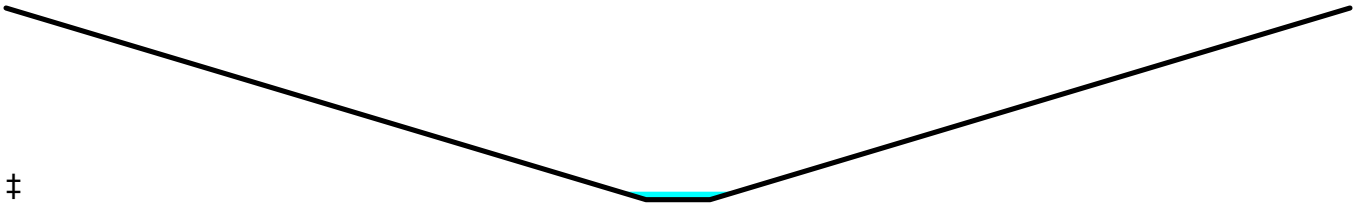
Summary for Reach R1B5: Reach 1B5

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 2.08" for 2 Year event
Inflow = 1.31 cfs @ 8.36 hrs, Volume= 0.841 af
Outflow = 1.31 cfs @ 8.36 hrs, Volume= 0.841 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.19 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.52 fps, Avg. Travel Time= 0.3 min

Peak Storage= 18 cf @ 8.36 hrs
Average Depth at Peak Storage= 0.04'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 1,525.38 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 30.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -9.90'



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Summary for Reach R1D1: Reach 1D1

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 2.18" for 2 Year event
Inflow = 9.68 cfs @ 8.20 hrs, Volume= 3.793 af
Outflow = 9.57 cfs @ 8.32 hrs, Volume= 3.793 af, Atten= 1%, Lag= 6.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.15 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 1.63 fps, Avg. Travel Time= 8.1 min

Peak Storage= 2,397 cf @ 8.25 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 213.97 cfs

Custom cross-section, Length= 789.0' Slope= 0.0710 '/'
Constant n= 0.068
Inlet Invert= 1,566.00', Outlet Invert= 1,510.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.60
2.50	31.6	25.2	24,952	213.97

Summary for Reach R1D2: Reach 1D2

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 2.18" for 2 Year event
Inflow = 9.70 cfs @ 8.17 hrs, Volume= 3.793 af
Outflow = 9.68 cfs @ 8.20 hrs, Volume= 3.793 af, Atten= 0%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.70 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.57 fps, Avg. Travel Time= 2.9 min

Peak Storage= 919 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 233.59 cfs

Custom cross-section, Length= 446.0' Slope= 0.1600 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -71.36'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	4,181	85.53
2.50	23.9	21.6	10,648	233.59

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 1.92" for 2 Year event
Inflow = 16.54 cfs @ 8.09 hrs, Volume= 7.283 af
Outflow = 16.25 cfs @ 8.22 hrs, Volume= 7.283 af, Atten= 2%, Lag= 7.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.44 fps, Min. Travel Time= 4.9 min
Avg. Velocity = 2.80 fps, Avg. Travel Time= 9.5 min

Peak Storage= 4,745 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.61'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 2.05" for 2 Year event
Inflow = 16.59 cfs @ 8.21 hrs, Volume= 7.582 af
Outflow = 16.12 cfs @ 8.44 hrs, Volume= 7.582 af, Atten= 3%, Lag= 13.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.82 fps, Min. Travel Time= 7.5 min
Avg. Velocity = 2.62 fps, Avg. Travel Time= 13.8 min

Peak Storage= 7,220 cf @ 8.31 hrs
Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



‡

Summary for Pond DB#1: Det Basin #1

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 2.18" for 2 Year event
Inflow = 1.47 cfs @ 8.01 hrs, Volume= 0.519 af
Outflow = 0.70 cfs @ 8.46 hrs, Volume= 0.509 af, Atten= 53%, Lag= 26.8 min
Primary = 0.70 cfs @ 8.46 hrs, Volume= 0.509 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,981.11' @ 8.46 hrs Surf.Area= 0.000 ac Storage= 0.046 af

Plug-Flow detention time= 33.3 min calculated for 0.509 af (98% of inflow)
Center-of-Mass det. time= 21.3 min (822.0 - 800.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,980.00'	0.283 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,980.00	0.000
1,981.00	0.039
1,982.00	0.097
1,983.00	0.178
1,984.00	0.283

Device	Routing	Invert	Outlet Devices
#1	Primary	1,976.50'	**4.0" Round Culvert 1** L= 38.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,976.50' / 1,975.60' S= 0.0236 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,980.25'	**2.0" x 6.0" Horiz. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,981.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,982.80'	**8.0" Round Culvert 2** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,982.80' / 1,975.60' S= 0.2483 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,983.80'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,982.80'	**6.0" W x 2.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.70 cfs @ 8.46 hrs HW=1,981.11' (Free Discharge)
└─**1=Culvert 1** (Inlet Controls 0.70 cfs @ 8.02 fps)
  ├─**2=Orifice/Grate** (Passes 0.70 cfs of 1.49 cfs potential flow)
  └─**3=Orifice/Grate** (Controls 0.00 cfs)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,980.00' (Free Discharge)
└─**4=Culvert 2** (Controls 0.00 cfs)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DB#2: Det Basin #2

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 2.34" for 2 Year event
Inflow = 1.89 cfs @ 8.00 hrs, Volume= 0.646 af
Outflow = 1.06 cfs @ 8.30 hrs, Volume= 0.646 af, Atten= 44%, Lag= 18.1 min
Primary = 0.96 cfs @ 8.30 hrs, Volume= 0.643 af
Secondary = 0.10 cfs @ 8.30 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,945.66' @ 8.30 hrs Surf.Area= 0.000 ac Storage= 0.054 af

Plug-Flow detention time= 21.3 min calculated for 0.646 af (100% of inflow)
Center-of-Mass det. time= 21.3 min (809.1 - 787.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,944.00'	0.118 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,944.00	0.000
1,945.00	0.028
1,946.00	0.067
1,947.00	0.118

Device	Routing	Invert	Outlet Devices
#1	Primary	1,943.75'	**6.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,943.75' / 1,940.60' S= 0.1125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,945.20'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,944.00'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600
#4	Secondary	1,945.50'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,945.50' / 1,940.60' S= 0.1960 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#5	Device 4	1,946.80'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,945.50'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600

Primary OutFlow Max=0.96 cfs @ 8.30 hrs HW=1,945.66' (Free Discharge)
└─**1=Culvert** (Inlet Controls 0.96 cfs @ 4.90 fps)
  ├─**2=Orifice/Grate** (Passes < 4.82 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 4.29 cfs potential flow)

Secondary OutFlow Max=0.10 cfs @ 8.30 hrs HW=1,945.66' (Free Discharge)
└─**4=Culvert** (Inlet Controls 0.10 cfs @ 1.08 fps)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Passes 0.10 cfs of 0.17 cfs potential flow)

Summary for Pond DB#3: Det Basin #3

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 2.10" for 2 Year event
Inflow = 2.36 cfs @ 8.02 hrs, Volume= 0.846 af
Outflow = 1.31 cfs @ 8.36 hrs, Volume= 0.841 af, Atten= 44%, Lag= 20.0 min
Primary = 1.31 cfs @ 8.36 hrs, Volume= 0.841 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,986.35' @ 8.36 hrs Surf.Area= 0.000 ac Storage= 0.060 af

Plug-Flow detention time= 21.9 min calculated for 0.841 af (99% of inflow)
Center-of-Mass det. time= 17.9 min (825.1 - 807.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,984.00'	0.177 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,984.00	0.000
1,985.00	0.021
1,986.00	0.048
1,987.00	0.083
1,988.00	0.125
1,989.00	0.177

Device	Routing	Invert	Outlet Devices
#1	Primary	1,983.00'	**6.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,983.00' / 1,982.60' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,984.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#3	Device 1	1,985.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,986.00'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,986.00' / 1,982.60' S= 0.1700 '/' Cc= 0.900 n= 0.010, Flow Area= 0.35 sf
#5	Device 4	1,986.50'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Tertiary	1,987.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,987.20' / 1,982.60' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#7	Device 6	1,988.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#8	Device 6	1,987.20'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=1.31 cfs @ 8.36 hrs HW=1,986.35' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.31 cfs @ 6.70 fps)
  ├─**2=Orifice/Grate** (Passes < 2.18 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 5.46 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,984.00' (Free Discharge)
└─**4=Culvert** (Controls 0.00 cfs)
  └─**5=Orifice/Grate** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,984.00' (Free Discharge)
└─**6=Culvert** (Controls 0.00 cfs)
  ├─**7=Orifice/Grate** (Controls 0.00 cfs)
  └─**8=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DB#4: Det Basin #4

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth = 2.34" for 2 Year event
Inflow = 1.93 cfs @ 8.02 hrs, Volume= 0.667 af
Outflow = 1.19 cfs @ 8.29 hrs, Volume= 0.663 af, Atten= 38%, Lag= 16.0 min
Primary = 0.55 cfs @ 8.29 hrs, Volume= 0.605 af
Secondary = 0.64 cfs @ 8.29 hrs, Volume= 0.058 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,954.17' @ 8.29 hrs Surf.Area= 0.000 ac Storage= 0.075 af

Plug-Flow detention time= 61.7 min calculated for 0.663 af (99% of inflow)
Center-of-Mass det. time= 57.9 min (847.8 - 789.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,951.00'	0.167 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,951.00	0.000
1,952.00	0.013
1,953.00	0.036
1,954.00	0.068
1,955.00	0.111
1,956.00	0.167

Device	Routing	Invert	Outlet Devices
#1	Primary	1,951.30'	**4.0" Round Culvert** L= 34.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,951.30' / 1,950.80' S= 0.0144 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,952.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,951.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#4	Secondary	1,953.60'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,953.60' / 1,950.80' S= 0.0966 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,955.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,953.60'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#7	Tertiary	1,954.30'	**10.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,954.30' / 1,950.80' S= 0.1207 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.55 sf
#8	Device 7	1,955.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#9	Device 7	1,954.30'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.55 cfs @ 8.29 hrs HW=1,954.17' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.55 cfs @ 6.25 fps)
  ├**2=Orifice/Grate** (Passes < 4.89 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 2.70 cfs potential flow)

Secondary OutFlow Max=0.65 cfs @ 8.29 hrs HW=1,954.17' (Free Discharge)
└**4=Culvert** (Inlet Controls 0.65 cfs @ 2.03 fps)
  ├**5=Orifice/Grate** (Controls 0.00 cfs)
  └**6=Orifice/Grate** (Passes 0.65 cfs of 0.88 cfs potential flow)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,951.00' (Free Discharge)
└**7=Culvert** (Controls 0.00 cfs)
  ├**8=Orifice/Grate** (Controls 0.00 cfs)
  └**9=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 2.08" for 2 Year event
Inflow = 87.81 cfs @ 8.23 hrs, Volume= 40.631 af
Primary = 87.81 cfs @ 8.23 hrs, Volume= 40.631 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1A OUT: WS1A Outlet

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 1.92" for 2 Year event
Inflow = 16.54 cfs @ 8.09 hrs, Volume= 7.283 af
Primary = 16.54 cfs @ 8.09 hrs, Volume= 7.283 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1B OUT: WS1B Outlet

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 2.05" for 2 Year event
Inflow = 16.59 cfs @ 8.21 hrs, Volume= 7.582 af
Primary = 16.59 cfs @ 8.21 hrs, Volume= 7.582 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1D OUT: WS1D Outlet

Inflow Area = 41.892 ac, 0.00% Impervious, Inflow Depth = 2.18" for 2 Year event
Inflow = 18.48 cfs @ 8.19 hrs, Volume= 7.598 af
Primary = 18.48 cfs @ 8.19 hrs, Volume= 7.598 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A1: Subcat WS1A1

Runoff = 32.99 cfs @ 8.06 hrs, Volume= 11.633 af, Depth= 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.211	70	Brush, Fair, HSG C
15.659	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
17.770	73	Brush, Good, HSG D
3.175	81	Vineyard, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
39.444	75	Weighted Average
39.444		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1A2: Subcat WS1A2

Runoff = 2.84 cfs @ 7.99 hrs, Volume= 0.941 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.104	70	Brush, Fair, HSG C
0.434	77	Brush, Fair, HSG D
0.249	73	Brush, Good, HSG D
2.073	81	Vineyard, Good, HSG D
2.861	79	Weighted Average
2.861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	87	0.1200	0.18		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	141	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.0	576	0.0900	9.76	43.92	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
9.5	804	Total			

Summary for Subcatchment WS1A3: Subcat WS1A3

Runoff = 3.52 cfs @ 7.98 hrs, Volume= 1.148 af, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
3.312	81	Vineyard, Good, HSG D
3.312		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0800	0.23		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
1.2	417	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.2	104	0.0900	10.46	188.28	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
8.5	621	Total			

Summary for Subcatchment WS1B1: Subcat WS1B1

Runoff = 3.60 cfs @ 8.00 hrs, Volume= 1.184 af, Depth= 4.16"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.018	70	Brush, Fair, HSG C
0.244	77	Brush, Fair, HSG D
3.155	81	Vineyard, Good, HSG D
3.417	81	Weighted Average
3.417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	79	0.1000	0.16		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.5	835	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.1	31	0.0300	6.04	108.70	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
10.7	945	Total			

Summary for Subcatchment WS1B2: Subcat WS1B2

Runoff = 29.88 cfs @ 8.18 hrs, Volume= 11.276 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.036	70	Brush, Fair, HSG C
	4.012	77	Brush, Fair, HSG D
	0.929	65	Brush, Good, HSG C
	12.934	73	Brush, Good, HSG D
	0.033	89	Gravel roads, HSG C
	0.186	91	Gravel roads, HSG D
	0.402	75	Vineyard, Good, HSG C
	15.665	81	Vineyard, Good, HSG D
	1.960	72	Woods/grass comb., Good, HSG C
	36.158	77	Weighted Average
	36.158		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet-1** Woods: Dense underbrush n= 0.800 P2= 4.26"
2.3	749	0.1100	5.34		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.6	100	0.4100	0.30		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	110	0.3000	8.82		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.8	270	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.1	529	0.0800	8.21	4.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.5	100	0.2800	0.26		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	50	0.2600	8.21		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
25.9	2,493	Total			

Summary for Subcatchment WS1B3: Subcat WS1B3

Runoff = 4.65 cfs @ 8.00 hrs, Volume= 1.552 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.809	77	Brush, Fair, HSG D
0.014	65	Brush, Good, HSG C
1.122	73	Brush, Good, HSG D
2.899	81	Vineyard, Good, HSG D
0.000	72	Woods/grass comb., Good, HSG C
4.843	78	Weighted Average
4.843		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.0	760	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
10.1	857	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 45.83 cfs @ 8.18 hrs, Volume= 17.323 af, Depth= 3.74"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	17.012	77	Brush, Fair, HSG D
	18.484	73	Brush, Good, HSG D
	0.659	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	15.148	81	Vineyard, Good, HSG D
	55.546	77	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
4.1	1,107	0.0800	4.55		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.7	100	0.3800	0.29		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.0	9	0.2200	7.55		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.4	206	0.0700	8.61	38.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.2	652	0.1000	9.17	5.00	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
5.3	68	0.2100	0.21		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
1.2	563	0.1300	7.91	91.90	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
26.0	2,761	Total			

Summary for Subcatchment WS1D1: Subcat WS1D1

Runoff = 18.92 cfs @ 8.15 hrs, Volume= 6.881 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	5.092	77	Brush, Fair, HSG D
	1.543	73	Brush, Good, HSG D
	14.276	81	Vineyard, Good, HSG D
	20.910	79	Weighted Average
	20.910		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
0.5	190	0.1400	6.02		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
6.2	100	0.3100	0.27		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	83	0.2700	8.37		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
0.7	299	0.0500	7.28	32.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.9	1,129	0.1200	10.05	5.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.6	100	0.2700	0.25		**Sheet Flow, Sheet 3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	179	0.2600	8.21		**Shallow Concentrated Flow, Shallow 3** Unpaved Kv= 16.1 fps
0.2	85	0.1600	8.76	115.00	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
23.5	2,265	Total			

Summary for Subcatchment WS1D2: Subcat WS1D2

Runoff = 19.77 cfs @ 8.09 hrs, Volume= 6.904 af, Depth= 3.95"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
9.698	77	Brush, Fair, HSG D
1.900	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
8.244	81	Vineyard, Good, HSG D
20.982	79	Weighted Average
20.982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
1.6	634	0.1600	6.44		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
0.1	79	0.1000	10.29	46.30	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.3	141	0.0500	7.80	140.34	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
0.3	251	0.1800	16.13	19.79	**Pipe Channel, 15" SW** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.018
7.3	100	0.2100	0.23		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	203	0.4400	10.68		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
2.0	633	0.0600	5.37	70.43	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
18.7	2,141	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 47.86 cfs @ 8.00 hrs, Volume= 15.848 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	14.817	77	Brush, Fair, HSG D
	2.273	73	Brush, Good, HSG D
	0.919	91	Gravel roads, HSG D
	3.198	84	Vineyard, Fair, HSG D
	25.714	81	Vineyard, Good, HSG D
	46.921	80	Weighted Average
	46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1800	0.32		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
11.2	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 3.68" for 10 Year event
Inflow = 80.61 cfs @ 8.18 hrs, Volume= 31.035 af
Outflow = 80.08 cfs @ 8.25 hrs, Volume= 31.035 af, Atten= 1%, Lag= 4.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.80 fps, Min. Travel Time= 2.3 min
Avg. Velocity = 2.99 fps, Avg. Travel Time= 4.4 min

Peak Storage= 10,886 cf @ 8.22 hrs
Average Depth at Peak Storage= 1.55'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R1A1: Reach 1A1

Inflow Area = 6.172 ac, 0.00% Impervious, Inflow Depth > 4.04" for 10 Year event
Inflow = 3.68 cfs @ 8.33 hrs, Volume= 2.079 af
Outflow = 3.68 cfs @ 8.35 hrs, Volume= 2.079 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.37 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.81 fps, Avg. Travel Time= 1.3 min

Peak Storage= 155 cf @ 8.34 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 85.53 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 142.0' Slope= 0.1600 '/'
Inlet Invert= 0.00', Outlet Invert= -22.72'



Summary for Reach R1A2: Reach 1A2

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 3.91" for 10 Year event
Inflow = 0.81 cfs @ 9.87 hrs, Volume= 0.932 af
Outflow = 0.81 cfs @ 10.26 hrs, Volume= 0.932 af, Atten= 0%, Lag= 23.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.34 fps, Min. Travel Time= 12.0 min
Avg. Velocity = 0.98 fps, Avg. Travel Time= 16.5 min

Peak Storage= 582 cf @ 10.06 hrs
Average Depth at Peak Storage= 0.14'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 47.81 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 966.0' Slope= 0.0500 '/'
Inlet Invert= 0.00', Outlet Invert= -48.30'



Summary for Reach R1A3: Reach 1A3

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 3.91" for 10 Year event
Inflow = 0.81 cfs @ 9.68 hrs, Volume= 0.932 af
Outflow = 0.81 cfs @ 9.87 hrs, Volume= 0.932 af, Atten= 0%, Lag= 11.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.90 fps, Min. Travel Time= 6.5 min
Avg. Velocity = 1.45 fps, Avg. Travel Time= 8.5 min

Peak Storage= 313 cf @ 9.76 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 65.59 cfs

4.50' x 1.00' deep channel, n= 0.053
Side Slope Z-value= 4.0 '/' Top Width= 12.50'
Length= 737.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -95.81'



‡

Summary for Reach R1A4: Reach 1A4

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 3.91" for 10 Year event
Inflow = 0.81 cfs @ 9.47 hrs, Volume= 0.932 af
Outflow = 0.81 cfs @ 9.68 hrs, Volume= 0.932 af, Atten= 0%, Lag= 12.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.22 fps, Min. Travel Time= 6.9 min
Avg. Velocity = 0.17 fps, Avg. Travel Time= 8.6 min

Peak Storage= 333 cf @ 9.56 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.00' Flow Area= 170.0 sf, Capacity= 207.48 cfs

70.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 270.00'
Length= 89.0' Slope= 0.2000 '/'
Inlet Invert= 0.00', Outlet Invert= -17.80'



‡

Summary for Reach R1A5: Reach 1A5

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 4.16" for 10 Year event
Inflow = 3.04 cfs @ 8.25 hrs, Volume= 1.148 af
Outflow = 3.01 cfs @ 8.33 hrs, Volume= 1.148 af, Atten= 1%, Lag= 5.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.00 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 1.39 fps, Avg. Travel Time= 6.4 min

Peak Storage= 540 cf @ 8.28 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 80.00 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 538.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -75.32'



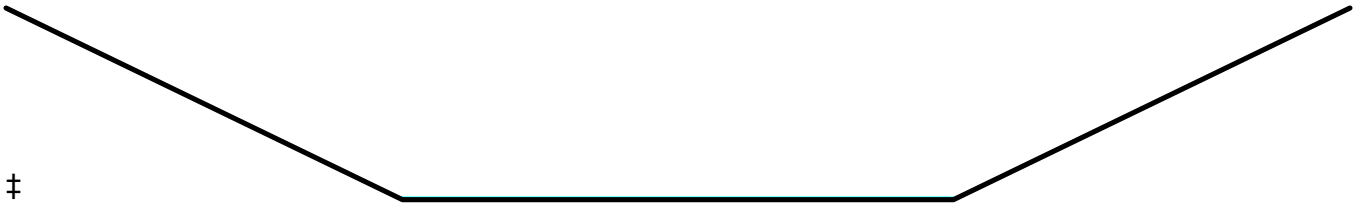
Summary for Reach R1A6: Reach 1A6

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 4.16" for 10 Year event
Inflow = 3.04 cfs @ 8.23 hrs, Volume= 1.148 af
Outflow = 3.04 cfs @ 8.25 hrs, Volume= 1.148 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.27 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 0.87 fps, Avg. Travel Time= 1.0 min

Peak Storage= 127 cf @ 8.24 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 3,516.55 cfs

139.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 53.0' Slope= 0.2500 '/'
Inlet Invert= 0.00', Outlet Invert= -13.25'



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Summary for Reach R1A7: Reach 1A7

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 4.16" for 10 Year event
Inflow = 3.11 cfs @ 8.09 hrs, Volume= 1.148 af
Outflow = 3.04 cfs @ 8.23 hrs, Volume= 1.148 af, Atten= 2%, Lag= 8.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.33 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.16 fps, Avg. Travel Time= 10.4 min

Peak Storage= 920 cf @ 8.14 hrs
Average Depth at Peak Storage= 0.06'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 404.02 cfs

139.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 100.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -33.00'



‡

Summary for Reach R1B1: Reach 1B1

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 3.96" for 10 Year event
Inflow = 6.75 cfs @ 8.25 hrs, Volume= 2.727 af
Outflow = 6.73 cfs @ 8.29 hrs, Volume= 2.727 af, Atten= 0%, Lag= 2.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.76 fps, Min. Travel Time= 1.5 min
Avg. Velocity = 1.90 fps, Avg. Travel Time= 2.9 min

Peak Storage= 594 cf @ 8.27 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 41.28 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 332.0' Slope= 0.0700 '/'
Inlet Invert= 0.00', Outlet Invert= -23.24'



‡

Summary for Reach R1B2: Reach 1B2

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 3.96" for 10 Year event
Inflow = 6.76 cfs @ 8.20 hrs, Volume= 2.727 af
Outflow = 6.75 cfs @ 8.25 hrs, Volume= 2.727 af, Atten= 0%, Lag= 2.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.10 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 2.53 fps, Avg. Travel Time= 3.3 min

Peak Storage= 656 cf @ 8.22 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 64.34 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 496.0' Slope= 0.1700 '/'
Inlet Invert= 0.00', Outlet Invert= -84.32'



‡

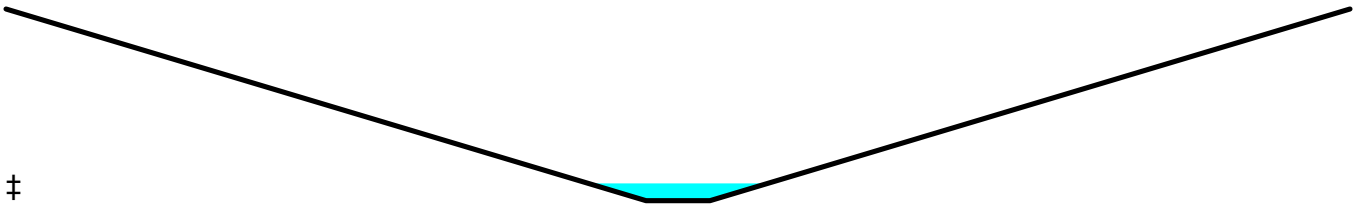
Summary for Reach R1B3: Reach 1B3

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth > 4.14" for 10 Year event
Inflow = 3.10 cfs @ 8.13 hrs, Volume= 1.180 af
Outflow = 3.10 cfs @ 8.19 hrs, Volume= 1.180 af, Atten= 0%, Lag= 3.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.82 fps, Min. Travel Time= 1.9 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 3.4 min

Peak Storage= 352 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 839.69 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 207.0' Slope= 0.1000 '/'
Inlet Invert= 0.00', Outlet Invert= -20.70'



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Summary for Reach R1B4: Reach 1B4

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 3.83" for 10 Year event
Inflow = 3.68 cfs @ 8.16 hrs, Volume= 1.547 af
Outflow = 3.67 cfs @ 8.21 hrs, Volume= 1.547 af, Atten= 0%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.72 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 3.2 min

Peak Storage= 371 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 54.05 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 376.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -45.12'



‡

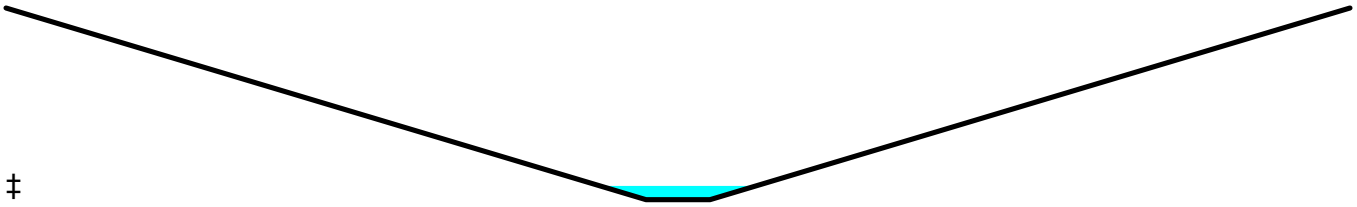
Summary for Reach R1B5: Reach 1B5

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 3.83" for 10 Year event
Inflow = 3.68 cfs @ 8.15 hrs, Volume= 1.547 af
Outflow = 3.68 cfs @ 8.16 hrs, Volume= 1.547 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.94 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 0.3 min

Peak Storage= 38 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 1,525.38 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 30.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -9.90'



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Summary for Reach R1D1: Reach 1D1

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 3.95" for 10 Year event
Inflow = 18.90 cfs @ 8.18 hrs, Volume= 6.881 af
Outflow = 18.77 cfs @ 8.27 hrs, Volume= 6.881 af, Atten= 1%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.89 fps, Min. Travel Time= 3.4 min
Avg. Velocity = 1.95 fps, Avg. Travel Time= 6.8 min

Peak Storage= 3,806 cf @ 8.22 hrs
Average Depth at Peak Storage= 0.71'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 213.97 cfs

Custom cross-section, Length= 789.0' Slope= 0.0710 '/'
Constant n= 0.068
Inlet Invert= 1,566.00', Outlet Invert= 1,510.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.60
2.50	31.6	25.2	24,952	213.97

Summary for Reach R1D2: Reach 1D2

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 3.95" for 10 Year event
Inflow = 18.92 cfs @ 8.15 hrs, Volume= 6.881 af
Outflow = 18.90 cfs @ 8.18 hrs, Volume= 6.881 af, Atten= 0%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.84 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 3.08 fps, Avg. Travel Time= 2.4 min

Peak Storage= 1,444 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.65'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 233.59 cfs

Custom cross-section, Length= 446.0' Slope= 0.1600 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -71.36'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	4,181	85.53
2.50	23.9	21.6	10,648	233.59

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 3.61" for 10 Year event
Inflow = 35.18 cfs @ 8.09 hrs, Volume= 13.712 af
Outflow = 34.80 cfs @ 8.19 hrs, Volume= 13.712 af, Atten= 1%, Lag= 5.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.88 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 3.38 fps, Avg. Travel Time= 7.8 min

Peak Storage= 8,037 cf @ 8.12 hrs
Average Depth at Peak Storage= 0.94'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 3.78" for 10 Year event
Inflow = 36.21 cfs @ 8.20 hrs, Volume= 14.003 af
Outflow = 35.33 cfs @ 8.37 hrs, Volume= 14.002 af, Atten= 2%, Lag= 10.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.02 fps, Min. Travel Time= 6.0 min
Avg. Velocity = 3.11 fps, Avg. Travel Time= 11.6 min

Peak Storage= 12,690 cf @ 8.27 hrs
Average Depth at Peak Storage= 0.81'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



‡

Summary for Pond DB#1: Det Basin #1

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 3.95" for 10 Year event
Inflow = 2.84 cfs @ 7.99 hrs, Volume= 0.941 af
Outflow = 0.81 cfs @ 9.47 hrs, Volume= 0.932 af, Atten= 72%, Lag= 89.0 min
Primary = 0.81 cfs @ 9.47 hrs, Volume= 0.932 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,982.57' @ 9.47 hrs Surf.Area= 0.000 ac Storage= 0.143 af

Plug-Flow detention time= 67.9 min calculated for 0.932 af (99% of inflow)
Center-of-Mass det. time= 60.9 min (826.5 - 765.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,980.00'	0.283 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,980.00	0.000
1,981.00	0.039
1,982.00	0.097
1,983.00	0.178
1,984.00	0.283

Device	Routing	Invert	Outlet Devices
#1	Primary	1,976.50'	**4.0" Round Culvert 1** L= 38.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,976.50' / 1,975.60' S= 0.0236 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,980.25'	**2.0" x 6.0" Horiz. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,981.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,982.80'	**8.0" Round Culvert 2** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,982.80' / 1,975.60' S= 0.2483 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,983.80'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,982.80'	**6.0" W x 2.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.81 cfs @ 9.47 hrs HW=1,982.57' (Free Discharge)
└─**1=Culvert 1** (Inlet Controls 0.81 cfs @ 9.24 fps)
  ├─**2=Orifice/Grate** (Passes < 2.45 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 3.92 cfs potential flow)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,980.00' (Free Discharge)
└─**4=Culvert 2** (Controls 0.00 cfs)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Summary for Pond DB#2: Det Basin #2

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 4.16" for 10 Year event
Inflow = 3.52 cfs @ 7.98 hrs, Volume= 1.148 af
Outflow = 3.11 cfs @ 8.09 hrs, Volume= 1.148 af, Atten= 12%, Lag= 6.8 min
Primary = 1.14 cfs @ 8.09 hrs, Volume= 1.029 af
Secondary = 1.97 cfs @ 8.09 hrs, Volume= 0.119 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,946.32' @ 8.09 hrs Surf.Area= 0.000 ac Storage= 0.083 af

Plug-Flow detention time= 24.7 min calculated for 1.147 af (100% of inflow)
Center-of-Mass det. time= 24.7 min (779.6 - 754.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,944.00'	0.118 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,944.00	0.000
1,945.00	0.028
1,946.00	0.067
1,947.00	0.118

Device	Routing	Invert	Outlet Devices
#1	Primary	1,943.75'	**6.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,943.75' / 1,940.60' S= 0.1125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,945.20'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,944.00'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600
#4	Secondary	1,945.50'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,945.50' / 1,940.60' S= 0.1960 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#5	Device 4	1,946.80'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,945.50'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600

Primary OutFlow Max=1.14 cfs @ 8.09 hrs HW=1,946.32' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.14 cfs @ 5.78 fps)
  ├─**2=Orifice/Grate** (Passes < 8.99 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 5.39 cfs potential flow)

Secondary OutFlow Max=1.97 cfs @ 8.09 hrs HW=1,946.32' (Free Discharge)
└─**4=Culvert** (Passes 1.97 cfs of 2.06 cfs potential flow)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Orifice Controls 1.97 cfs @ 2.90 fps)

Summary for Pond DB#3: Det Basin #3

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 3.85" for 10 Year event
Inflow = 4.65 cfs @ 8.00 hrs, Volume= 1.552 af
Outflow = 3.68 cfs @ 8.15 hrs, Volume= 1.547 af, Atten= 21%, Lag= 9.1 min
Primary = 1.56 cfs @ 8.15 hrs, Volume= 1.406 af
Secondary = 1.52 cfs @ 8.15 hrs, Volume= 0.127 af
Tertiary = 0.60 cfs @ 8.15 hrs, Volume= 0.014 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,987.64' @ 8.15 hrs Surf.Area= 0.000 ac Storage= 0.110 af

Plug-Flow detention time= 21.0 min calculated for 1.547 af (100% of inflow)
Center-of-Mass det. time= 18.7 min (789.8 - 771.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,984.00'	0.177 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,984.00	0.000
1,985.00	0.021
1,986.00	0.048
1,987.00	0.083
1,988.00	0.125
1,989.00	0.177

Device	Routing	Invert	Outlet Devices
#1	Primary	1,983.00'	**6.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,983.00' / 1,982.60' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,984.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#3	Device 1	1,985.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,986.00'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,986.00' / 1,982.60' S= 0.1700 '/' Cc= 0.900 n= 0.010, Flow Area= 0.35 sf
#5	Device 4	1,986.50'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Tertiary	1,987.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,987.20' / 1,982.60' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#7	Device 6	1,988.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#8	Device 6	1,987.20'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=1.56 cfs @ 8.15 hrs HW=1,987.64' (Free Discharge)
└**1=Culvert** (Inlet Controls 1.56 cfs @ 7.97 fps)
  ├**2=Orifice/Grate** (Passes < 2.84 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 8.65 cfs potential flow)

Secondary OutFlow Max=1.52 cfs @ 8.15 hrs HW=1,987.64' (Free Discharge)
└**4=Culvert** (Inlet Controls 1.52 cfs @ 4.35 fps)
  └**5=Orifice/Grate** (Passes 1.52 cfs of 9.09 cfs potential flow)

Tertiary OutFlow Max=0.60 cfs @ 8.15 hrs HW=1,987.64' (Free Discharge)
└**6=Culvert** (Inlet Controls 0.60 cfs @ 1.79 fps)
  ├**7=Orifice/Grate** (Controls 0.00 cfs)
  └**8=Orifice/Grate** (Passes 0.60 cfs of 0.63 cfs potential flow)

Summary for Pond DB#4: Det Basin #4

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth = 4.16" for 10 Year event
Inflow = 3.60 cfs @ 8.00 hrs, Volume= 1.184 af
Outflow = 3.10 cfs @ 8.13 hrs, Volume= 1.180 af, Atten= 14%, Lag= 7.7 min
Primary = 0.63 cfs @ 8.13 hrs, Volume= 0.825 af
Secondary = 1.39 cfs @ 8.13 hrs, Volume= 0.305 af
Tertiary = 1.09 cfs @ 8.13 hrs, Volume= 0.050 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,955.02' @ 8.13 hrs Surf.Area= 0.000 ac Storage= 0.112 af

Plug-Flow detention time= 59.4 min calculated for 1.180 af (100% of inflow)
Center-of-Mass det. time= 57.2 min (814.1 - 756.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,951.00'	0.167 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,951.00	0.000
1,952.00	0.013
1,953.00	0.036
1,954.00	0.068
1,955.00	0.111
1,956.00	0.167

Device	Routing	Invert	Outlet Devices
#1	Primary	1,951.30'	**4.0" Round Culvert** L= 34.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,951.30' / 1,950.80' S= 0.0144 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,952.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,951.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#4	Secondary	1,953.60'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,953.60' / 1,950.80' S= 0.0966 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,955.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,953.60'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#7	Tertiary	1,954.30'	**10.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,954.30' / 1,950.80' S= 0.1207 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.55 sf
#8	Device 7	1,955.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#9	Device 7	1,954.30'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.63 cfs @ 8.13 hrs HW=1,955.02' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.63 cfs @ 7.17 fps)
  ├**2=Orifice/Grate** (Passes < 6.01 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 3.08 cfs potential flow)

Secondary OutFlow Max=1.39 cfs @ 8.13 hrs HW=1,955.02' (Free Discharge)
└**4=Culvert** (Inlet Controls 1.39 cfs @ 3.97 fps)
  ├**5=Orifice/Grate** (Passes < 0.06 cfs potential flow)
  └**6=Orifice/Grate** (Passes < 1.74 cfs potential flow)

Tertiary OutFlow Max=1.09 cfs @ 8.13 hrs HW=1,955.02' (Free Discharge)
└**7=Culvert** (Passes 1.09 cfs of 1.15 cfs potential flow)
  ├**8=Orifice/Grate** (Controls 0.00 cfs)
  └**9=Orifice/Grate** (Orifice Controls 1.09 cfs @ 3.27 fps)

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 3.82" for 10 Year event
Inflow = 181.78 cfs @ 8.17 hrs, Volume= 74.670 af
Primary = 181.78 cfs @ 8.17 hrs, Volume= 74.670 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1A OUT: WS1A Outlet

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 3.61" for 10 Year event
Inflow = 35.18 cfs @ 8.09 hrs, Volume= 13.712 af
Primary = 35.18 cfs @ 8.09 hrs, Volume= 13.712 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1B OUT: WS1B Outlet

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 3.78" for 10 Year event
Inflow = 36.21 cfs @ 8.20 hrs, Volume= 14.003 af
Primary = 36.21 cfs @ 8.20 hrs, Volume= 14.003 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1D OUT: WS1D Outlet

Inflow Area = 41.892 ac, 0.00% Impervious, Inflow Depth = 3.95" for 10 Year event
Inflow = 36.83 cfs @ 8.16 hrs, Volume= 13.785 af
Primary = 36.83 cfs @ 8.16 hrs, Volume= 13.785 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A1: Subcat WS1A1

Runoff = 52.36 cfs @ 8.06 hrs, Volume= 17.733 af, Depth= 5.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.211	70	Brush, Fair, HSG C
15.659	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
17.770	73	Brush, Good, HSG D
3.175	81	Vineyard, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
39.444	75	Weighted Average
39.444		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1A2: Subcat WS1A2

Runoff = 4.33 cfs @ 7.97 hrs, Volume= 1.400 af, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.104	70	Brush, Fair, HSG C
0.434	77	Brush, Fair, HSG D
0.249	73	Brush, Good, HSG D
2.073	81	Vineyard, Good, HSG D
2.861	79	Weighted Average
2.861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	87	0.1200	0.18		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	141	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.0	576	0.0900	9.76	43.92	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
9.5	804	Total			

Summary for Subcatchment WS1A3: Subcat WS1A3

Runoff = 5.26 cfs @ 7.96 hrs, Volume= 1.686 af, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
3.312	81	Vineyard, Good, HSG D
3.312		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0800	0.23		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
1.2	417	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.2	104	0.0900	10.46	188.28	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
8.5	621	Total			

Summary for Subcatchment WS1B1: Subcat WS1B1

Runoff = 5.39 cfs @ 8.00 hrs, Volume= 1.740 af, Depth= 6.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.018	70	Brush, Fair, HSG C
0.244	77	Brush, Fair, HSG D
3.155	81	Vineyard, Good, HSG D
3.417	81	Weighted Average
3.417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	79	0.1000	0.16		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.5	835	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.1	31	0.0300	6.04	108.70	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
10.7	945	Total			

Summary for Subcatchment WS1B2: Subcat WS1B2

Runoff = 46.60 cfs @ 8.17 hrs, Volume= 16.974 af, Depth= 5.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.036	70	Brush, Fair, HSG C
	4.012	77	Brush, Fair, HSG D
	0.929	65	Brush, Good, HSG C
	12.934	73	Brush, Good, HSG D
	0.033	89	Gravel roads, HSG C
	0.186	91	Gravel roads, HSG D
	0.402	75	Vineyard, Good, HSG C
	15.665	81	Vineyard, Good, HSG D
	1.960	72	Woods/grass comb., Good, HSG C
	36.158	77	Weighted Average
	36.158		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet-1** Woods: Dense underbrush n= 0.800 P2= 4.26"
2.3	749	0.1100	5.34		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.6	100	0.4100	0.30		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	110	0.3000	8.82		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.8	270	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.1	529	0.0800	8.21	4.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.5	100	0.2800	0.26		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	50	0.2600	8.21		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
25.9	2,493	Total			

Summary for Subcatchment WS1B3: Subcat WS1B3

Runoff = 7.13 cfs @ 7.98 hrs, Volume= 2.322 af, Depth= 5.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.809	77	Brush, Fair, HSG D
0.014	65	Brush, Good, HSG C
1.122	73	Brush, Good, HSG D
2.899	81	Vineyard, Good, HSG D
0.000	72	Woods/grass comb., Good, HSG C
4.843	78	Weighted Average
4.843		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.0	760	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
10.1	857	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 71.48 cfs @ 8.17 hrs, Volume= 26.076 af, Depth= 5.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	17.012	77	Brush, Fair, HSG D
	18.484	73	Brush, Good, HSG D
	0.659	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	15.148	81	Vineyard, Good, HSG D
	55.546	77	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
4.1	1,107	0.0800	4.55		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.7	100	0.3800	0.29		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.0	9	0.2200	7.55		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.4	206	0.0700	8.61	38.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.2	652	0.1000	9.17	5.00	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
5.3	68	0.2100	0.21		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
1.2	563	0.1300	7.91	91.90	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
26.0	2,761	Total			

Summary for Subcatchment WS1D1: Subcat WS1D1

Runoff = 28.93 cfs @ 8.13 hrs, Volume= 10.232 af, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	5.092	77	Brush, Fair, HSG D
	1.543	73	Brush, Good, HSG D
	14.276	81	Vineyard, Good, HSG D
	20.910	79	Weighted Average
	20.910		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
0.5	190	0.1400	6.02		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
6.2	100	0.3100	0.27		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	83	0.2700	8.37		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
0.7	299	0.0500	7.28	32.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.9	1,129	0.1200	10.05	5.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.6	100	0.2700	0.25		**Sheet Flow, Sheet 3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	179	0.2600	8.21		**Shallow Concentrated Flow, Shallow 3** Unpaved Kv= 16.1 fps
0.2	85	0.1600	8.76	115.00	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
23.5	2,265	Total			

Summary for Subcatchment WS1D2: Subcat WS1D2

Runoff = 30.20 cfs @ 8.08 hrs, Volume= 10.267 af, Depth= 5.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
9.698	77	Brush, Fair, HSG D
1.900	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
8.244	81	Vineyard, Good, HSG D
20.982	79	Weighted Average
20.982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
1.6	634	0.1600	6.44		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
0.1	79	0.1000	10.29	46.30	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.3	141	0.0500	7.80	140.34	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
0.3	251	0.1800	16.13	19.79	**Pipe Channel, 15" SW** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.018
7.3	100	0.2100	0.23		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	203	0.4400	10.68		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
2.0	633	0.0600	5.37	70.43	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
18.7	2,141	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 72.23 cfs @ 8.00 hrs, Volume= 23.428 af, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	14.817	77	Brush, Fair, HSG D
	2.273	73	Brush, Good, HSG D
	0.919	91	Gravel roads, HSG D
	3.198	84	Vineyard, Fair, HSG D
	25.714	81	Vineyard, Good, HSG D
	46.921	80	Weighted Average
	46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1800	0.32		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
11.2	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 5.56" for 50 Year event
Inflow = 127.83 cfs @ 8.17 hrs, Volume= 46.885 af
Outflow = 127.22 cfs @ 8.23 hrs, Volume= 46.885 af, Atten= 0%, Lag= 3.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.12 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 3.34 fps, Avg. Travel Time= 3.9 min

Peak Storage= 16,410 cf @ 8.19 hrs
Average Depth at Peak Storage= 2.00'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R1A1: Reach 1A1

Inflow Area = 6.172 ac, 0.00% Impervious, Inflow Depth = 5.98" for 50 Year event
Inflow = 5.44 cfs @ 8.28 hrs, Volume= 3.076 af
Outflow = 5.44 cfs @ 8.30 hrs, Volume= 3.076 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.86 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.07 fps, Avg. Travel Time= 1.1 min

Peak Storage= 200 cf @ 8.29 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 85.53 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 142.0' Slope= 0.1600 '/'
Inlet Invert= 0.00', Outlet Invert= -22.72'



Summary for Reach R1A2: Reach 1A2

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 5.83" for 50 Year event
Inflow = 1.61 cfs @ 9.15 hrs, Volume= 1.390 af
Outflow = 1.60 cfs @ 9.42 hrs, Volume= 1.390 af, Atten= 0%, Lag= 15.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.72 fps, Min. Travel Time= 9.4 min
Avg. Velocity = 1.12 fps, Avg. Travel Time= 14.4 min

Peak Storage= 900 cf @ 9.26 hrs
Average Depth at Peak Storage= 0.22'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 47.81 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 966.0' Slope= 0.0500 '/'
Inlet Invert= 0.00', Outlet Invert= -48.30'



Summary for Reach R1A3: Reach 1A3

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 5.83" for 50 Year event
Inflow = 1.61 cfs @ 9.02 hrs, Volume= 1.390 af
Outflow = 1.61 cfs @ 9.15 hrs, Volume= 1.390 af, Atten= 0%, Lag= 8.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.44 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 1.65 fps, Avg. Travel Time= 7.4 min

Peak Storage= 487 cf @ 9.07 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 65.59 cfs

4.50' x 1.00' deep channel, n= 0.053
Side Slope Z-value= 4.0 '/' Top Width= 12.50'
Length= 737.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -95.81'



‡

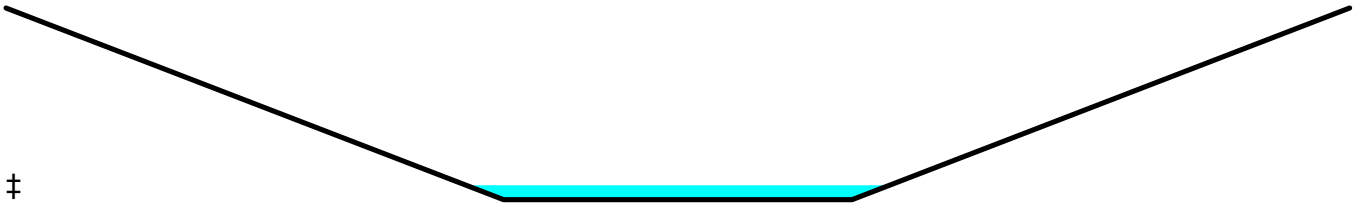
Summary for Reach R1A4: Reach 1A4

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 5.83" for 50 Year event
Inflow = 1.61 cfs @ 8.87 hrs, Volume= 1.390 af
Outflow = 1.61 cfs @ 9.02 hrs, Volume= 1.390 af, Atten= 0%, Lag= 8.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.28 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 7.6 min

Peak Storage= 515 cf @ 8.93 hrs
Average Depth at Peak Storage= 0.07'
Bank-Full Depth= 1.00' Flow Area= 170.0 sf, Capacity= 207.48 cfs

70.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 270.00'
Length= 89.0' Slope= 0.2000 '/'
Inlet Invert= 0.00', Outlet Invert= -17.80'



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Summary for Reach R1A5: Reach 1A5

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.11" for 50 Year event
Inflow = 4.72 cfs @ 8.21 hrs, Volume= 1.686 af
Outflow = 4.70 cfs @ 8.27 hrs, Volume= 1.686 af, Atten= 0%, Lag= 4.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.51 fps, Min. Travel Time= 2.6 min
Avg. Velocity = 1.58 fps, Avg. Travel Time= 5.7 min

Peak Storage= 720 cf @ 8.23 hrs
Average Depth at Peak Storage= 0.30'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 80.00 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 538.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -75.32'



Summary for Reach R1A6: Reach 1A6

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.11" for 50 Year event
Inflow = 4.72 cfs @ 8.19 hrs, Volume= 1.686 af
Outflow = 4.72 cfs @ 8.21 hrs, Volume= 1.686 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.49 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 1.0 min

Peak Storage= 168 cf @ 8.20 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 3,516.55 cfs

139.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 53.0' Slope= 0.2500 '/'
Inlet Invert= 0.00', Outlet Invert= -13.25'



‡

Summary for Reach R1A7: Reach 1A7

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.11" for 50 Year event
Inflow = 4.76 cfs @ 8.08 hrs, Volume= 1.686 af
Outflow = 4.72 cfs @ 8.19 hrs, Volume= 1.686 af, Atten= 1%, Lag= 6.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.39 fps, Min. Travel Time= 4.3 min
Avg. Velocity = 0.18 fps, Avg. Travel Time= 9.3 min

Peak Storage= 1,211 cf @ 8.12 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 404.02 cfs

139.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 100.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -33.00'



‡

Summary for Reach R1B1: Reach 1B1

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 5.89" for 50 Year event
Inflow = 10.78 cfs @ 8.19 hrs, Volume= 4.053 af
Outflow = 10.75 cfs @ 8.23 hrs, Volume= 4.053 af, Atten= 0%, Lag= 2.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.34 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.14 fps, Avg. Travel Time= 2.6 min

Peak Storage= 823 cf @ 8.21 hrs
Average Depth at Peak Storage= 0.50'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 41.28 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 332.0' Slope= 0.0700 '/'
Inlet Invert= 0.00', Outlet Invert= -23.24'



‡

Summary for Reach R1B2: Reach 1B2

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth = 5.89" for 50 Year event
Inflow = 10.82 cfs @ 8.15 hrs, Volume= 4.053 af
Outflow = 10.78 cfs @ 8.19 hrs, Volume= 4.053 af, Atten= 0%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 5.91 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 2.9 min

Peak Storage= 905 cf @ 8.17 hrs
Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 64.34 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 496.0' Slope= 0.1700 '/'
Inlet Invert= 0.00', Outlet Invert= -84.32'



‡

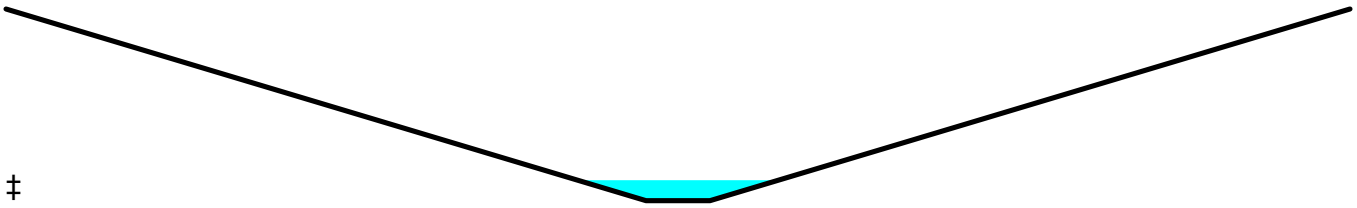
Summary for Reach R1B3: Reach 1B3

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth > 6.10" for 50 Year event
Inflow = 4.47 cfs @ 8.14 hrs, Volume= 1.736 af
Outflow = 4.46 cfs @ 8.19 hrs, Volume= 1.736 af, Atten= 0%, Lag= 3.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.01 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.12 fps, Avg. Travel Time= 3.1 min

Peak Storage= 460 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 839.69 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 207.0' Slope= 0.1000 '/'
Inlet Invert= 0.00', Outlet Invert= -20.70'



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Summary for Reach R1B4: Reach 1B4

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 5.74" for 50 Year event
Inflow = 6.43 cfs @ 8.11 hrs, Volume= 2.317 af
Outflow = 6.39 cfs @ 8.15 hrs, Volume= 2.317 af, Atten= 1%, Lag= 2.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.45 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.19 fps, Avg. Travel Time= 2.9 min

Peak Storage= 539 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.32'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 54.05 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 376.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -45.12'



‡

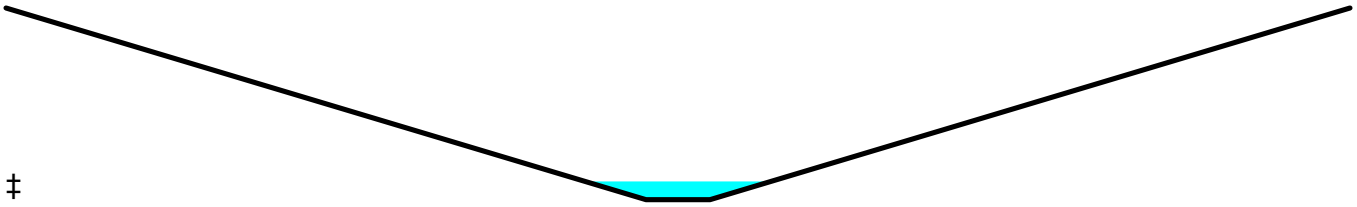
Summary for Reach R1B5: Reach 1B5

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 5.74" for 50 Year event
Inflow = 6.43 cfs @ 8.10 hrs, Volume= 2.317 af
Outflow = 6.43 cfs @ 8.11 hrs, Volume= 2.317 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.43 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 1.94 fps, Avg. Travel Time= 0.3 min

Peak Storage= 56 cf @ 8.11 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 1,525.38 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 30.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -9.90'



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Summary for Reach R1D1: Reach 1D1

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 5.87" for 50 Year event
Inflow = 28.90 cfs @ 8.17 hrs, Volume= 10.232 af
Outflow = 28.74 cfs @ 8.25 hrs, Volume= 10.232 af, Atten= 1%, Lag= 5.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.42 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 2.19 fps, Avg. Travel Time= 6.0 min

Peak Storage= 5,132 cf @ 8.20 hrs
Average Depth at Peak Storage= 0.90'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 213.97 cfs

Custom cross-section, Length= 789.0' Slope= 0.0710 '/'
Constant n= 0.068
Inlet Invert= 1,566.00', Outlet Invert= 1,510.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.60
2.50	31.6	25.2	24,952	213.97

Summary for Reach R1D2: Reach 1D2

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 5.87" for 50 Year event
Inflow = 28.93 cfs @ 8.13 hrs, Volume= 10.232 af
Outflow = 28.90 cfs @ 8.17 hrs, Volume= 10.232 af, Atten= 0%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.66 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 3.49 fps, Avg. Travel Time= 2.1 min

Peak Storage= 1,936 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 233.59 cfs

Custom cross-section, Length= 446.0' Slope= 0.1600 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -71.36'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	4,181	85.53
2.50	23.9	21.6	10,648	233.59

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 5.47" for 50 Year event
Inflow = 56.88 cfs @ 8.06 hrs, Volume= 20.810 af
Outflow = 56.40 cfs @ 8.16 hrs, Volume= 20.810 af, Atten= 1%, Lag= 5.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.93 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 3.85 fps, Avg. Travel Time= 6.9 min

Peak Storage= 11,314 cf @ 8.10 hrs
Average Depth at Peak Storage= 1.22'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 5.68" for 50 Year event
Inflow = 57.08 cfs @ 8.20 hrs, Volume= 21.027 af
Outflow = 55.91 cfs @ 8.34 hrs, Volume= 21.026 af, Atten= 2%, Lag= 8.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.81 fps, Min. Travel Time= 5.3 min
Avg. Velocity = 3.48 fps, Avg. Travel Time= 10.3 min

Peak Storage= 17,731 cf @ 8.25 hrs
Average Depth at Peak Storage= 1.02'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



‡

Summary for Pond DB#1: Det Basin #1

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 5.87" for 50 Year event
Inflow = 4.33 cfs @ 7.97 hrs, Volume= 1.400 af
Outflow = 1.61 cfs @ 8.87 hrs, Volume= 1.390 af, Atten= 63%, Lag= 53.9 min
Primary = 0.86 cfs @ 8.87 hrs, Volume= 1.244 af
Secondary = 0.75 cfs @ 8.87 hrs, Volume= 0.146 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,983.45' @ 8.87 hrs Surf.Area= 0.000 ac Storage= 0.225 af

Plug-Flow detention time= 99.3 min calculated for 1.390 af (99% of inflow)
Center-of-Mass det. time= 94.4 min (838.3 - 744.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,980.00'	0.283 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,980.00	0.000
1,981.00	0.039
1,982.00	0.097
1,983.00	0.178
1,984.00	0.283

Device	Routing	Invert	Outlet Devices
#1	Primary	1,976.50'	**4.0" Round Culvert 1** L= 38.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,976.50' / 1,975.60' S= 0.0236 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,980.25'	**2.0" x 6.0" Horiz. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,981.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,982.80'	**8.0" Round Culvert 2** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,982.80' / 1,975.60' S= 0.2483 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,983.80'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,982.80'	**6.0" W x 2.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.86 cfs @ 8.87 hrs HW=1,983.45' (Free Discharge)
└─**1=Culvert 1** (Barrel Controls 0.86 cfs @ 9.87 fps)
  ├─**2=Orifice/Grate** (Passes < 2.87 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 5.28 cfs potential flow)

Secondary OutFlow Max=0.75 cfs @ 8.87 hrs HW=1,983.45' (Free Discharge)
└─**4=Culvert 2** (Inlet Controls 0.75 cfs @ 2.16 fps)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Passes 0.75 cfs of 1.21 cfs potential flow)

Summary for Pond DB#2: Det Basin #2

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.11" for 50 Year event
Inflow = 5.26 cfs @ 7.96 hrs, Volume= 1.686 af
Outflow = 4.76 cfs @ 8.08 hrs, Volume= 1.686 af, Atten= 9%, Lag= 7.4 min
Primary = 1.25 cfs @ 8.08 hrs, Volume= 1.362 af
Secondary = 3.51 cfs @ 8.08 hrs, Volume= 0.325 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,946.80' @ 8.08 hrs Surf.Area= 0.000 ac Storage= 0.108 af

Plug-Flow detention time= 27.8 min calculated for 1.686 af (100% of inflow)
Center-of-Mass det. time= 27.9 min (762.3 - 734.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,944.00'	0.118 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,944.00	0.000
1,945.00	0.028
1,946.00	0.067
1,947.00	0.118

Device	Routing	Invert	Outlet Devices
#1	Primary	1,943.75'	**6.0" Round Culvert**
			L= 28.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 1,943.75' / 1,940.60' S= 0.1125 '/' Cc= 0.900
			n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,945.20'	**18.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#3	Device 1	1,944.00'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600
#4	Secondary	1,945.50'	**15.0" Round Culvert**
			L= 25.0' CPP, projecting, no headwall, Ke= 0.900
			Inlet / Outlet Invert= 1,945.50' / 1,940.60' S= 0.1960 '/' Cc= 0.900
			n= 0.010, Flow Area= 1.23 sf
#5	Device 4	1,946.80'	**36.0" Horiz. Orifice/Grate** C= 0.600
			Limited to weir flow at low heads
#6	Device 4	1,945.50'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600

Primary OutFlow Max=1.25 cfs @ 8.08 hrs HW=1,946.80' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.25 cfs @ 6.36 fps)
  ├─**2=Orifice/Grate** (Passes < 10.75 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 6.07 cfs potential flow)

Secondary OutFlow Max=3.51 cfs @ 8.08 hrs HW=1,946.80' (Free Discharge)
└─**4=Culvert** (Passes 3.51 cfs of 3.82 cfs potential flow)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Orifice Controls 3.51 cfs @ 4.22 fps)

Summary for Pond DB#3: Det Basin #3

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 5.75" for 50 Year event
Inflow = 7.13 cfs @ 7.98 hrs, Volume= 2.322 af
Outflow = 6.43 cfs @ 8.10 hrs, Volume= 2.317 af, Atten= 10%, Lag= 7.4 min
Primary = 1.73 cfs @ 8.10 hrs, Volume= 1.890 af
Secondary = 2.01 cfs @ 8.10 hrs, Volume= 0.310 af
Tertiary = 2.69 cfs @ 8.10 hrs, Volume= 0.117 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,988.63' @ 8.10 hrs Surf.Area= 0.000 ac Storage= 0.158 af

Plug-Flow detention time= 24.1 min calculated for 2.316 af (100% of inflow)
Center-of-Mass det. time= 22.6 min (771.4 - 748.8)

Volume	Invert	Avail.Storage	Storage Description
#1	1,984.00'	0.177 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,984.00	0.000
1,985.00	0.021
1,986.00	0.048
1,987.00	0.083
1,988.00	0.125
1,989.00	0.177

Device	Routing	Invert	Outlet Devices
#1	Primary	1,983.00'	**6.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,983.00' / 1,982.60' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,984.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#3	Device 1	1,985.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,986.00'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,986.00' / 1,982.60' S= 0.1700 '/' Cc= 0.900 n= 0.010, Flow Area= 0.35 sf
#5	Device 4	1,986.50'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Tertiary	1,987.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,987.20' / 1,982.60' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#7	Device 6	1,988.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#8	Device 6	1,987.20'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=1.73 cfs @ 8.10 hrs HW=1,988.63' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.73 cfs @ 8.82 fps)
  ├─**2=Orifice/Grate** (Passes < 3.26 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 10.45 cfs potential flow)

Secondary OutFlow Max=2.01 cfs @ 8.10 hrs HW=1,988.63' (Free Discharge)
└─**4=Culvert** (Inlet Controls 2.01 cfs @ 5.76 fps)
  └─**5=Orifice/Grate** (Passes 2.01 cfs of 12.42 cfs potential flow)

Tertiary OutFlow Max=2.69 cfs @ 8.10 hrs HW=1,988.63' (Free Discharge)
└─**6=Culvert** (Passes 2.69 cfs of 2.88 cfs potential flow)
  ├─**7=Orifice/Grate** (Weir Controls 0.95 cfs @ 1.18 fps)
  └─**8=Orifice/Grate** (Orifice Controls 1.74 cfs @ 5.22 fps)

Summary for Pond DB#4: Det Basin #4

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth = 6.11" for 50 Year event
Inflow = 5.39 cfs @ 8.00 hrs, Volume= 1.740 af
Outflow = 4.47 cfs @ 8.14 hrs, Volume= 1.736 af, Atten= 17%, Lag= 8.5 min
Primary = 0.68 cfs @ 8.14 hrs, Volume= 0.922 af
Secondary = 1.75 cfs @ 8.14 hrs, Volume= 0.666 af
Tertiary = 2.04 cfs @ 8.14 hrs, Volume= 0.148 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,955.68' @ 8.14 hrs Surf.Area= 0.000 ac Storage= 0.149 af

Plug-Flow detention time= 49.0 min calculated for 1.736 af (100% of inflow)
Center-of-Mass det. time= 47.4 min (784.0 - 736.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,951.00'	0.167 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,951.00	0.000
1,952.00	0.013
1,953.00	0.036
1,954.00	0.068
1,955.00	0.111
1,956.00	0.167

Device	Routing	Invert	Outlet Devices
#1	Primary	1,951.30'	**4.0" Round Culvert** L= 34.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,951.30' / 1,950.80' S= 0.0144 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,952.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,951.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#4	Secondary	1,953.60'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,953.60' / 1,950.80' S= 0.0966 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,955.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,953.60'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#7	Tertiary	1,954.30'	**10.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,954.30' / 1,950.80' S= 0.1207 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.55 sf
#8	Device 7	1,955.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#9	Device 7	1,954.30'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.68 cfs @ 8.14 hrs HW=1,955.68' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.68 cfs @ 7.80 fps)
  ├**2=Orifice/Grate** (Passes < 6.74 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 3.34 cfs potential flow)

Secondary OutFlow Max=1.75 cfs @ 8.14 hrs HW=1,955.68' (Free Discharge)
└**4=Culvert** (Inlet Controls 1.75 cfs @ 5.02 fps)
  ├**5=Orifice/Grate** (Passes < 7.02 cfs potential flow)
  └**6=Orifice/Grate** (Passes < 2.17 cfs potential flow)

Tertiary OutFlow Max=2.04 cfs @ 8.14 hrs HW=1,955.68' (Free Discharge)
└**7=Culvert** (Inlet Controls 2.04 cfs @ 3.73 fps)
  ├**8=Orifice/Grate** (Passes < 1.58 cfs potential flow)
  └**9=Orifice/Grate** (Passes < 1.70 cfs potential flow)

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 5.73" for 50 Year event
Inflow = 288.00 cfs @ 8.15 hrs, Volume= 111.838 af
Primary = 288.00 cfs @ 8.15 hrs, Volume= 111.838 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1A OUT: WS1A Outlet

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 5.47" for 50 Year event
Inflow = 56.88 cfs @ 8.06 hrs, Volume= 20.810 af
Primary = 56.88 cfs @ 8.06 hrs, Volume= 20.810 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1B OUT: WS1B Outlet

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 5.68" for 50 Year event
Inflow = 57.08 cfs @ 8.20 hrs, Volume= 21.027 af
Primary = 57.08 cfs @ 8.20 hrs, Volume= 21.027 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1D OUT: WS1D Outlet

Inflow Area = 41.892 ac, 0.00% Impervious, Inflow Depth = 5.87" for 50 Year event
Inflow = 56.78 cfs @ 8.16 hrs, Volume= 20.499 af
Primary = 56.78 cfs @ 8.16 hrs, Volume= 20.499 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS1A1: Subcat WS1A1

Runoff = 60.83 cfs @ 8.06 hrs, Volume= 20.413 af, Depth= 6.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.211	70	Brush, Fair, HSG C
15.659	77	Brush, Fair, HSG D
0.763	65	Brush, Good, HSG C
17.770	73	Brush, Good, HSG D
3.175	81	Vineyard, Good, HSG D
0.346	77	Woods, Good, HSG D
0.560	72	Woods/grass comb., Good, HSG C
0.959	79	Woods/grass comb., Good, HSG D
39.444	75	Weighted Average
39.444		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
1.4	476	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
2.8	1,207	0.1100	7.10	60.33	**Trap/Vee/Rect Channel Flow, Channel X-Sect 6** Bot.W=4.50' D=1.00' Z= 4.0 '/' Top.W=12.50' n= 0.053
3.3	1,108	0.0600	5.59	52.38	**Trap/Vee/Rect Channel Flow, Channel X-Sect 9** Bot.W=4.00' D=1.50' Z= 1.5 '/' Top.W=8.50' n= 0.065
15.6	2,847	Total			

Summary for Subcatchment WS1A2: Subcat WS1A2

Runoff = 4.97 cfs @ 7.97 hrs, Volume= 1.599 af, Depth= 6.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.104	70	Brush, Fair, HSG C
0.434	77	Brush, Fair, HSG D
0.249	73	Brush, Good, HSG D
2.073	81	Vineyard, Good, HSG D
2.861	79	Weighted Average
2.861		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	87	0.1200	0.18		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	141	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
1.0	576	0.0900	9.76	43.92	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
9.5	804	Total			

Summary for Subcatchment WS1A3: Subcat WS1A3

Runoff = 6.00 cfs @ 7.96 hrs, Volume= 1.920 af, Depth= 6.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
3.312	81	Vineyard, Good, HSG D
3.312		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.1	100	0.0800	0.23		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
1.2	417	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.2	104	0.0900	10.46	188.28	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
8.5	621	Total			

Summary for Subcatchment WS1B1: Subcat WS1B1

Runoff = 6.15 cfs @ 7.98 hrs, Volume= 1.981 af, Depth= 6.96"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.018	70	Brush, Fair, HSG C
0.244	77	Brush, Fair, HSG D
3.155	81	Vineyard, Good, HSG D
3.417	81	Weighted Average
3.417		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	79	0.1000	0.16		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.5	835	0.1200	5.58		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.1	31	0.0300	6.04	108.70	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
10.7	945	Total			

Summary for Subcatchment WS1B2: Subcat WS1B2

Runoff = 53.88 cfs @ 8.17 hrs, Volume= 19.465 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.036	70	Brush, Fair, HSG C
	4.012	77	Brush, Fair, HSG D
	0.929	65	Brush, Good, HSG C
	12.934	73	Brush, Good, HSG D
	0.033	89	Gravel roads, HSG C
	0.186	91	Gravel roads, HSG D
	0.402	75	Vineyard, Good, HSG C
	15.665	81	Vineyard, Good, HSG D
	1.960	72	Woods/grass comb., Good, HSG C
	36.158	77	Weighted Average
	36.158		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	53	0.1800	0.11		**Sheet Flow, Sheet-1** Woods: Dense underbrush n= 0.800 P2= 4.26"
2.3	749	0.1100	5.34		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.6	100	0.4100	0.30		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	110	0.3000	8.82		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.8	270	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.1	529	0.0800	8.21	4.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.5	100	0.2800	0.26		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	50	0.2600	8.21		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	532	0.0900	7.20	46.81	**Trap/Vee/Rect Channel Flow, Channel X-Sect 8** Bot.W=3.50' D=1.00' Z= 3.0 '/' Top.W=9.50' n= 0.047
25.9	2,493	Total			

Summary for Subcatchment WS1B3: Subcat WS1B3

Runoff = 8.22 cfs @ 7.98 hrs, Volume= 2.658 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.809	77	Brush, Fair, HSG D
0.014	65	Brush, Good, HSG C
1.122	73	Brush, Good, HSG D
2.899	81	Vineyard, Good, HSG D
0.000	72	Woods/grass comb., Good, HSG C
4.843	78	Weighted Average
4.843		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.0	760	0.1600	6.44		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
10.1	857	Total			

Summary for Subcatchment WS1C: Subcat WS1C

Runoff = 82.64 cfs @ 8.17 hrs, Volume= 29.903 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	17.012	77	Brush, Fair, HSG D
	18.484	73	Brush, Good, HSG D
	0.659	91	Gravel roads, HSG D
	4.243	84	Vineyard, Fair, HSG D
	15.148	81	Vineyard, Good, HSG D
	55.546	77	Weighted Average
	55.546		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	56	0.0500	0.12		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
4.1	1,107	0.0800	4.55		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.7	100	0.3800	0.29		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.0	9	0.2200	7.55		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.4	206	0.0700	8.61	38.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.2	652	0.1000	9.17	5.00	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
5.3	68	0.2100	0.21		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
1.2	563	0.1300	7.91	91.90	**Trap/Vee/Rect Channel Flow, Channel X-Sect 12** Bot.W=4.00' D=1.50' Z= 3.0 & 2.0 '/' Top.W=11.50' n= 0.066
26.0	2,761	Total			

Summary for Subcatchment WS1D1: Subcat WS1D1

Runoff = 33.26 cfs @ 8.13 hrs, Volume= 11.692 af, Depth= 6.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	5.092	77	Brush, Fair, HSG D
	1.543	73	Brush, Good, HSG D
	14.276	81	Vineyard, Good, HSG D
	20.910	79	Weighted Average
	20.910		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
0.5	190	0.1400	6.02		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
6.2	100	0.3100	0.27		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.2	83	0.2700	8.37		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
0.7	299	0.0500	7.28	32.74	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
1.9	1,129	0.1200	10.05	5.48	**Pipe Channel, 10" SW Pipe** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
6.6	100	0.2700	0.25		**Sheet Flow, Sheet 3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.4	179	0.2600	8.21		**Shallow Concentrated Flow, Shallow 3** Unpaved Kv= 16.1 fps
0.2	85	0.1600	8.76	115.00	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
23.5	2,265	Total			

Summary for Subcatchment WS1D2: Subcat WS1D2

Runoff = 34.71 cfs @ 8.08 hrs, Volume= 11.732 af, Depth= 6.71"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
9.698	77	Brush, Fair, HSG D
1.900	73	Brush, Good, HSG D
0.309	91	Gravel roads, HSG D
0.832	84	Vineyard, Fair, HSG D
8.244	81	Vineyard, Good, HSG D
20.982	79	Weighted Average
20.982		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0900	0.25		**Sheet Flow, Sheet 1** Grass: Dense n= 0.240 P2= 4.26"
1.6	634	0.1600	6.44		**Shallow Concentrated Flow, Shallow 1** Unpaved Kv= 16.1 fps
0.1	79	0.1000	10.29	46.30	**Trap/Vee/Rect Channel Flow, Diversion Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.3	141	0.0500	7.80	140.34	**Trap/Vee/Rect Channel Flow, Diversion Avenue** Bot.W=0.00' D=1.50' Z= 8.0 '/' Top.W=24.00' n= 0.035
0.3	251	0.1800	16.13	19.79	**Pipe Channel, 15" SW** 15.0" Round Area= 1.2 sf Perim= 3.9' r= 0.31' n= 0.018
7.3	100	0.2100	0.23		**Sheet Flow, Sheet 2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	203	0.4400	10.68		**Shallow Concentrated Flow, Shallow 2** Unpaved Kv= 16.1 fps
2.0	633	0.0600	5.37	70.43	**Trap/Vee/Rect Channel Flow, Channel X-Sect 13** Bot.W=5.00' D=1.50' Z= 2.5 '/' Top.W=12.50' n= 0.068
18.7	2,141	Total			

Summary for Subcatchment WS1E: Subcat WS1E

Runoff = 82.71 cfs @ 8.00 hrs, Volume= 26.722 af, Depth= 6.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	14.817	77	Brush, Fair, HSG D
	2.273	73	Brush, Good, HSG D
	0.919	91	Gravel roads, HSG D
	3.198	84	Vineyard, Fair, HSG D
	25.714	81	Vineyard, Good, HSG D
	46.921	80	Weighted Average
	46.921		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	100	0.1800	0.32		**Sheet Flow, Sheet** Grass: Dense n= 0.240 P2= 4.26"
3.2	1,162	0.1400	6.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.9	518	0.1900	9.45	61.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 14** Bot.W=2.50' D=1.00' Z= 4.0 '/' Top.W=10.50' n= 0.049
2.0	995	0.1400	8.46	126.91	**Trap/Vee/Rect Channel Flow, Channel X-Sect 17** Bot.W=4.00' D=1.50' Z= 4.0 '/' Top.W=16.00' n= 0.062
11.2	2,775	Total			

Summary for Reach R1: Reach 1

Inflow Area = 101.163 ac, 0.00% Impervious, Inflow Depth = 6.38" for 100 Year event
Inflow = 148.08 cfs @ 8.17 hrs, Volume= 53.825 af
Outflow = 147.47 cfs @ 8.22 hrs, Volume= 53.825 af, Atten= 0%, Lag= 3.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.27 fps, Min. Travel Time= 2.1 min
Avg. Velocity = 3.48 fps, Avg. Travel Time= 3.8 min

Peak Storage= 18,559 cf @ 8.19 hrs
Average Depth at Peak Storage= 2.14'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 212.49 cfs

Custom cross-section, Length= 789.0' Slope= 0.0700 '/'
Constant n= 0.068
Inlet Invert= 0.00', Outlet Invert= -55.23'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.07
2.50	31.6	25.2	24,952	212.49

Summary for Reach R1A1: Reach 1A1

Inflow Area = 6.172 ac, 0.00% Impervious, Inflow Depth > 6.82" for 100 Year event
Inflow = 6.26 cfs @ 8.26 hrs, Volume= 3.510 af
Outflow = 6.26 cfs @ 8.28 hrs, Volume= 3.510 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.05 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 2.18 fps, Avg. Travel Time= 1.1 min

Peak Storage= 219 cf @ 8.27 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 85.53 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 142.0' Slope= 0.1600 '/'
Inlet Invert= 0.00', Outlet Invert= -22.72'



Summary for Reach R1A2: Reach 1A2

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 6.67" for 100 Year event
Inflow = 1.94 cfs @ 9.00 hrs, Volume= 1.590 af
Outflow = 1.94 cfs @ 9.25 hrs, Volume= 1.590 af, Atten= 0%, Lag= 15.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.84 fps, Min. Travel Time= 8.7 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 13.7 min

Peak Storage= 1,017 cf @ 9.11 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 47.81 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 966.0' Slope= 0.0500 '/'
Inlet Invert= 0.00', Outlet Invert= -48.30'



Summary for Reach R1A3: Reach 1A3

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 6.67" for 100 Year event
Inflow = 1.94 cfs @ 8.88 hrs, Volume= 1.590 af
Outflow = 1.94 cfs @ 9.00 hrs, Volume= 1.590 af, Atten= 0%, Lag= 7.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.60 fps, Min. Travel Time= 4.7 min
Avg. Velocity = 1.71 fps, Avg. Travel Time= 7.2 min

Peak Storage= 550 cf @ 8.92 hrs
Average Depth at Peak Storage= 0.15'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 65.59 cfs

4.50' x 1.00' deep channel, n= 0.053
Side Slope Z-value= 4.0 '/' Top Width= 12.50'
Length= 737.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -95.81'



‡

Summary for Reach R1A4: Reach 1A4

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 6.67" for 100 Year event
Inflow = 1.94 cfs @ 8.75 hrs, Volume= 1.590 af
Outflow = 1.94 cfs @ 8.88 hrs, Volume= 1.590 af, Atten= 0%, Lag= 7.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.30 fps, Min. Travel Time= 5.0 min
Avg. Velocity = 0.20 fps, Avg. Travel Time= 7.4 min

Peak Storage= 582 cf @ 8.79 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 170.0 sf, Capacity= 207.48 cfs

70.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 270.00'
Length= 89.0' Slope= 0.2000 '/'
Inlet Invert= 0.00', Outlet Invert= -17.80'



‡

Summary for Reach R1A5: Reach 1A5

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.96" for 100 Year event
Inflow = 5.51 cfs @ 8.19 hrs, Volume= 1.920 af
Outflow = 5.49 cfs @ 8.26 hrs, Volume= 1.920 af, Atten= 0%, Lag= 3.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.71 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.65 fps, Avg. Travel Time= 5.4 min

Peak Storage= 796 cf @ 8.22 hrs
Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.50' Flow Area= 9.4 sf, Capacity= 80.00 cfs

4.00' x 1.50' deep channel, n= 0.065
Side Slope Z-value= 1.5 '/' Top Width= 8.50'
Length= 538.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -75.32'



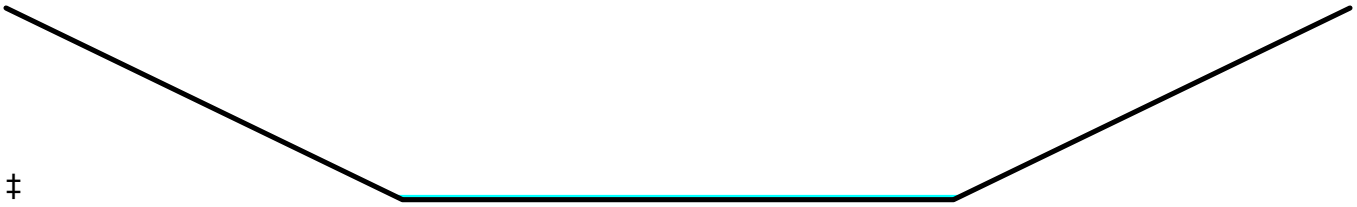
Summary for Reach R1A6: Reach 1A6

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.96" for 100 Year event
Inflow = 5.51 cfs @ 8.18 hrs, Volume= 1.920 af
Outflow = 5.51 cfs @ 8.19 hrs, Volume= 1.920 af, Atten= 0%, Lag= 0.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.59 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 0.89 fps, Avg. Travel Time= 1.0 min

Peak Storage= 184 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.02'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 3,516.55 cfs

139.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 53.0' Slope= 0.2500 '/'
Inlet Invert= 0.00', Outlet Invert= -13.25'



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Summary for Reach R1A7: Reach 1A7

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.96" for 100 Year event
Inflow = 5.55 cfs @ 8.07 hrs, Volume= 1.920 af
Outflow = 5.51 cfs @ 8.18 hrs, Volume= 1.920 af, Atten= 1%, Lag= 6.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.41 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 8.9 min

Peak Storage= 1,335 cf @ 8.11 hrs
Average Depth at Peak Storage= 0.09'
Bank-Full Depth= 1.00' Flow Area= 239.0 sf, Capacity= 404.02 cfs

139.00' x 1.00' deep channel, n= 0.400
Side Slope Z-value= 100.0 '/' Top Width= 339.00'
Length= 100.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -33.00'



‡

Summary for Reach R1B1: Reach 1B1

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth > 6.73" for 100 Year event
Inflow = 12.09 cfs @ 8.21 hrs, Volume= 4.630 af
Outflow = 12.08 cfs @ 8.24 hrs, Volume= 4.630 af, Atten= 0%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.49 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.23 fps, Avg. Travel Time= 2.5 min

Peak Storage= 894 cf @ 8.22 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 41.28 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 332.0' Slope= 0.0700 '/'
Inlet Invert= 0.00', Outlet Invert= -23.24'



‡

Summary for Reach R1B2: Reach 1B2

Inflow Area = 8.260 ac, 0.00% Impervious, Inflow Depth = 6.73" for 100 Year event
Inflow = 12.10 cfs @ 8.17 hrs, Volume= 4.630 af
Outflow = 12.09 cfs @ 8.21 hrs, Volume= 4.630 af, Atten= 0%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.13 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 2.99 fps, Avg. Travel Time= 2.8 min

Peak Storage= 979 cf @ 8.19 hrs
Average Depth at Peak Storage= 0.42'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 64.34 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 496.0' Slope= 0.1700 '/'
Inlet Invert= 0.00', Outlet Invert= -84.32'



‡

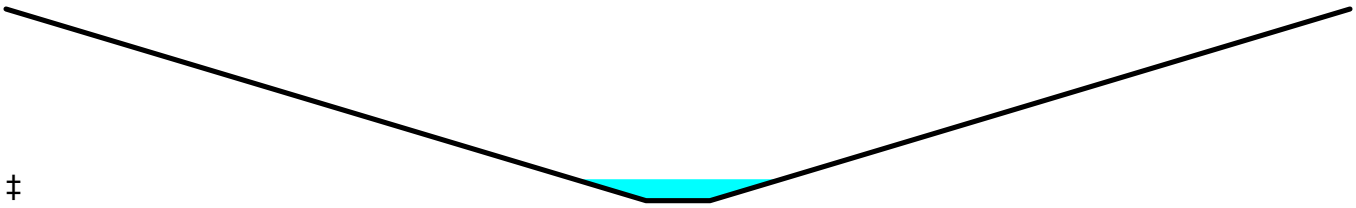
Summary for Reach R1B3: Reach 1B3

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth > 6.94" for 100 Year event
Inflow = 4.94 cfs @ 8.15 hrs, Volume= 1.977 af
Outflow = 4.93 cfs @ 8.20 hrs, Volume= 1.977 af, Atten= 0%, Lag= 2.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.06 fps, Min. Travel Time= 1.7 min
Avg. Velocity = 1.15 fps, Avg. Travel Time= 3.0 min

Peak Storage= 495 cf @ 8.17 hrs
Average Depth at Peak Storage= 0.11'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 839.69 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 207.0' Slope= 0.1000 '/'
Inlet Invert= 0.00', Outlet Invert= -20.70'



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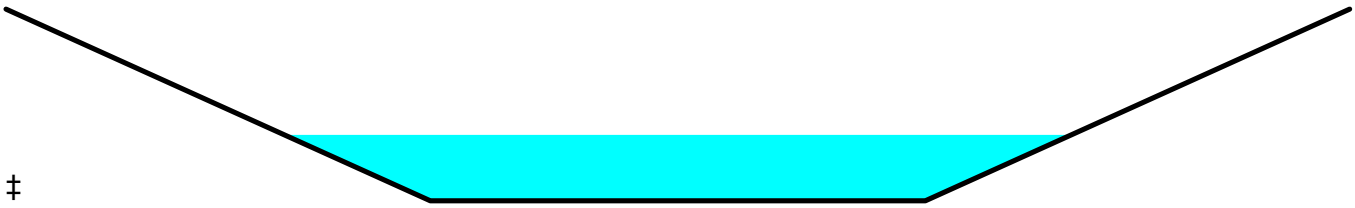
Summary for Reach R1B4: Reach 1B4

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 6.57" for 100 Year event
Inflow = 7.20 cfs @ 8.12 hrs, Volume= 2.653 af
Outflow = 7.19 cfs @ 8.16 hrs, Volume= 2.653 af, Atten= 0%, Lag= 2.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.62 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.29 fps, Avg. Travel Time= 2.7 min

Peak Storage= 585 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00' Flow Area= 6.5 sf, Capacity= 54.05 cfs

3.50' x 1.00' deep channel, n= 0.047
Side Slope Z-value= 3.0 '/' Top Width= 9.50'
Length= 376.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -45.12'



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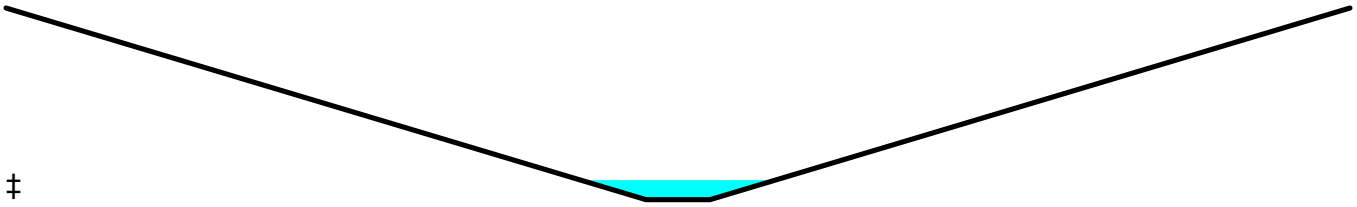
Summary for Reach R1B5: Reach 1B5

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 6.57" for 100 Year event
Inflow = 7.20 cfs @ 8.11 hrs, Volume= 2.653 af
Outflow = 7.20 cfs @ 8.12 hrs, Volume= 2.653 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.53 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.01 fps, Avg. Travel Time= 0.2 min

Peak Storage= 61 cf @ 8.12 hrs
Average Depth at Peak Storage= 0.10'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 1,525.38 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 30.0' Slope= 0.3300 '/'
Inlet Invert= 0.00', Outlet Invert= -9.90'



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Summary for Reach R1D1: Reach 1D1

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 6.71" for 100 Year event
Inflow = 33.23 cfs @ 8.16 hrs, Volume= 11.692 af
Outflow = 33.06 cfs @ 8.25 hrs, Volume= 11.692 af, Atten= 1%, Lag= 4.9 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.60 fps, Min. Travel Time= 2.9 min
Avg. Velocity = 2.28 fps, Avg. Travel Time= 5.8 min

Peak Storage= 5,666 cf @ 8.20 hrs
Average Depth at Peak Storage= 0.97'
Bank-Full Depth= 2.50' Flow Area= 31.6 sf, Capacity= 213.97 cfs

Custom cross-section, Length= 789.0' Slope= 0.0710 '/'
Constant n= 0.068
Inlet Invert= 1,566.00', Outlet Invert= 1,510.00'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-12.25	1,568.50	0.00
-6.25	1,567.50	1.00
-2.50	1,566.00	2.50
0.00	1,566.00	2.50
2.50	1,566.00	2.50
6.25	1,567.50	1.00
12.25	1,568.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	5.0	0	0.00
1.50	13.1	13.1	10,356	76.60
2.50	31.6	25.2	24,952	213.97

Summary for Reach R1D2: Reach 1D2

Inflow Area = 20.910 ac, 0.00% Impervious, Inflow Depth = 6.71" for 100 Year event
Inflow = 33.26 cfs @ 8.13 hrs, Volume= 11.692 af
Outflow = 33.23 cfs @ 8.16 hrs, Volume= 11.692 af, Atten= 0%, Lag= 2.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 6.95 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 3.64 fps, Avg. Travel Time= 2.0 min

Peak Storage= 2,134 cf @ 8.15 hrs
Average Depth at Peak Storage= 0.90'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 233.59 cfs

Custom cross-section, Length= 446.0' Slope= 0.1600 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -71.36'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	4,181	85.53
2.50	23.9	21.6	10,648	233.59

Summary for Reach R2: Reach 2

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 6.29" for 100 Year event
Inflow = 66.00 cfs @ 8.06 hrs, Volume= 23.923 af
Outflow = 65.52 cfs @ 8.15 hrs, Volume= 23.922 af, Atten= 1%, Lag= 5.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 8.27 fps, Min. Travel Time= 3.2 min
Avg. Velocity = 4.03 fps, Avg. Travel Time= 6.6 min

Peak Storage= 12,595 cf @ 8.10 hrs
Average Depth at Peak Storage= 1.32'
Bank-Full Depth= 2.50' Flow Area= 23.9 sf, Capacity= 226.17 cfs

Custom cross-section, Length= 1,590.0' Slope= 0.1500 '/'
Constant n= 0.065
Inlet Invert= 0.00', Outlet Invert= -238.50'



‡

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
-10.25	1,804.50	0.00
-4.25	1,803.50	1.00
-2.00	1,802.00	2.50
0.00	1,802.00	2.50
2.00	1,802.00	2.50
4.25	1,803.50	1.00
10.25	1,804.50	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	4.0	0	0.00
1.50	9.4	9.4	14,906	82.81
2.50	23.9	21.6	37,961	226.17

Summary for Reach R3: Reach 3

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 6.51" for 100 Year event
Inflow = 65.75 cfs @ 8.18 hrs, Volume= 24.095 af
Outflow = 64.66 cfs @ 8.32 hrs, Volume= 24.095 af, Atten= 2%, Lag= 8.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Max. Velocity= 7.09 fps, Min. Travel Time= 5.1 min
Avg. Velocity = 3.62 fps, Avg. Travel Time= 10.0 min

Peak Storage= 19,724 cf @ 8.24 hrs
Average Depth at Peak Storage= 1.09'
Bank-Full Depth= 1.50' Flow Area= 15.0 sf, Capacity= 126.91 cfs

4.00' x 1.50' deep channel, n= 0.062
Side Slope Z-value= 4.0 '/' Top Width= 16.00'
Length= 2,161.0' Slope= 0.1400 '/'
Inlet Invert= 0.00', Outlet Invert= -302.54'



‡

Summary for Pond DB#1: Det Basin #1

Inflow Area = 2.861 ac, 0.00% Impervious, Inflow Depth = 6.71" for 100 Year event
Inflow = 4.97 cfs @ 7.97 hrs, Volume= 1.599 af
Outflow = 1.94 cfs @ 8.75 hrs, Volume= 1.590 af, Atten= 61%, Lag= 46.9 min
Primary = 0.88 cfs @ 8.75 hrs, Volume= 1.337 af
Secondary = 1.06 cfs @ 8.75 hrs, Volume= 0.253 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,983.78' @ 8.75 hrs Surf.Area= 0.000 ac Storage= 0.260 af

Plug-Flow detention time= 104.2 min calculated for 1.590 af (99% of inflow)
Center-of-Mass det. time= 99.8 min (836.9 - 737.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,980.00'	0.283 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,980.00	0.000
1,981.00	0.039
1,982.00	0.097
1,983.00	0.178
1,984.00	0.283

Device	Routing	Invert	Outlet Devices
#1	Primary	1,976.50'	**4.0" Round Culvert 1** L= 38.2' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,976.50' / 1,975.60' S= 0.0236 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,980.25'	**2.0" x 6.0" Horiz. Orifice/Grate X 4.00** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,981.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,982.80'	**8.0" Round Culvert 2** L= 29.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,982.80' / 1,975.60' S= 0.2483 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,983.80'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,982.80'	**6.0" W x 2.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.88 cfs @ 8.75 hrs HW=1,983.78' (Free Discharge)
└─**1=Culvert 1** (Barrel Controls 0.88 cfs @ 10.08 fps)
  ├─**2=Orifice/Grate** (Passes < 3.01 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 5.71 cfs potential flow)

Secondary OutFlow Max=1.06 cfs @ 8.75 hrs HW=1,983.78' (Free Discharge)
└─**4=Culvert 2** (Inlet Controls 1.06 cfs @ 3.05 fps)
  ├─**5=Orifice/Grate** (Controls 0.00 cfs)
  └─**6=Orifice/Grate** (Passes 1.06 cfs of 1.52 cfs potential flow)

Summary for Pond DB#2: Det Basin #2

Inflow Area = 3.312 ac, 0.00% Impervious, Inflow Depth = 6.96" for 100 Year event
Inflow = 6.00 cfs @ 7.96 hrs, Volume= 1.920 af
Outflow = 5.55 cfs @ 8.07 hrs, Volume= 1.920 af, Atten= 8%, Lag= 6.7 min
Primary = 1.28 cfs @ 8.07 hrs, Volume= 1.475 af
Secondary = 4.27 cfs @ 8.07 hrs, Volume= 0.445 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,946.96' @ 8.07 hrs Surf.Area= 0.000 ac Storage= 0.116 af

Plug-Flow detention time= 28.4 min calculated for 1.920 af (100% of inflow)
Center-of-Mass det. time= 28.4 min (756.4 - 728.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,944.00'	0.118 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,944.00	0.000
1,945.00	0.028
1,946.00	0.067
1,947.00	0.118

Device	Routing	Invert	Outlet Devices
#1	Primary	1,943.75'	**6.0" Round Culvert** L= 28.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,943.75' / 1,940.60' S= 0.1125 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,945.20'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,944.00'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600
#4	Secondary	1,945.50'	**15.0" Round Culvert** L= 25.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,945.50' / 1,940.60' S= 0.1960 '/' Cc= 0.900 n= 0.010, Flow Area= 1.23 sf
#5	Device 4	1,946.80'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,945.50'	**2.0" W x 12.0" H Vert. Orifice/Grate X 5.00** C= 0.600

Primary OutFlow Max=1.28 cfs @ 8.07 hrs HW=1,946.96' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.28 cfs @ 6.54 fps)
  ├─**2=Orifice/Grate** (Passes < 11.29 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 6.28 cfs potential flow)

Secondary OutFlow Max=4.26 cfs @ 8.07 hrs HW=1,946.96' (Free Discharge)
└─**4=Culvert** (Inlet Controls 4.26 cfs @ 3.48 fps)
  ├─**5=Orifice/Grate** (Passes < 1.99 cfs potential flow)
  └─**6=Orifice/Grate** (Passes < 3.89 cfs potential flow)

Summary for Pond DB#3: Det Basin #3

Inflow Area = 4.843 ac, 0.00% Impervious, Inflow Depth = 6.58" for 100 Year event
Inflow = 8.22 cfs @ 7.98 hrs, Volume= 2.658 af
Outflow = 7.20 cfs @ 8.11 hrs, Volume= 2.653 af, Atten= 12%, Lag= 8.0 min
Primary = 1.78 cfs @ 8.11 hrs, Volume= 2.050 af
Secondary = 2.13 cfs @ 8.11 hrs, Volume= 0.424 af
Tertiary = 3.29 cfs @ 8.11 hrs, Volume= 0.179 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,988.91' @ 8.11 hrs Surf.Area= 0.000 ac Storage= 0.173 af

Plug-Flow detention time= 25.2 min calculated for 2.652 af (100% of inflow)
Center-of-Mass det. time= 23.8 min (765.4 - 741.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,984.00'	0.177 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,984.00	0.000
1,985.00	0.021
1,986.00	0.048
1,987.00	0.083
1,988.00	0.125
1,989.00	0.177

Device	Routing	Invert	Outlet Devices
#1	Primary	1,983.00'	**6.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,983.00' / 1,982.60' S= 0.0200 '/' Cc= 0.900 n= 0.010, Flow Area= 0.20 sf
#2	Device 1	1,984.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#3	Device 1	1,985.50'	**15.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,986.00'	**8.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,986.00' / 1,982.60' S= 0.1700 '/' Cc= 0.900 n= 0.010, Flow Area= 0.35 sf
#5	Device 4	1,986.50'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Tertiary	1,987.20'	**12.0" Round Culvert** L= 20.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,987.20' / 1,982.60' S= 0.2300 '/' Cc= 0.900 n= 0.010, Flow Area= 0.79 sf
#7	Device 6	1,988.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#8	Device 6	1,987.20'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=1.78 cfs @ 8.11 hrs HW=1,988.91' (Free Discharge)
└─**1=Culvert** (Inlet Controls 1.78 cfs @ 9.05 fps)
  ├─**2=Orifice/Grate** (Passes < 3.37 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 10.92 cfs potential flow)

Secondary OutFlow Max=2.13 cfs @ 8.11 hrs HW=1,988.91' (Free Discharge)
└─**4=Culvert** (Inlet Controls 2.13 cfs @ 6.11 fps)
  └─**5=Orifice/Grate** (Passes 2.13 cfs of 13.22 cfs potential flow)

Tertiary OutFlow Max=3.29 cfs @ 8.11 hrs HW=1,988.91' (Free Discharge)
└─**6=Culvert** (Inlet Controls 3.29 cfs @ 4.19 fps)
  ├─**7=Orifice/Grate** (Passes < 5.46 cfs potential flow)
  └─**8=Orifice/Grate** (Passes < 1.94 cfs potential flow)

Summary for Pond DB#4: Det Basin #4

Inflow Area = 3.417 ac, 0.00% Impervious, Inflow Depth = 6.96" for 100 Year event
Inflow = 6.15 cfs @ 7.98 hrs, Volume= 1.981 af
Outflow = 4.94 cfs @ 8.15 hrs, Volume= 1.977 af, Atten= 20%, Lag= 10.3 min
Primary = 0.71 cfs @ 8.15 hrs, Volume= 0.952 af
Secondary = 1.90 cfs @ 8.15 hrs, Volume= 0.825 af
Tertiary = 2.33 cfs @ 8.15 hrs, Volume= 0.201 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs
Peak Elev= 1,955.98' @ 8.15 hrs Surf.Area= 0.000 ac Storage= 0.166 af

Plug-Flow detention time= 45.8 min calculated for 1.977 af (100% of inflow)
Center-of-Mass det. time= 44.4 min (774.4 - 730.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,951.00'	0.167 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,951.00	0.000
1,952.00	0.013
1,953.00	0.036
1,954.00	0.068
1,955.00	0.111
1,956.00	0.167

Device	Routing	Invert	Outlet Devices
#1	Primary	1,951.30'	**4.0" Round Culvert** L= 34.8' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,951.30' / 1,950.80' S= 0.0144 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.09 sf
#2	Device 1	1,952.50'	**12.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,951.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#4	Secondary	1,953.60'	**8.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,953.60' / 1,950.80' S= 0.0966 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.35 sf
#5	Device 4	1,955.00'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#6	Device 4	1,953.60'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600
#7	Tertiary	1,954.30'	**10.0" Round Culvert** L= 29.0' CMP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,954.30' / 1,950.80' S= 0.1207 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 0.55 sf
#8	Device 7	1,955.50'	**24.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#9	Device 7	1,954.30'	**2.0" W x 6.0" H Vert. Orifice/Grate X 4.00** C= 0.600

Primary OutFlow Max=0.71 cfs @ 8.15 hrs HW=1,955.98' (Free Discharge)
└**1=Culvert** (Inlet Controls 0.71 cfs @ 8.08 fps)
  ├**2=Orifice/Grate** (Passes < 7.06 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 3.46 cfs potential flow)

Secondary OutFlow Max=1.90 cfs @ 8.15 hrs HW=1,955.98' (Free Discharge)
└**4=Culvert** (Inlet Controls 1.90 cfs @ 5.44 fps)
  ├**5=Orifice/Grate** (Passes < 8.44 cfs potential flow)
  └**6=Orifice/Grate** (Passes < 2.34 cfs potential flow)

Tertiary OutFlow Max=2.33 cfs @ 8.15 hrs HW=1,955.98' (Free Discharge)
└**7=Culvert** (Inlet Controls 2.33 cfs @ 4.28 fps)
  ├**8=Orifice/Grate** (Passes < 6.92 cfs potential flow)
  └**9=Orifice/Grate** (Passes < 1.92 cfs potential flow)

Summary for Link WS1 OUT: WS1 Outlet

Inflow Area = 234.395 ac, 0.00% Impervious, Inflow Depth = 6.56" for 100 Year event
Inflow = 333.92 cfs @ 8.15 hrs, Volume= 128.065 af
Primary = 333.92 cfs @ 8.15 hrs, Volume= 128.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1A OUT: WS1A Outlet

Inflow Area = 45.616 ac, 0.00% Impervious, Inflow Depth = 6.29" for 100 Year event
Inflow = 66.00 cfs @ 8.06 hrs, Volume= 23.923 af
Primary = 66.00 cfs @ 8.06 hrs, Volume= 23.923 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1B OUT: WS1B Outlet

Inflow Area = 44.418 ac, 0.00% Impervious, Inflow Depth = 6.51" for 100 Year event
Inflow = 65.75 cfs @ 8.18 hrs, Volume= 24.095 af
Primary = 65.75 cfs @ 8.18 hrs, Volume= 24.095 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs

Summary for Link WS1D OUT: WS1D Outlet

Inflow Area = 41.892 ac, 0.00% Impervious, Inflow Depth = 6.71" for 100 Year event
Inflow = 65.42 cfs @ 8.15 hrs, Volume= 23.423 af
Primary = 65.42 cfs @ 8.15 hrs, Volume= 23.423 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-30.00 hrs, dt= 0.01 hrs



Subcat WS2

Subcat Reach Pond Link

Routing Diagram for HydroCAD Pre-Project Watershed 2
Prepared by PPI Engineering., Printed 12/18/2018
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Summary for Subcatchment WS2: Subcat WS2

Runoff = 15.69 cfs @ 8.08 hrs, Volume= 6.003 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.201	70	Brush, Fair, HSG C
	14.845	77	Brush, Fair, HSG D
	0.451	65	Brush, Good, HSG C
	17.983	73	Brush, Good, HSG D
	0.077	87	Dirt roads, HSG C
	0.584	89	Dirt roads, HSG D
	0.080	89	Gravel roads, HSG C
	0.209	91	Gravel roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.057	70	Woods, Good, HSG C
	37.131	76	Weighted Average
	37.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.9	1,687	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
2.8	1,131	0.0900	6.65	53.22	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
15.3	3,010	Total			

Summary for Subcatchment WS2: Subcat WS2

Runoff = 32.30 cfs @ 8.07 hrs, Volume= 11.264 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.201	70	Brush, Fair, HSG C
	14.845	77	Brush, Fair, HSG D
	0.451	65	Brush, Good, HSG C
	17.983	73	Brush, Good, HSG D
	0.077	87	Dirt roads, HSG C
	0.584	89	Dirt roads, HSG D
	0.080	89	Gravel roads, HSG C
	0.209	91	Gravel roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.057	70	Woods, Good, HSG C
	37.131	76	Weighted Average
	37.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.9	1,687	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
2.8	1,131	0.0900	6.65	53.22	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
15.3	3,010	Total			

Summary for Subcatchment WS2: Subcat WS2

Runoff = 50.70 cfs @ 8.05 hrs, Volume= 17.062 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.201	70	Brush, Fair, HSG C
	14.845	77	Brush, Fair, HSG D
	0.451	65	Brush, Good, HSG C
	17.983	73	Brush, Good, HSG D
	0.077	87	Dirt roads, HSG C
	0.584	89	Dirt roads, HSG D
	0.080	89	Gravel roads, HSG C
	0.209	91	Gravel roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.057	70	Woods, Good, HSG C
	37.131	76	Weighted Average
	37.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.9	1,687	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
2.8	1,131	0.0900	6.65	53.22	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
15.3	3,010	Total			

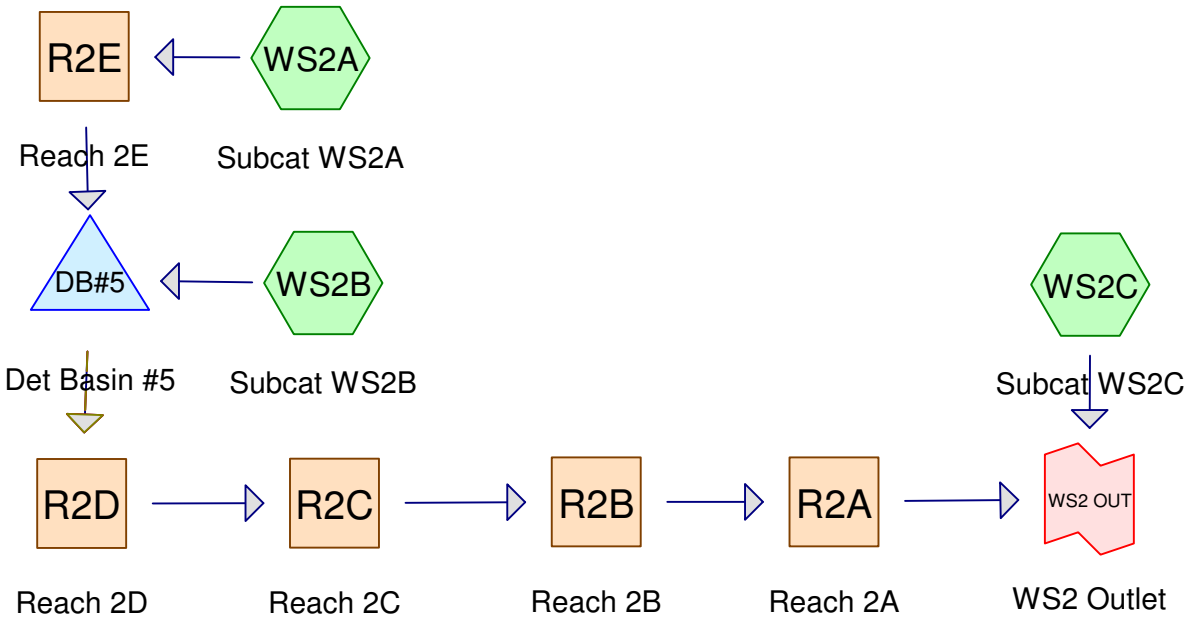
Summary for Subcatchment WS2: Subcat WS2

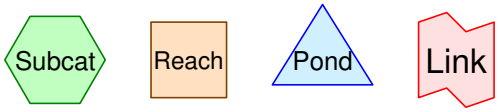
Runoff = 58.76 cfs @ 8.04 hrs, Volume= 19.603 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.201	70	Brush, Fair, HSG C
	14.845	77	Brush, Fair, HSG D
	0.451	65	Brush, Good, HSG C
	17.983	73	Brush, Good, HSG D
	0.077	87	Dirt roads, HSG C
	0.584	89	Dirt roads, HSG D
	0.080	89	Gravel roads, HSG C
	0.209	91	Gravel roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.057	70	Woods, Good, HSG C
	37.131	76	Weighted Average
	37.131		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.9	1,687	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
2.8	1,131	0.0900	6.65	53.22	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
15.3	3,010	Total			





Routing Diagram for HydroCAD Post-Project Watershed 2
Prepared by PPI Engineering., Printed 12/18/2018
HydroCAD® 10.00-17 s/n 09429 © 2016 HydroCAD Software Solutions LLC

Summary for Subcatchment WS2A: Subcat WS2A

Runoff = 1.39 cfs @ 8.03 hrs, Volume= 0.514 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.042	65	Brush, Good, HSG C
1.914	73	Brush, Good, HSG D
0.025	91	Gravel Roads, HSG D
1.197	81	Vineyard, Good, HSG D
3.178	76	Weighted Average
3.178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.4	1,005	0.1900	7.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.3	117	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
10.8	1,183	Total			

Summary for Subcatchment WS2B: Subcat WS2B

Runoff = 2.72 cfs @ 8.10 hrs, Volume= 1.022 af, Depth= 2.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

Area (ac)	CN	Description
0.561	77	Brush, Fair, HSG D
2.010	73	Brush, Good, HSG D
0.018	89	Dirt roads, HSG D
0.075	91	Gravel Roads, HSG D
3.184	81	Vineyard, Good, HSG D
5.849	78	Weighted Average
5.849		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
1.9	801	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
6.4	100	0.2900	0.26		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.6	286	0.2600	8.21		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
17.0	1,284	Total			

Summary for Subcatchment WS2C: Subcat WS2C

Runoff = 13.10 cfs @ 8.21 hrs, Volume= 5.289 af, Depth= 2.26"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Year Rainfall=4.26"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.196	70	Brush, Fair, HSG C
	2.651	77	Brush, Fair, HSG D
	0.059	65	Brush, Good, HSG C
	4.619	73	Brush, Good, HSG D
	0.119	89	Dirt roads, HSG D
	0.156	89	Gravel Roads, HSG C
	0.473	91	Gravel Roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.354	75	Vineyard, Good, HSG C
	16.775	81	Vineyard, Good, HSG D
	0.057	70	Woods, Good, HSG C
	28.104	80	Weighted Average
	28.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,270	0.1700	6.64		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.9	100	0.3500	0.28		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	204	0.3900	10.05		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.2	75	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.9	552	0.1200	10.05	5.48	**Pipe Channel, 10" SW** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
8.1	83	0.1100	0.17		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	48	0.1500	6.24		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	395	0.0600	5.43	43.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
28.5	2,919	Total			

Summary for Reach R2A: Reach 2A

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth > 2.04" for 2 Year event
Inflow = 2.78 cfs @ 8.53 hrs, Volume= 1.536 af
Outflow = 2.78 cfs @ 8.56 hrs, Volume= 1.536 af, Atten= 0%, Lag= 1.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.05 fps, Min. Travel Time= 1.1 min
Avg. Velocity = 1.23 fps, Avg. Travel Time= 1.8 min

Peak Storage= 178 cf @ 8.54 hrs
Average Depth at Peak Storage= 0.28'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 35.37 cfs

3.50' x 1.00' deep channel, n= 0.045
Side Slope Z-value= 5.0 '/' Top Width= 13.50'
Length= 131.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -3.93'



‡

Summary for Reach R2B: Reach 2B

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 2.04" for 2 Year event
Inflow = 2.81 cfs @ 8.35 hrs, Volume= 1.536 af
Outflow = 2.78 cfs @ 8.53 hrs, Volume= 1.536 af, Atten= 1%, Lag= 10.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.94 fps, Min. Travel Time= 6.4 min
Avg. Velocity = 1.76 fps, Avg. Travel Time= 10.7 min

Peak Storage= 1,068 cf @ 8.42 hrs
Average Depth at Peak Storage= 0.23'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 53.22 cfs

3.00' x 1.00' deep channel, n= 0.048
Side Slope Z-value= 5.0 '/' Top Width= 13.00'
Length= 1,127.0' Slope= 0.0900 '/'
Inlet Invert= 0.00', Outlet Invert= -101.43'



‡

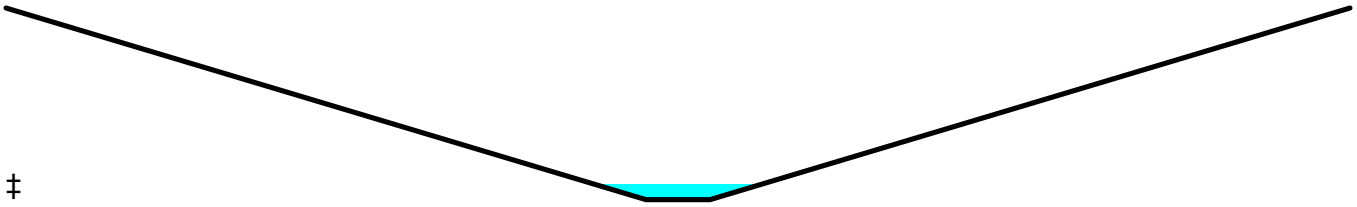
Summary for Reach R2C: Reach 2C

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 2.04" for 2 Year event
Inflow = 2.81 cfs @ 8.34 hrs, Volume= 1.536 af
Outflow = 2.81 cfs @ 8.35 hrs, Volume= 1.536 af, Atten= 0%, Lag= 0.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.89 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 1.28 fps, Avg. Travel Time= 0.4 min

Peak Storage= 49 cf @ 8.35 hrs
Average Depth at Peak Storage= 0.08'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 919.84 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 33.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.96'



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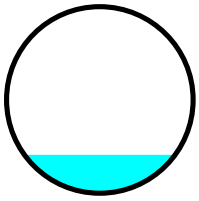
Summary for Reach R2D: Reach 2D

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 2.04" for 2 Year event
Inflow = 2.81 cfs @ 8.34 hrs, Volume= 1.536 af
Outflow = 2.81 cfs @ 8.34 hrs, Volume= 1.536 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.45 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 10.28 fps, Avg. Travel Time= 0.3 min

Peak Storage= 30 cf @ 8.34 hrs
Average Depth at Peak Storage= 0.26'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 30.28 cfs

15.0" Round Pipe
n= 0.010 PPI Dual Walled CPP
Length= 163.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -21.19'



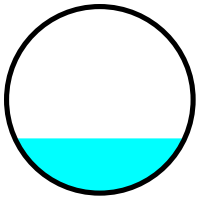
Summary for Reach R2E: Reach 2E

Inflow Area = 3.178 ac, 0.00% Impervious, Inflow Depth = 1.94" for 2 Year event
Inflow = 1.39 cfs @ 8.03 hrs, Volume= 0.514 af
Outflow = 1.38 cfs @ 8.06 hrs, Volume= 0.514 af, Atten= 0%, Lag= 1.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 10.42 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 6.42 fps, Avg. Travel Time= 1.3 min

Peak Storage= 66 cf @ 8.04 hrs
Average Depth at Peak Storage= 0.24'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 7.42 cfs

10.0" Round Pipe
n= 0.018
Length= 498.0' Slope= 0.2200 '/'
Inlet Invert= 0.00', Outlet Invert= -109.56'



Summary for Pond DB#5: Det Basin #5

Inflow Area =	9.027 ac,	0.00% Impervious,	Inflow Depth =	2.04"	for 2 Year event
Inflow =	4.10 cfs @	8.07 hrs,	Volume=	1.536 af	
Outflow =	2.81 cfs @	8.34 hrs,	Volume=	1.536 af,	Atten= 31%, Lag= 15.9 min
Primary =	2.73 cfs @	8.34 hrs,	Volume=	1.534 af	
Secondary =	0.09 cfs @	8.34 hrs,	Volume=	0.001 af	
Tertiary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af	

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 1,855.55' @ 8.34 hrs Surf.Area= 0.000 ac Storage= 0.062 af

Plug-Flow detention time= 5.8 min calculated for 1.536 af (100% of inflow)
Center-of-Mass det. time= 5.8 min (822.1 - 816.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,853.00'	0.173 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,853.00	0.000
1,854.00	0.017
1,855.00	0.043
1,856.00	0.077
1,857.00	0.120
1,858.00	0.173

Device	Routing	Invert	Outlet Devices
#1	Primary	1,851.00'	**8.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,851.00' / 1,844.75' S= 0.1420 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	1,853.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 10.00** C= 0.600
#3	Device 1	1,854.75'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,855.40'	**15.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,855.40' / 1,844.75' S= 0.2663 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

#5	Device 4	1,855.40'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#6	Device 4	1,856.85'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	1,856.60'	**15.0" Round Culvert** L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,856.60' / 1,844.75' S= 0.3292 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 1.23 sf
#8	Device 7	1,856.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#9	Device 7	1,857.90'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=2.73 cfs @ 8.34 hrs HW=1,855.55' (Free Discharge)
└─**1=Culvert** (Inlet Controls 2.73 cfs @ 7.81 fps)
  ├─**2=Orifice/Grate** (Passes < 6.08 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 7.62 cfs potential flow)

Secondary OutFlow Max=0.09 cfs @ 8.34 hrs HW=1,855.55' (Free Discharge)
└─**4=Culvert** (Inlet Controls 0.09 cfs @ 1.04 fps)
  ├─**5=Orifice/Grate** (Passes 0.09 cfs of 0.16 cfs potential flow)
  └─**6=Orifice/Grate** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,853.00' (Free Discharge)
└─**7=Culvert** (Controls 0.00 cfs)
  ├─**8=Orifice/Grate** (Controls 0.00 cfs)
  └─**9=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link WS2 OUT: WS2 Outlet

Inflow Area = 37.131 ac, 0.00% Impervious, Inflow Depth = 2.21" for 2 Year event
Inflow = 15.50 cfs @ 8.23 hrs, Volume= 6.825 af
Primary = 15.50 cfs @ 8.23 hrs, Volume= 6.825 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS2A: Subcat WS2A

Runoff = 2.83 cfs @ 8.02 hrs, Volume= 0.964 af, Depth= 3.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.042	65	Brush, Good, HSG C
1.914	73	Brush, Good, HSG D
0.025	91	Gravel Roads, HSG D
1.197	81	Vineyard, Good, HSG D
3.178	76	Weighted Average
3.178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.4	1,005	0.1900	7.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.3	117	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
10.8	1,183	Total			

Summary for Subcatchment WS2B: Subcat WS2B

Runoff = 5.40 cfs @ 8.07 hrs, Volume= 1.874 af, Depth= 3.85"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

Area (ac)	CN	Description
0.561	77	Brush, Fair, HSG D
2.010	73	Brush, Good, HSG D
0.018	89	Dirt roads, HSG D
0.075	91	Gravel Roads, HSG D
3.184	81	Vineyard, Good, HSG D
5.849	78	Weighted Average
5.849		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
1.9	801	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
6.4	100	0.2900	0.26		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.6	286	0.2600	8.21		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
17.0	1,284	Total			

Summary for Subcatchment WS2C: Subcat WS2C

Runoff = 25.17 cfs @ 8.20 hrs, Volume= 9.492 af, Depth= 4.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Year Rainfall=6.30"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.196	70	Brush, Fair, HSG C
	2.651	77	Brush, Fair, HSG D
	0.059	65	Brush, Good, HSG C
	4.619	73	Brush, Good, HSG D
	0.119	89	Dirt roads, HSG D
	0.156	89	Gravel Roads, HSG C
	0.473	91	Gravel Roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.354	75	Vineyard, Good, HSG C
	16.775	81	Vineyard, Good, HSG D
	0.057	70	Woods, Good, HSG C
	28.104	80	Weighted Average
	28.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,270	0.1700	6.64		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.9	100	0.3500	0.28		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	204	0.3900	10.05		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.2	75	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.9	552	0.1200	10.05	5.48	**Pipe Channel, 10" SW** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
8.1	83	0.1100	0.17		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	48	0.1500	6.24		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	395	0.0600	5.43	43.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
28.5	2,919	Total			

Summary for Reach R2A: Reach 2A

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10 Year event
Inflow = 7.35 cfs @ 8.30 hrs, Volume= 2.838 af
Outflow = 7.34 cfs @ 8.32 hrs, Volume= 2.838 af, Atten= 0%, Lag= 1.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.72 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 1.46 fps, Avg. Travel Time= 1.5 min

Peak Storage= 353 cf @ 8.31 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 35.37 cfs

3.50' x 1.00' deep channel, n= 0.045
Side Slope Z-value= 5.0 '/' Top Width= 13.50'
Length= 131.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -3.93'



‡

Summary for Reach R2B: Reach 2B

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10 Year event
Inflow = 7.62 cfs @ 8.16 hrs, Volume= 2.838 af
Outflow = 7.35 cfs @ 8.30 hrs, Volume= 2.838 af, Atten= 4%, Lag= 8.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.90 fps, Min. Travel Time= 4.8 min
Avg. Velocity = 2.09 fps, Avg. Travel Time= 9.0 min

Peak Storage= 2,121 cf @ 8.22 hrs
Average Depth at Peak Storage= 0.38'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 53.22 cfs

3.00' x 1.00' deep channel, n= 0.048
Side Slope Z-value= 5.0 '/' Top Width= 13.00'
Length= 1,127.0' Slope= 0.0900 '/'
Inlet Invert= 0.00', Outlet Invert= -101.43'



‡

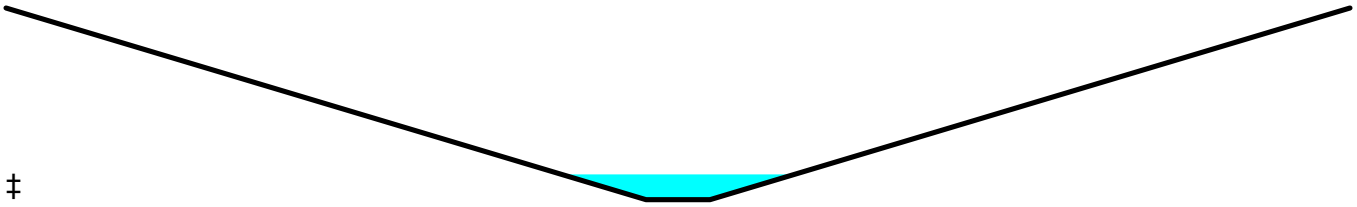
Summary for Reach R2C: Reach 2C

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10 Year event
Inflow = 7.62 cfs @ 8.16 hrs, Volume= 2.838 af
Outflow = 7.62 cfs @ 8.16 hrs, Volume= 2.838 af, Atten= 0%, Lag= 0.4 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.48 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.49 fps, Avg. Travel Time= 0.4 min

Peak Storage= 102 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.13'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 919.84 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 33.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.96'



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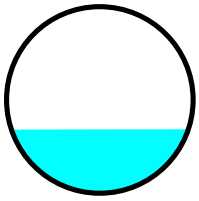
Summary for Reach R2D: Reach 2D

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10 Year event
Inflow = 7.63 cfs @ 8.15 hrs, Volume= 2.838 af
Outflow = 7.62 cfs @ 8.16 hrs, Volume= 2.838 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 20.55 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 12.02 fps, Avg. Travel Time= 0.2 min

Peak Storage= 60 cf @ 8.16 hrs
Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 30.28 cfs

15.0" Round Pipe
n= 0.010 PPI Dual Walled CPP
Length= 163.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -21.19'



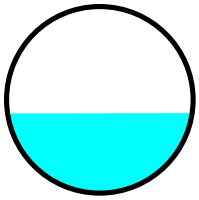
Summary for Reach R2E: Reach 2E

Inflow Area = 3.178 ac, 0.00% Impervious, Inflow Depth = 3.64" for 10 Year event
Inflow = 2.83 cfs @ 8.02 hrs, Volume= 0.964 af
Outflow = 2.83 cfs @ 8.04 hrs, Volume= 0.964 af, Atten= 0%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 12.69 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 7.52 fps, Avg. Travel Time= 1.1 min

Peak Storage= 111 cf @ 8.03 hrs
Average Depth at Peak Storage= 0.36'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 7.42 cfs

10.0" Round Pipe
n= 0.018
Length= 498.0' Slope= 0.2200 '/'
Inlet Invert= 0.00', Outlet Invert= -109.56'



Summary for Pond DB#5: Det Basin #5

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 3.77" for 10 Year event
Inflow = 8.22 cfs @ 8.06 hrs, Volume= 2.838 af
Outflow = 7.63 cfs @ 8.15 hrs, Volume= 2.838 af, Atten= 7%, Lag= 5.5 min
Primary = 3.13 cfs @ 8.15 hrs, Volume= 2.600 af
Secondary = 4.19 cfs @ 8.15 hrs, Volume= 0.234 af
Tertiary = 0.31 cfs @ 8.15 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 1,856.89' @ 8.15 hrs Surf.Area= 0.000 ac Storage= 0.115 af

Plug-Flow detention time= 7.0 min calculated for 2.837 af (100% of inflow)
Center-of-Mass det. time= 7.0 min (786.4 - 779.4)

Volume	Invert	Avail.Storage	Storage Description
#1	1,853.00'	0.173 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,853.00	0.000
1,854.00	0.017
1,855.00	0.043
1,856.00	0.077
1,857.00	0.120
1,858.00	0.173

Device	Routing	Invert	Outlet Devices
#1	Primary	1,851.00'	**8.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,851.00' / 1,844.75' S= 0.1420 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	1,853.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 10.00** C= 0.600
#3	Device 1	1,854.75'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,855.40'	**15.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,855.40' / 1,844.75' S= 0.2663 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

#5	Device 4	1,855.40'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#6	Device 4	1,856.85'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	1,856.60'	**15.0" Round Culvert** L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,856.60' / 1,844.75' S= 0.3292 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 1.23 sf
#8	Device 7	1,856.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#9	Device 7	1,857.90'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.13 cfs @ 8.15 hrs HW=1,856.89' (Free Discharge)
└─**1=Culvert** (Inlet Controls 3.13 cfs @ 8.96 fps)
  ├─**2=Orifice/Grate** (Passes < 7.65 cfs potential flow)
  └─**3=Orifice/Grate** (Passes < 12.44 cfs potential flow)

Secondary OutFlow Max=4.15 cfs @ 8.15 hrs HW=1,856.89' (Free Discharge)
└─**4=Culvert** (Passes 4.15 cfs of 4.33 cfs potential flow)
  ├─**5=Orifice/Grate** (Orifice Controls 3.94 cfs @ 4.73 fps)
  └─**6=Orifice/Grate** (Weir Controls 0.21 cfs @ 0.62 fps)

Tertiary OutFlow Max=0.31 cfs @ 8.15 hrs HW=1,856.89' (Free Discharge)
└─**7=Culvert** (Inlet Controls 0.31 cfs @ 1.44 fps)
  ├─**8=Orifice/Grate** (Passes 0.31 cfs of 1.16 cfs potential flow)
  └─**9=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link WS2 OUT: WS2 Outlet

Inflow Area = 37.131 ac, 0.00% Impervious, Inflow Depth = 3.98" for 10 Year event
Inflow = 31.85 cfs @ 8.26 hrs, Volume= 12.330 af
Primary = 31.85 cfs @ 8.26 hrs, Volume= 12.330 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS2A: Subcat WS2A

Runoff = 4.44 cfs @ 8.00 hrs, Volume= 1.461 af, Depth= 5.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.042	65	Brush, Good, HSG C
1.914	73	Brush, Good, HSG D
0.025	91	Gravel Roads, HSG D
1.197	81	Vineyard, Good, HSG D
3.178	76	Weighted Average
3.178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.4	1,005	0.1900	7.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.3	117	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
10.8	1,183	Total			

Summary for Subcatchment WS2B: Subcat WS2B

Runoff = 8.32 cfs @ 8.07 hrs, Volume= 2.804 af, Depth= 5.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

Area (ac)	CN	Description
0.561	77	Brush, Fair, HSG D
2.010	73	Brush, Good, HSG D
0.018	89	Dirt roads, HSG D
0.075	91	Gravel Roads, HSG D
3.184	81	Vineyard, Good, HSG D
5.849	78	Weighted Average
5.849		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
1.9	801	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
6.4	100	0.2900	0.26		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.6	286	0.2600	8.21		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
17.0	1,284	Total			

Summary for Subcatchment WS2C: Subcat WS2C

Runoff = 38.15 cfs @ 8.20 hrs, Volume= 14.032 af, Depth= 5.99"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 50 Year Rainfall=8.39"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.196	70	Brush, Fair, HSG C
	2.651	77	Brush, Fair, HSG D
	0.059	65	Brush, Good, HSG C
	4.619	73	Brush, Good, HSG D
	0.119	89	Dirt roads, HSG D
	0.156	89	Gravel Roads, HSG C
	0.473	91	Gravel Roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.354	75	Vineyard, Good, HSG C
	16.775	81	Vineyard, Good, HSG D
	0.057	70	Woods, Good, HSG C
	28.104	80	Weighted Average
	28.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,270	0.1700	6.64		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.9	100	0.3500	0.28		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	204	0.3900	10.05		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.2	75	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.9	552	0.1200	10.05	5.48	**Pipe Channel, 10" SW** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
8.1	83	0.1100	0.17		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	48	0.1500	6.24		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	395	0.0600	5.43	43.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
28.5	2,919	Total			

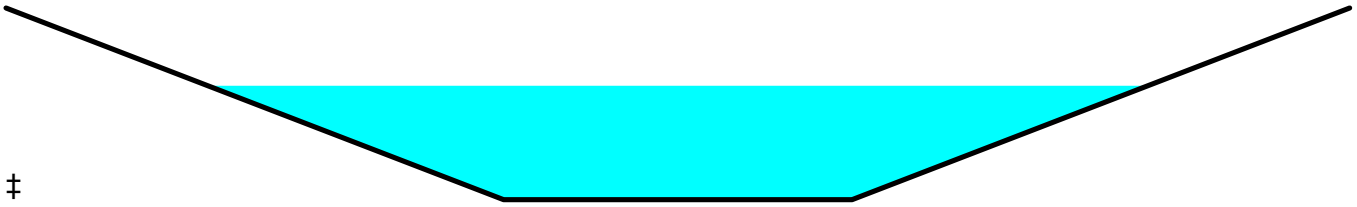
Summary for Reach R2A: Reach 2A

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 5.67" for 50 Year event
Inflow = 12.01 cfs @ 8.25 hrs, Volume= 4.264 af
Outflow = 12.01 cfs @ 8.27 hrs, Volume= 4.264 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.12 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 1.3 min

Peak Storage= 504 cf @ 8.26 hrs
Average Depth at Peak Storage= 0.59'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 35.37 cfs

3.50' x 1.00' deep channel, n= 0.045
Side Slope Z-value= 5.0 '/' Top Width= 13.50'
Length= 131.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -3.93'



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Summary for Reach R2B: Reach 2B

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 5.67" for 50 Year event
Inflow = 12.18 cfs @ 8.14 hrs, Volume= 4.264 af
Outflow = 12.01 cfs @ 8.25 hrs, Volume= 4.264 af, Atten= 1%, Lag= 7.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.48 fps, Min. Travel Time= 4.2 min
Avg. Velocity = 2.34 fps, Avg. Travel Time= 8.0 min

Peak Storage= 3,023 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.49'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 53.22 cfs

3.00' x 1.00' deep channel, n= 0.048
Side Slope Z-value= 5.0 '/' Top Width= 13.00'
Length= 1,127.0' Slope= 0.0900 '/'
Inlet Invert= 0.00', Outlet Invert= -101.43'



‡

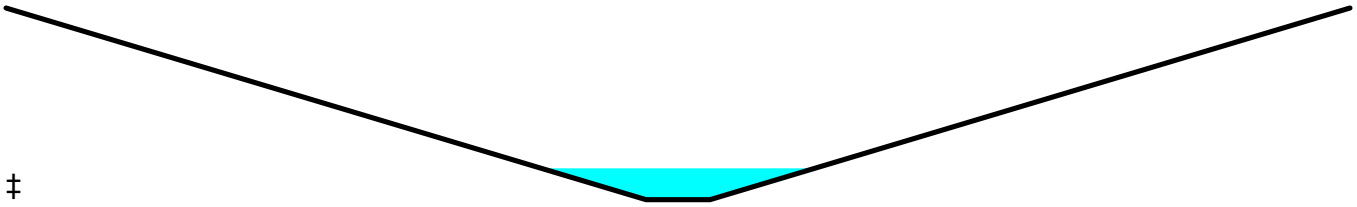
Summary for Reach R2C: Reach 2C

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 5.67" for 50 Year event
Inflow = 12.18 cfs @ 8.13 hrs, Volume= 4.264 af
Outflow = 12.18 cfs @ 8.14 hrs, Volume= 4.264 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.80 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.64 fps, Avg. Travel Time= 0.3 min

Peak Storage= 144 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.16'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 919.84 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 33.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.96'



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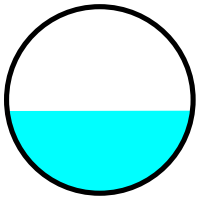
Summary for Reach R2D: Reach 2D

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 5.67" for 50 Year event
Inflow = 12.18 cfs @ 8.13 hrs, Volume= 4.264 af
Outflow = 12.18 cfs @ 8.13 hrs, Volume= 4.264 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 23.33 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 13.36 fps, Avg. Travel Time= 0.2 min

Peak Storage= 85 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.55'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 30.28 cfs

15.0" Round Pipe
n= 0.010 PPI Dual Walled CPP
Length= 163.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -21.19'



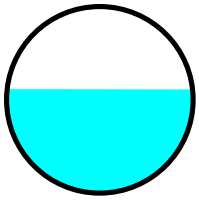
Summary for Reach R2E: Reach 2E

Inflow Area = 3.178 ac, 0.00% Impervious, Inflow Depth = 5.51" for 50 Year event
Inflow = 4.44 cfs @ 8.00 hrs, Volume= 1.461 af
Outflow = 4.44 cfs @ 8.02 hrs, Volume= 1.461 af, Atten= 0%, Lag= 1.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.21 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 8.36 fps, Avg. Travel Time= 1.0 min

Peak Storage= 156 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.46'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 7.42 cfs

10.0" Round Pipe
n= 0.018
Length= 498.0' Slope= 0.2200 '/'
Inlet Invert= 0.00', Outlet Invert= -109.56'



Summary for Pond DB#5: Det Basin #5

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 5.67" for 50 Year event
Inflow = 12.72 cfs @ 8.06 hrs, Volume= 4.264 af
Outflow = 12.18 cfs @ 8.13 hrs, Volume= 4.264 af, Atten= 4%, Lag= 4.2 min
Primary = 3.33 cfs @ 8.13 hrs, Volume= 3.557 af
Secondary = 5.91 cfs @ 8.13 hrs, Volume= 0.606 af
Tertiary = 2.94 cfs @ 8.13 hrs, Volume= 0.101 af

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 1,857.63' @ 8.13 hrs Surf.Area= 0.000 ac Storage= 0.153 af

Plug-Flow detention time= 9.1 min calculated for 4.264 af (100% of inflow)
Center-of-Mass det. time= 9.1 min (765.7 - 756.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,853.00'	0.173 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,853.00	0.000
1,854.00	0.017
1,855.00	0.043
1,856.00	0.077
1,857.00	0.120
1,858.00	0.173

Device	Routing	Invert	Outlet Devices
#1	Primary	1,851.00'	**8.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,851.00' / 1,844.75' S= 0.1420 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	1,853.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 10.00** C= 0.600
#3	Device 1	1,854.75'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,855.40'	**15.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,855.40' / 1,844.75' S= 0.2663 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

#5	Device 4	1,855.40'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#6	Device 4	1,856.85'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	1,856.60'	**15.0" Round Culvert** L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,856.60' / 1,844.75' S= 0.3292 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 1.23 sf
#8	Device 7	1,856.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#9	Device 7	1,857.90'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.33 cfs @ 8.13 hrs HW=1,857.63' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.33 cfs @ 9.54 fps)
  ├**2=Orifice/Grate** (Passes < 8.39 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 14.44 cfs potential flow)

Secondary OutFlow Max=5.91 cfs @ 8.13 hrs HW=1,857.63' (Free Discharge)
└**4=Culvert** (Inlet Controls 5.91 cfs @ 4.81 fps)
  ├**5=Orifice/Grate** (Passes < 5.26 cfs potential flow)
  └**6=Orifice/Grate** (Passes < 21.15 cfs potential flow)

Tertiary OutFlow Max=2.94 cfs @ 8.13 hrs HW=1,857.63' (Free Discharge)
└**7=Culvert** (Inlet Controls 2.94 cfs @ 2.73 fps)
  ├**8=Orifice/Grate** (Passes 2.94 cfs of 3.59 cfs potential flow)
  └**9=Orifice/Grate** (Controls 0.00 cfs)

Summary for Link WS2 OUT: WS2 Outlet

Inflow Area = 37.131 ac, 0.00% Impervious, Inflow Depth = 5.91" for 50 Year event
Inflow = 49.84 cfs @ 8.21 hrs, Volume= 18.296 af
Primary = 49.84 cfs @ 8.21 hrs, Volume= 18.296 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

Summary for Subcatchment WS2A: Subcat WS2A

Runoff = 5.14 cfs @ 8.00 hrs, Volume= 1.678 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
* 0.000	0	, HSG D
0.042	65	Brush, Good, HSG C
1.914	73	Brush, Good, HSG D
0.025	91	Gravel Roads, HSG D
1.197	81	Vineyard, Good, HSG D
3.178	76	Weighted Average
3.178		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet** Woods: Light underbrush n= 0.400 P2= 4.26"
2.4	1,005	0.1900	7.02		**Shallow Concentrated Flow, Shallow** Unpaved Kv= 16.1 fps
0.3	117	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
10.8	1,183	Total			

Summary for Subcatchment WS2B: Subcat WS2B

Runoff = 9.58 cfs @ 8.07 hrs, Volume= 3.210 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

Area (ac)	CN	Description
0.561	77	Brush, Fair, HSG D
2.010	73	Brush, Good, HSG D
0.018	89	Dirt roads, HSG D
0.075	91	Gravel Roads, HSG D
3.184	81	Vineyard, Good, HSG D
5.849	78	Weighted Average
5.849		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	97	0.1500	0.20		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
1.9	801	0.2000	7.20		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
6.4	100	0.2900	0.26		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.6	286	0.2600	8.21		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
17.0	1,284	Total			

Summary for Subcatchment WS2C: Subcat WS2C

Runoff = 43.74 cfs @ 8.20 hrs, Volume= 16.005 af, Depth= 6.83"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Year Rainfall=9.28"

	Area (ac)	CN	Description
*	0.000	0	, HSG D
	0.196	70	Brush, Fair, HSG C
	2.651	77	Brush, Fair, HSG D
	0.059	65	Brush, Good, HSG C
	4.619	73	Brush, Good, HSG D
	0.119	89	Dirt roads, HSG D
	0.156	89	Gravel Roads, HSG C
	0.473	91	Gravel Roads, HSG D
	0.059	79	Vineyard, Fair, HSG C
	2.585	84	Vineyard, Fair, HSG D
	0.354	75	Vineyard, Good, HSG C
	16.775	81	Vineyard, Good, HSG D
	0.057	70	Woods, Good, HSG C
	28.104	80	Weighted Average
	28.104		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
8.1	61	0.0600	0.13		**Sheet Flow, Sheet-1** Woods: Light underbrush n= 0.400 P2= 4.26"
3.2	1,270	0.1700	6.64		**Shallow Concentrated Flow, Shallow-1** Unpaved Kv= 16.1 fps
5.9	100	0.3500	0.28		**Sheet Flow, Sheet-2** Woods: Light underbrush n= 0.400 P2= 4.26"
0.3	204	0.3900	10.05		**Shallow Concentrated Flow, Shallow-2** Unpaved Kv= 16.1 fps
0.2	75	0.0300	5.64	25.36	**Trap/Vee/Rect Channel Flow, Ditch** Bot.W=0.00' D=1.50' Z= 2.0 '/' Top.W=6.00' n= 0.035
0.9	552	0.1200	10.05	5.48	**Pipe Channel, 10" SW** 10.0" Round Area= 0.5 sf Perim= 2.6' r= 0.21' n= 0.018
8.1	83	0.1100	0.17		**Sheet Flow, Sheet-3** Woods: Light underbrush n= 0.400 P2= 4.26"
0.1	48	0.1500	6.24		**Shallow Concentrated Flow, Shallow-3** Unpaved Kv= 16.1 fps
1.2	395	0.0600	5.43	43.45	**Trap/Vee/Rect Channel Flow, Channel X-Sect 4** Bot.W=3.00' D=1.00' Z= 5.0 '/' Top.W=13.00' n= 0.048
0.5	131	0.0300	4.16	35.37	**Trap/Vee/Rect Channel Flow, Channel X-Sect 3** Bot.W=3.50' D=1.00' Z= 5.0 '/' Top.W=13.50' n= 0.045
28.5	2,919	Total			

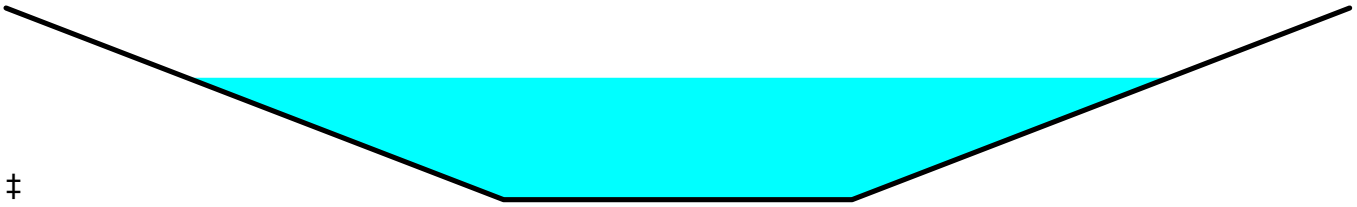
Summary for Reach R2A: Reach 2A

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 6.50" for 100 Year event
Inflow = 13.78 cfs @ 8.25 hrs, Volume= 4.887 af
Outflow = 13.77 cfs @ 8.27 hrs, Volume= 4.887 af, Atten= 0%, Lag= 1.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 3.24 fps, Min. Travel Time= 0.7 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 1.3 min

Peak Storage= 557 cf @ 8.26 hrs
Average Depth at Peak Storage= 0.64'
Bank-Full Depth= 1.00' Flow Area= 8.5 sf, Capacity= 35.37 cfs

3.50' x 1.00' deep channel, n= 0.045
Side Slope Z-value= 5.0 '/' Top Width= 13.50'
Length= 131.0' Slope= 0.0300 '/'
Inlet Invert= 0.00', Outlet Invert= -3.93'



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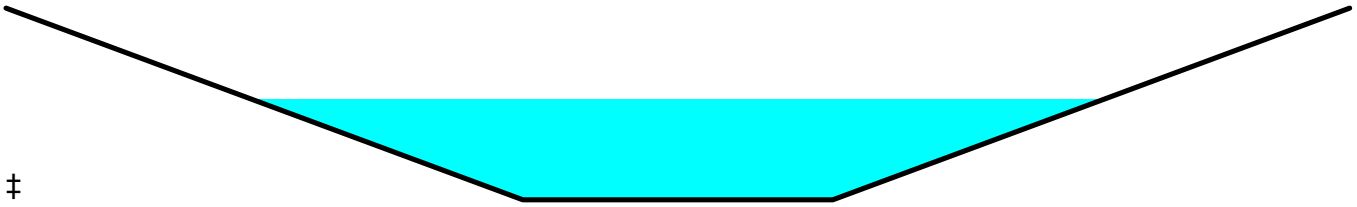
Summary for Reach R2B: Reach 2B

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 6.50" for 100 Year event
Inflow = 13.92 cfs @ 8.14 hrs, Volume= 4.888 af
Outflow = 13.78 cfs @ 8.25 hrs, Volume= 4.887 af, Atten= 1%, Lag= 6.7 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 4.65 fps, Min. Travel Time= 4.0 min
Avg. Velocity = 2.43 fps, Avg. Travel Time= 7.7 min

Peak Storage= 3,340 cf @ 8.18 hrs
Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00' Flow Area= 8.0 sf, Capacity= 53.22 cfs

3.00' x 1.00' deep channel, n= 0.048
Side Slope Z-value= 5.0 '/' Top Width= 13.00'
Length= 1,127.0' Slope= 0.0900 '/'
Inlet Invert= 0.00', Outlet Invert= -101.43'



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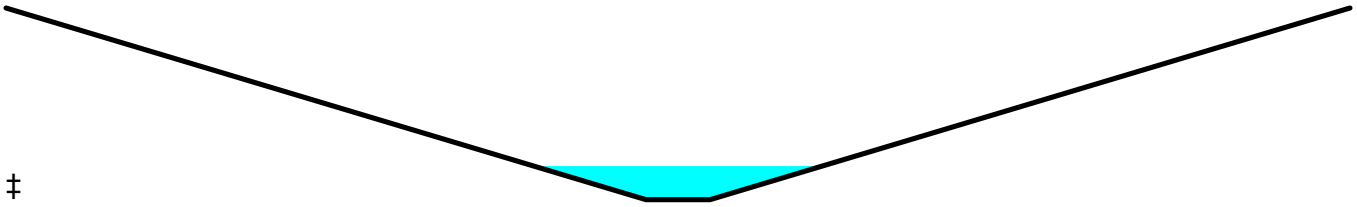
Summary for Reach R2C: Reach 2C

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 6.50" for 100 Year event
Inflow = 13.92 cfs @ 8.13 hrs, Volume= 4.888 af
Outflow = 13.92 cfs @ 8.14 hrs, Volume= 4.888 af, Atten= 0%, Lag= 0.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 2.90 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 0.3 min

Peak Storage= 158 cf @ 8.14 hrs
Average Depth at Peak Storage= 0.17'
Bank-Full Depth= 1.00' Flow Area= 110.0 sf, Capacity= 919.84 cfs

10.00' x 1.00' deep channel, n= 0.040
Side Slope Z-value= 100.0 '/' Top Width= 210.00'
Length= 33.0' Slope= 0.1200 '/'
Inlet Invert= 0.00', Outlet Invert= -3.96'



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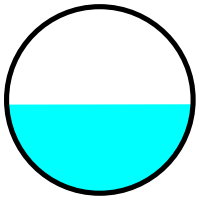
Summary for Reach R2D: Reach 2D

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 6.50" for 100 Year event
Inflow = 13.92 cfs @ 8.13 hrs, Volume= 4.888 af
Outflow = 13.92 cfs @ 8.13 hrs, Volume= 4.888 af, Atten= 0%, Lag= 0.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 24.16 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 13.86 fps, Avg. Travel Time= 0.2 min

Peak Storage= 94 cf @ 8.13 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 30.28 cfs

15.0" Round Pipe
n= 0.010 PPI Dual Walled CPP
Length= 163.0' Slope= 0.1300 '/'
Inlet Invert= 0.00', Outlet Invert= -21.19'



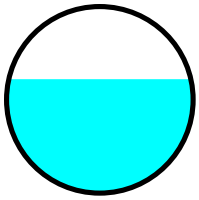
Summary for Reach R2E: Reach 2E

Inflow Area = 3.178 ac, 0.00% Impervious, Inflow Depth = 6.34" for 100 Year event
Inflow = 5.14 cfs @ 8.00 hrs, Volume= 1.678 af
Outflow = 5.14 cfs @ 8.02 hrs, Volume= 1.678 af, Atten= 0%, Lag= 1.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.69 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 8.67 fps, Avg. Travel Time= 1.0 min

Peak Storage= 174 cf @ 8.01 hrs
Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 7.42 cfs

10.0" Round Pipe
n= 0.018
Length= 498.0' Slope= 0.2200 '/'
Inlet Invert= 0.00', Outlet Invert= -109.56'



Summary for Pond DB#5: Det Basin #5

Inflow Area = 9.027 ac, 0.00% Impervious, Inflow Depth = 6.50" for 100 Year event
Inflow = 14.68 cfs @ 8.05 hrs, Volume= 4.888 af
Outflow = 13.92 cfs @ 8.13 hrs, Volume= 4.888 af, Atten= 5%, Lag= 4.8 min
Primary = 3.42 cfs @ 8.13 hrs, Volume= 3.905 af
Secondary = 6.50 cfs @ 8.13 hrs, Volume= 0.816 af
Tertiary = 4.01 cfs @ 8.13 hrs, Volume= 0.166 af

Routing by Stor-Ind method, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs
Peak Elev= 1,857.96' @ 8.13 hrs Surf.Area= 0.000 ac Storage= 0.171 af

Plug-Flow detention time= 10.4 min calculated for 4.888 af (100% of inflow)
Center-of-Mass det. time= 10.3 min (759.6 - 749.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,853.00'	0.173 af	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (acre-feet)
1,853.00	0.000
1,854.00	0.017
1,855.00	0.043
1,856.00	0.077
1,857.00	0.120
1,858.00	0.173

Device	Routing	Invert	Outlet Devices
#1	Primary	1,851.00'	**8.0" Round Culvert** L= 44.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,851.00' / 1,844.75' S= 0.1420 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#2	Device 1	1,853.00'	**2.0" W x 6.0" H Vert. Orifice/Grate X 10.00** C= 0.600
#3	Device 1	1,854.75'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#4	Secondary	1,855.40'	**15.0" Round Culvert** L= 40.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,855.40' / 1,844.75' S= 0.2663 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 1.23 sf

#5	Device 4	1,855.40'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#6	Device 4	1,856.85'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	1,856.60'	**15.0" Round Culvert** L= 36.0' CPP, projecting, no headwall, Ke= 0.900 Inlet / Outlet Invert= 1,856.60' / 1,844.75' S= 0.3292 '/' Cc= 0.900 n= 0.010 PPI Dual Walled CPP, Flow Area= 1.23 sf
#8	Device 7	1,856.25'	**2.0" W x 6.0" H Vert. Orifice/Grate X 5.00 columns** X 2 rows with 6.0" cc spacing C= 0.600
#9	Device 7	1,857.90'	**36.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=3.42 cfs @ 8.13 hrs HW=1,857.96' (Free Discharge)
└**1=Culvert** (Inlet Controls 3.42 cfs @ 9.79 fps)
  ├**2=Orifice/Grate** (Passes < 8.71 cfs potential flow)
  └**3=Orifice/Grate** (Passes < 15.26 cfs potential flow)

Secondary OutFlow Max=6.50 cfs @ 8.13 hrs HW=1,857.96' (Free Discharge)
└**4=Culvert** (Inlet Controls 6.50 cfs @ 5.29 fps)
  ├**5=Orifice/Grate** (Passes < 5.75 cfs potential flow)
  └**6=Orifice/Grate** (Passes < 35.93 cfs potential flow)

Tertiary OutFlow Max=4.01 cfs @ 8.13 hrs HW=1,857.96' (Free Discharge)
└**7=Culvert** (Inlet Controls 4.01 cfs @ 3.27 fps)
  ├**8=Orifice/Grate** (Passes < 4.29 cfs potential flow)
  └**9=Orifice/Grate** (Passes < 0.50 cfs potential flow)

Summary for Link WS2 OUT: WS2 Outlet

Inflow Area = 37.131 ac, 0.00% Impervious, Inflow Depth = 6.75" for 100 Year event
Inflow = 57.22 cfs @ 8.20 hrs, Volume= 20.893 af
Primary = 57.22 cfs @ 8.20 hrs, Volume= 20.893 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-28.00 hrs, dt= 0.01 hrs

SECTION 1

DITCH HYDRAULICS

Hydraulic Analysis Report

Project Data

Project Title: Stagecoach North Track I ECP

Designer: J. Bushey

Project Date: Monday, October 29, 2018

Project Units: U.S. Customary Units

Notes: Flow rates were calculated from unit flows (cfs/AC) determined via hydrologic analysis and corresponding hydraulic watershed areas (AC) for the respective drainage elements.

Channel Analysis: Block V2 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0700 ft/ft

Manning's n: 0.0350

Flow: 3.7000 cfs

Result Parameters

Depth: 0.6218 ft

Area of Flow: 0.7732 ft^2

Wetted Perimeter: 2.7806 ft

Hydraulic Radius: 0.2781 ft

Average Velocity: 4.7855 ft/s

Top Width: 2.4870 ft

Froude Number: 1.5125

Critical Depth: 0.7337 ft

Critical Velocity: 3.4369 ft/s

Critical Slope: 0.0290 ft/ft

Critical Top Width: 2.93 ft

Calculated Max Shear Stress: 2.7159 lb/ft^2

Calculated Avg Shear Stress: 1.2146 lb/ft^2

Channel Analysis: Block V3 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0200 ft/ft

Manning's n: 0.0350

Flow: 3.3000 cfs

Result Parameters

Depth: 0.7534 ft

Area of Flow: 1.1351 ft^2

Wetted Perimeter: 3.3691 ft

Hydraulic Radius: 0.3369 ft

Average Velocity: 2.9072 ft/s

Top Width: 3.0134 ft

Froude Number: 0.8348

Critical Depth: 0.7009 ft

Critical Velocity: 3.3591 ft/s

Critical Slope: 0.0294 ft/ft

Critical Top Width: 2.80 ft

Calculated Max Shear Stress: 0.9402 lb/ft^2

Calculated Avg Shear Stress: 0.4205 lb/ft^2

Channel Analysis: Block V4 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1000 ft/ft

Manning's n: 0.0350

Flow: 3.9500 cfs

Result Parameters

Depth: 0.5960 ft

Area of Flow: 0.7104 ft^2

Wetted Perimeter: 2.6653 ft

Hydraulic Radius: 0.2665 ft

Average Velocity: 5.5605 ft/s

Top Width: 2.3839 ft

Froude Number: 1.7951

Critical Depth: 0.7531 ft

Critical Velocity: 3.4821 ft/s

Critical Slope: 0.0287 ft/ft

Critical Top Width: 3.01 ft

Calculated Max Shear Stress: 3.7189 lb/ft^2

Calculated Avg Shear Stress: 1.6631 lb/ft^2

Channel Analysis: Block V6 West Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0500 ft/ft

Manning's n: 0.0350

Flow: 1.0200 cfs

Result Parameters

Depth: 0.4085 ft

Area of Flow: 0.3337 ft^2

Wetted Perimeter: 1.8268 ft

Hydraulic Radius: 0.1827 ft

Average Velocity: 3.0565 ft/s

Top Width: 1.6339 ft

Froude Number: 1.1919

Critical Depth: 0.4382 ft

Critical Velocity: 2.6561 ft/s

Critical Slope: 0.0344 ft/ft

Critical Top Width: 1.75 ft

Calculated Max Shear Stress: 1.2745 lb/ft^2

Calculated Avg Shear Stress: 0.5700 lb/ft^2

Channel Analysis: Block V6 Middle Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 1.6800 cfs

Result Parameters

Depth: 0.5136 ft

Area of Flow: 0.5275 ft^2

Wetted Perimeter: 2.2968 ft

Hydraulic Radius: 0.2297 ft

Average Velocity: 3.1847 ft/s

Top Width: 2.0543 ft

Froude Number: 1.1075

Critical Depth: 0.5350 ft

Critical Velocity: 2.9349 ft/s

Critical Slope: 0.0322 ft/ft

Critical Top Width: 2.14 ft

Calculated Max Shear Stress: 1.2819 lb/ft^2

Calculated Avg Shear Stress: 0.5733 lb/ft^2

Channel Analysis: Block V6 East Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 3.2200 cfs

Result Parameters

Depth: 0.6555 ft

Area of Flow: 0.8593 ft^2

Wetted Perimeter: 2.9314 ft

Hydraulic Radius: 0.2931 ft

Average Velocity: 3.7471 ft/s

Top Width: 2.6219 ft

Froude Number: 1.1535

Critical Depth: 0.6940 ft

Critical Velocity: 3.3427 ft/s

Critical Slope: 0.0295 ft/ft

Critical Top Width: 2.78 ft

Calculated Max Shear Stress: 1.6361 lb/ft^2

Calculated Avg Shear Stress: 0.7317 lb/ft^2

Channel Analysis: Block W8 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 3.7600 cfs

Result Parameters

Depth: 0.6947 ft

Area of Flow: 0.9653 ft^2

Wetted Perimeter: 3.1069 ft

Hydraulic Radius: 0.3107 ft

Average Velocity: 3.8952 ft/s

Top Width: 2.7789 ft

Froude Number: 1.1647

Critical Depth: 0.7384 ft

Critical Velocity: 3.4480 ft/s

Critical Slope: 0.0289 ft/ft

Critical Top Width: 2.95 ft

Calculated Max Shear Stress: 1.7340 lb/ft^2

Calculated Avg Shear Stress: 0.7755 lb/ft^2

Channel Analysis: Block X10 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0800 ft/ft

Manning's n: 0.0350

Flow: 1.5300 cfs

Result Parameters

Depth: 0.4354 ft

Area of Flow: 0.3792 ft^2

Wetted Perimeter: 1.9474 ft

Hydraulic Radius: 0.1947 ft

Average Velocity: 4.0345 ft/s

Top Width: 1.7418 ft

Froude Number: 1.5238

Critical Depth: 0.5153 ft

Critical Velocity: 2.8805 ft/s

Critical Slope: 0.0326 ft/ft

Critical Top Width: 2.06 ft

Calculated Max Shear Stress: 2.1737 lb/ft^2

Calculated Avg Shear Stress: 0.9721 lb/ft^2

Channel Analysis: Block X10 West Diversion Ave

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.0300 ft/ft

Manning's n: 0.0350

Flow: 5.5800 cfs

Result Parameters

Depth: 0.4926 ft

Area of Flow: 1.9412 ft^2

Wetted Perimeter: 7.9428 ft

Hydraulic Radius: 0.2444 ft

Average Velocity: 2.8746 ft/s

Top Width: 7.8815 ft

Froude Number: 1.0207

Critical Depth: 0.4967 ft

Critical Velocity: 2.8277 ft/s

Critical Slope: 0.0287 ft/ft

Critical Top Width: 7.95 ft

Calculated Max Shear Stress: 0.9221 lb/ft^2

Calculated Avg Shear Stress: 0.4575 lb/ft^2

Channel Analysis: Block X10 East Diversion Ave

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 0.7000 cfs

Result Parameters

Depth: 0.2143 ft

Area of Flow: 0.3673 ft^2

Wetted Perimeter: 3.4552 ft

Hydraulic Radius: 0.1063 ft

Average Velocity: 1.9056 ft/s

Top Width: 3.4285 ft

Froude Number: 1.0260

Critical Depth: 0.2165 ft

Critical Velocity: 1.8669 ft/s

Critical Slope: 0.0379 ft/ft

Critical Top Width: 3.46 ft

Calculated Max Shear Stress: 0.5348 lb/ft^2

Calculated Avg Shear Stress: 0.2654 lb/ft^2

Channel Analysis: Block Y14 West Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0300 ft/ft

Manning's n: 0.0350

Flow: 0.2200 cfs

Result Parameters

Depth: 0.2529 ft

Area of Flow: 0.1279 ft^2

Wetted Perimeter: 1.1310 ft

Hydraulic Radius: 0.1131 ft

Average Velocity: 1.7198 ft/s

Top Width: 1.0116 ft

Froude Number: 0.8523

Critical Depth: 0.2372 ft

Critical Velocity: 1.9544 ft/s

Critical Slope: 0.0422 ft/ft

Critical Top Width: 0.95 ft

Calculated Max Shear Stress: 0.4734 lb/ft^2

Calculated Avg Shear Stress: 0.2117 lb/ft^2

Channel Analysis: Block Y14 East Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0700 ft/ft

Manning's n: 0.0350

Flow: 4.5100 cfs

Result Parameters

Depth: 0.6697 ft

Area of Flow: 0.8969 ft^2

Wetted Perimeter: 2.9949 ft

Hydraulic Radius: 0.2995 ft

Average Velocity: 5.0283 ft/s

Top Width: 2.6787 ft

Froude Number: 1.5313

Critical Depth: 0.7941 ft

Critical Velocity: 3.5757 ft/s

Critical Slope: 0.0282 ft/ft

Critical Top Width: 3.18 ft

Calculated Max Shear Stress: 2.9251 lb/ft^2

Calculated Avg Shear Stress: 1.3082 lb/ft^2

Channel Analysis: Block Y15 West Diversion Ave

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 2.5500 cfs

Result Parameters

Depth: 0.3480 ft

Area of Flow: 0.9686 ft^2

Wetted Perimeter: 5.6106 ft

Hydraulic Radius: 0.1726 ft

Average Velocity: 2.6327 ft/s

Top Width: 5.5673 ft

Froude Number: 1.1123

Critical Depth: 0.3631 ft

Critical Velocity: 2.4178 ft/s

Critical Slope: 0.0319 ft/ft

Critical Top Width: 5.81 ft

Calculated Max Shear Stress: 0.8685 lb/ft^2

Calculated Avg Shear Stress: 0.4309 lb/ft^2

Channel Analysis: Block Y15 East Diversion Ave

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.0200 ft/ft

Manning's n: 0.0350

Flow: 2.8600 cfs

Result Parameters

Depth: 0.4137 ft

Area of Flow: 1.3690 ft^2

Wetted Perimeter: 6.6702 ft

Hydraulic Radius: 0.2052 ft

Average Velocity: 2.0892 ft/s

Top Width: 6.6187 ft

Froude Number: 0.8095

Critical Depth: 0.3801 ft

Critical Velocity: 2.4739 ft/s

Critical Slope: 0.0314 ft/ft

Critical Top Width: 6.08 ft

Calculated Max Shear Stress: 0.5163 lb/ft^2

Calculated Avg Shear Stress: 0.2561 lb/ft^2

Channel Analysis: Block Y16 Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.0900 ft/ft

Manning's n: 0.0350

Flow: 3.3300 cfs

Result Parameters

Depth: 0.5702 ft

Area of Flow: 0.6502 ft^2

Wetted Perimeter: 2.5498 ft

Hydraulic Radius: 0.2550 ft

Average Velocity: 5.1217 ft/s

Top Width: 2.2807 ft

Froude Number: 1.6905

Critical Depth: 0.7034 ft

Critical Velocity: 3.3652 ft/s

Critical Slope: 0.0294 ft/ft

Critical Top Width: 2.81 ft

Calculated Max Shear Stress: 3.2020 lb/ft^2

Calculated Avg Shear Stress: 1.4320 lb/ft^2

Channel Analysis: Block Z18 West Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 2.0000 ft/ft

Side Slope 2 (Z2): 2.0000 ft/ft

Longitudinal Slope: 0.1000 ft/ft

Manning's n: 0.0350

Flow: 1.7400 cfs

Result Parameters

Depth: 0.4382 ft

Area of Flow: 0.3841 ft^2

Wetted Perimeter: 1.9599 ft

Hydraulic Radius: 0.1960 ft

Average Velocity: 4.5300 ft/s

Top Width: 1.7529 ft

Froude Number: 1.7054

Critical Depth: 0.5426 ft

Critical Velocity: 2.9555 ft/s

Critical Slope: 0.0320 ft/ft

Critical Top Width: 2.17 ft

Calculated Max Shear Stress: 2.7346 lb/ft^2

Calculated Avg Shear Stress: 1.2230 lb/ft^2

Channel Analysis: Block Z18 East Ditch

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.1900 ft/ft

Manning's n: 0.0350

Flow: 1.2300 cfs

Result Parameters

Depth: 0.1977 ft

Area of Flow: 0.3125 ft^2

Wetted Perimeter: 3.1871 ft

Hydraulic Radius: 0.0981 ft

Average Velocity: 3.9355 ft/s

Top Width: 3.1625 ft

Froude Number: 2.2061

Critical Depth: 0.2712 ft

Critical Velocity: 2.0897 ft/s

Critical Slope: 0.0351 ft/ft

Critical Top Width: 4.34 ft

Calculated Max Shear Stress: 2.3434 lb/ft^2

Calculated Avg Shear Stress: 1.1626 lb/ft^2

SECTION 2

INLET AND PIPE HYDRAULICS

Hydraulic Analysis Report

Project Data

Project Title: Stagecoach North Track I ECP

Designer: J. Bushey

Project Date: Monday, October 29, 2018

Project Units: U.S. Customary Units

Notes: Flow rates were calculated from unit flows (cfs/AC) determined via hydrologic analysis and corresponding hydraulic watershed areas (AC) for the respective drainage elements.

Channel Analysis: Block V4 Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.8333 ft

Longitudinal Slope: 0.1167 ft/ft

Manning's n: 0.0180

Flow: 3.9500 cfs

Result Parameters

Depth: 0.5289 ft

Area of Flow: 0.3651 ft^2

Wetted Perimeter: 1.5363 ft

Hydraulic Radius: 0.2376 ft

Average Velocity: 10.8189 ft/s

Top Width: 0.8025 ft

Froude Number: 2.8267

Critical Depth: 0.8010 ft

Critical Velocity: 7.3364 ft/s

Critical Slope: 0.0543 ft/ft

Critical Top Width: 0.32 ft

Calculated Max Shear Stress: 3.8505 lb/ft^2

Calculated Avg Shear Stress: 1.7301 lb/ft^2

Channel Analysis: Block V6 Culvert Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.6667 ft

Longitudinal Slope: 0.1250 ft/ft

Manning's n: 0.0170

Flow: 1.6800 cfs

Result Parameters

Depth: 0.3389 ft

Area of Flow: 0.1783 ft^2

Wetted Perimeter: 1.0584 ft

Hydraulic Radius: 0.1684 ft

Average Velocity: 9.4246 ft/s

Top Width: 0.6666 ft

Froude Number: 3.2118

Critical Depth: 0.5967 ft

Critical Velocity: 5.0973 ft/s

Critical Slope: 0.0292 ft/ft

Critical Top Width: 0.41 ft

Calculated Max Shear Stress: 2.6435 lb/ft^2

Calculated Avg Shear Stress: 1.3137 lb/ft^2

Channel Analysis: Block V6 Pipe

Notes: Flow of 4.90cfs is the sum of flows from the two (2) inlets at the top of Block V6.

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.8333 ft

Longitudinal Slope: 0.2100 ft/ft

Manning's n: 0.0180

Flow: 4.9000 cfs

Result Parameters

Depth: 0.5019 ft

Area of Flow: 0.3432 ft^2

Wetted Perimeter: 1.4807 ft

Hydraulic Radius: 0.2318 ft

Average Velocity: 14.2760 ft/s

Top Width: 0.8157 ft

Froude Number: 3.8784

Critical Depth: 0.8192 ft

Critical Velocity: 9.0177 ft/s

Critical Slope: 0.0865 ft/ft

Critical Top Width: 0.22 ft

Calculated Max Shear Stress: 6.5769 lb/ft^2

Calculated Avg Shear Stress: 3.0376 lb/ft^2

Channel Analysis: Block W8 Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.8333 ft

Longitudinal Slope: 0.0800 ft/ft

Manning's n: 0.0180

Flow: 3.7600 cfs

Result Parameters

Depth: 0.5849 ft

Area of Flow: 0.4090 ft^2

Wetted Perimeter: 1.6552 ft

Hydraulic Radius: 0.2471 ft

Average Velocity: 9.1941 ft/s

Top Width: 0.7624 ft

Froude Number: 2.2123

Critical Depth: 0.7945 ft

Critical Velocity: 7.0121 ft/s

Critical Slope: 0.0490 ft/ft

Critical Top Width: 0.35 ft

Calculated Max Shear Stress: 2.9196 lb/ft^2

Calculated Avg Shear Stress: 1.2334 lb/ft^2

Channel Analysis: Block X10 Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.1800 ft/ft

Manning's n: 0.0180

Flow: 7.8100 cfs

Result Parameters

Depth: 0.5456 ft

Area of Flow: 0.5146 ft^2

Wetted Perimeter: 1.8043 ft

Hydraulic Radius: 0.2852 ft

Average Velocity: 15.1764 ft/s

Top Width: 1.2399 ft

Froude Number: 4.1513

Critical Depth: 1.1053 ft

Critical Velocity: 6.8027 ft/s

Critical Slope: 0.0251 ft/ft

Critical Top Width: 0.80 ft

Calculated Max Shear Stress: 6.1282 lb/ft^2

Calculated Avg Shear Stress: 3.2036 lb/ft^2

Channel Analysis: Block Y14 Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.8333 ft

Longitudinal Slope: 0.1160 ft/ft

Manning's n: 0.0180

Flow: 4.7300 cfs

Result Parameters

Depth: 0.6054 ft

Area of Flow: 0.4244 ft^2

Wetted Perimeter: 1.7007 ft

Hydraulic Radius: 0.2495 ft

Average Velocity: 11.1451 ft/s

Top Width: 0.7429 ft

Froude Number: 2.5985

Critical Depth: 0.8170 ft

Critical Velocity: 8.7131 ft/s

Critical Slope: 0.0801 ft/ft

Critical Top Width: 0.23 ft

Calculated Max Shear Stress: 4.3820 lb/ft^2

Calculated Avg Shear Stress: 1.8063 lb/ft^2

Channel Analysis: Block Z18 Pipe

Notes:

Input Parameters

Channel Type: Circular

Pipe Diameter: 0.8330 ft

Longitudinal Slope: 0.1000 ft/ft

Manning's n: 0.0180

Flow: 2.9800 cfs

Result Parameters

Depth: 0.4632 ft

Area of Flow: 0.3113 ft^2

Wetted Perimeter: 1.4021 ft

Hydraulic Radius: 0.2220 ft

Average Velocity: 9.5725 ft/s

Top Width: 0.8277 ft

Froude Number: 2.7507

Critical Depth: 0.7496 ft

Critical Velocity: 5.7688 ft/s

Critical Slope: 0.0313 ft/ft

Critical Top Width: 0.50 ft

Calculated Max Shear Stress: 2.8904 lb/ft^2

Calculated Avg Shear Stress: 1.3855 lb/ft^2

Channel Analysis: Basin 5 Outlet Pipe

Notes: Flow of 13.92 cfs is the 100-year outflow from proposed Detention Basin #5 in Watershed 2.

Input Parameters

Channel Type: Circular

Pipe Diameter: 1.2500 ft

Longitudinal Slope: 0.1400 ft/ft

Manning's n: 0.0100

Flow: 13.9200 cfs

Result Parameters

Depth: 0.5826 ft

Area of Flow: 0.5607 ft^2

Wetted Perimeter: 1.8787 ft

Hydraulic Radius: 0.2984 ft

Average Velocity: 24.8280 ft/s

Top Width: 1.2471 ft

Froude Number: 6.5256

Critical Depth: 1.2312 ft

Critical Velocity: 11.3784 ft/s

Critical Slope: 0.0249 ft/ft

Critical Top Width: 0.30 ft

Calculated Max Shear Stress: 5.0898 lb/ft^2

Calculated Avg Shear Stress: 2.6071 lb/ft^2

SECTION 3

CULVERT HYDRAULICS

PPI ENGINEERING

PROJECT STAGECOACH NORTH
TR I HYDRAULICS

DATE: 10/31/18
JOB NO.: 117133.01
COMP. BY: CC
CHKD. BY:
SHEET 1 OF 3

- BLOCK Y14 CULVERT IS LOCATED IN HYDROLOGIC ANALYSIS SUBWATERSHED 10. FROM THAT ANALYSIS:

  SUBWATERSHED 10 100-YEAR FLOW: 65.42 cfs

  SUBWATERSHED 10 AREA: 41.89 AC

  ∴ UNIT FLOW RATE, $q_{UNIT} = \frac{65.42 \text{ cfs}}{41.89 \text{ AC}} = 1.56 \text{ cfs/AC}$

- BLOCK Y14 CULVERT 100-YR FLOW:

  BLOCK Y14 CULVERT WATERSHED AREA: ± 0.37AC

  ∴ $Q_{100} = (0.37\text{AC})(1.56 \text{ cfs/AC}) = 0.58 \text{ cfs}$

  FROM NOMOGRAPH, HW = 0.63' w/ Δ = 12" CMP

  SPEC 12" CMP w/ 1' COVER (HW = 1' + 1' = 2' > 0.63')

  ↑ PIPE DIAMETER ↑ 1' OF COVER

- REPLACEMENT CULVERT IS POINT OF INTEREST FOR HYDROLOGIC ANALYSIS SUBWATERSHED 18.

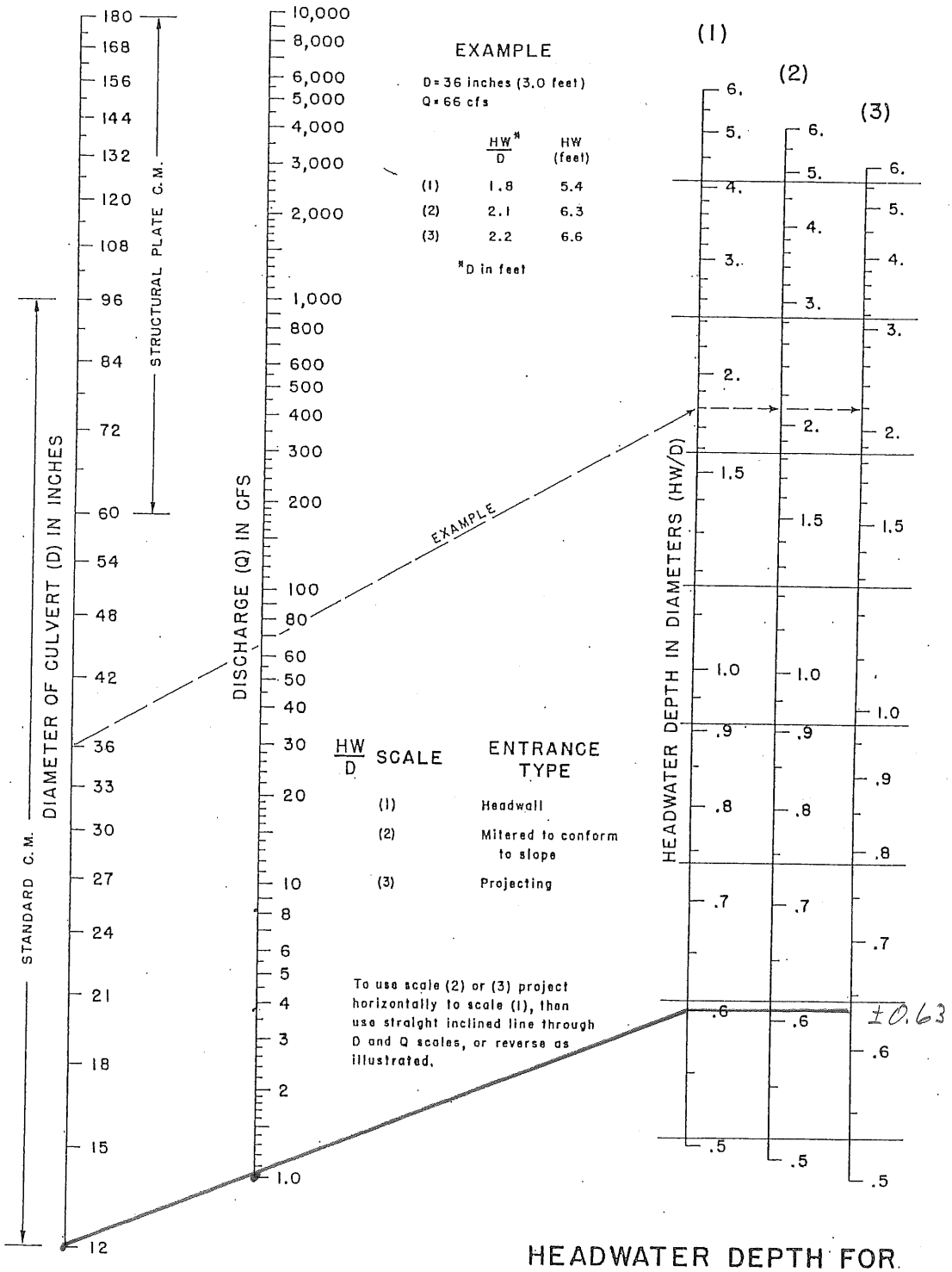
  ∴ Q_{100} = 65.75 cfs (ref. HYDROLOGIC ANALYSIS)

  FROM NOMOGRAPH, HW = 3.92' w/ Δ = 48" CMP

  SPEC 48" CMP w/ 1' MIN. COVER (HW = 4' + 1' = 5' > 3.92')

  ↑ PIPE DIAMETER ↑ 1' OF COVER

2/3

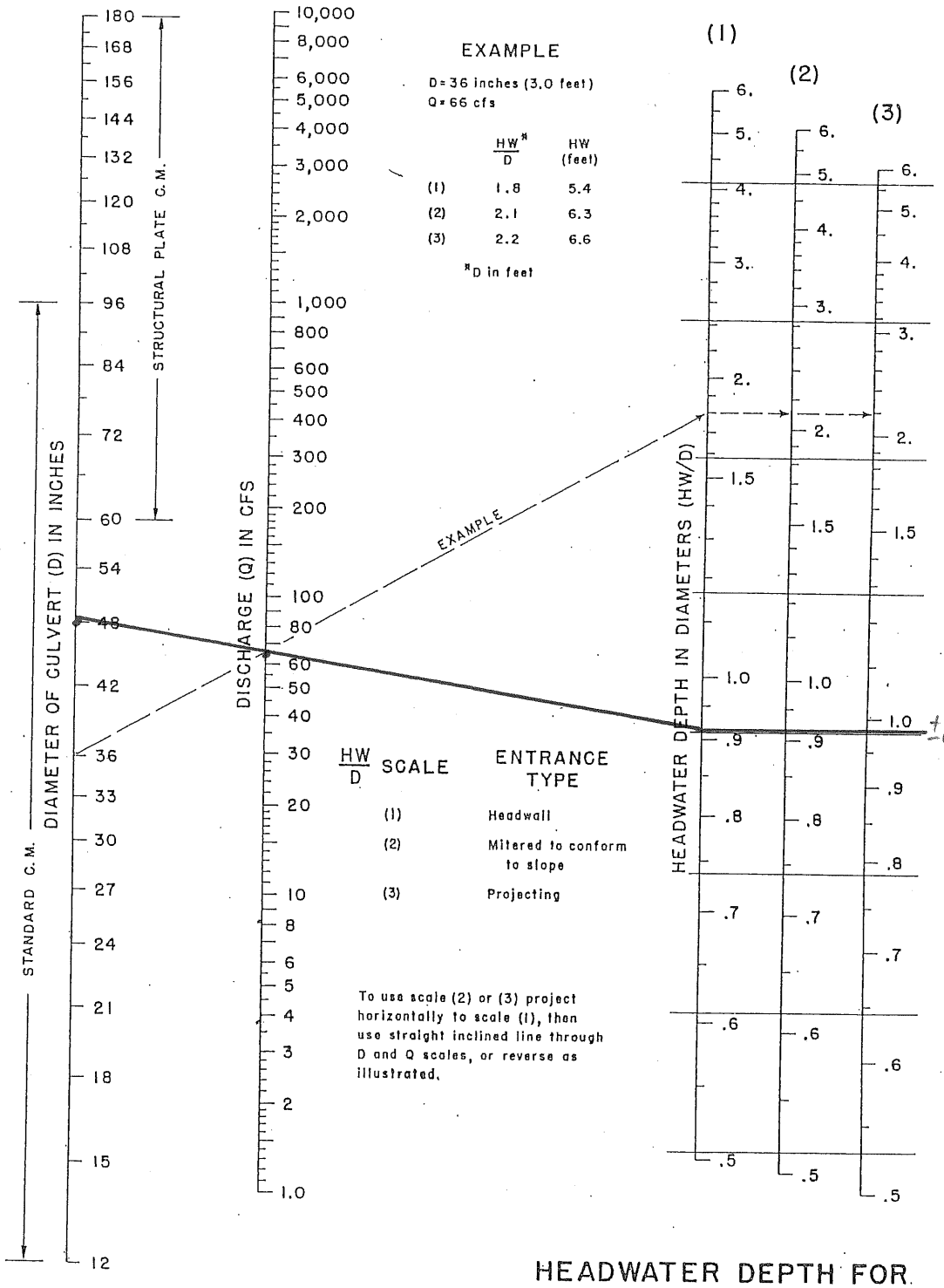


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

$\frac{HW}{D} = 0.63 \quad \therefore \quad HW = 0.630 = (0.63)(1\text{'}) = \underline{0.63'}$

3/3



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

$\frac{HW}{D} = 0.98 \quad \therefore HW = 0.98D = 0.98(4') = \underline{3.92'}$

Hydraulic Analysis Report

Project Data

Project Title: Updated Stagecoach North Hydraulics

Designer: M. Bueno

Project Date: Monday, October 29, 2018

Project Units: U.S. Customary Units

Notes: Flow rates were calculated from unit flows (cfs/AC) determined via hydrologic analysis and corresponding hydraulic watershed areas (AC) for the respective drainage elements.

Block X10 Diversion Avenue was updated to include flow from the upstream ditch in Block X10.
07/15/2020 - MB

Channel Analysis: Block X10 East Diversion Ave

Notes:

Input Parameters

Channel Type: Triangular

Side Slope 1 (Z1): 8.0000 ft/ft

Side Slope 2 (Z2): 8.0000 ft/ft

Longitudinal Slope: 0.0400 ft/ft

Manning's n: 0.0350

Flow: 2.2300 cfs

Result Parameters

Depth: 0.3309 ft

Area of Flow: 0.8759 ft^2

Wetted Perimeter: 5.3355 ft

Hydraulic Radius: 0.1642 ft

Average Velocity: 2.5459 ft/s

Top Width: 5.2943 ft

Froude Number: 1.1030

Critical Depth: 0.3441 ft

Critical Velocity: 2.3538 ft/s

Critical Slope: 0.0324 ft/ft

Critical Top Width: 5.51 ft

Calculated Max Shear Stress: 0.8259 lb/ft^2

Calculated Avg Shear Stress: 0.4098 lb/ft^2

Stagecoach North Track I
Unit Flow Calculations
PPI Engineering
7/15/2020
ALB

Diversion Ditch and Avenue Analysis

	Hydrologic Watershed/ Subwatershed	Watershed/ Subwatershed Area (AC)	Watershed/ Subwatershed Q_{100H} (cfs)	100-Year Unit Flow (cfs/AC)		Ditch Watershed Area (AC)	Ditch Q_{100} (cfs)
Block V2 Ditch	1E	46.92	82.71	1.76		2.10	3.70
Block V3 Ditch	2	37.13	57.22	1.54		2.14	3.30
Block V4 Ditch	2	37.13	57.22	1.54		2.56	3.95
Block V6 West Ditch	1B	44.42	65.75	1.48		0.69	1.02
Block V6 Middle Ditch	2	37.13	57.22	1.54		1.09	1.68
Block V6 East Ditch	2	37.13	57.22	1.54		2.09	3.22
Block W8 Ditch	1B	44.42	65.75	1.48		2.54	3.76
Block X10 Ditch	1D	41.89	65.42	1.56		0.98	1.53
Block X10 West Diversion Ave	1D	41.89	65.42	1.56		3.57	5.58
Block X10 East Diversion Ave	1D	41.89	65.42	1.56		0.45	0.70
Block Y14 West Ditch	1D	41.89	65.42	1.56		0.14	0.22
Block Y14 East Ditch	1D	41.89	65.42	1.56		2.89	4.51
Block Y15 West Diversion Ave	1A	45.62	66.00	1.45		1.76	2.55
Block Y15 East Diversion Ave	1B	44.42	65.75	1.48		1.93	2.86
Block Y16 Ditch	1A	45.62	66.00	1.45		2.30	3.33
Block Z18 West Ditch	1C	55.55	82.64	1.49		1.17	1.74
Block Z18 East Ditch	1C	55.55	82.64	1.49		0.83	1.23

Stagecoach North Track I
Unit Flow Rate Calculations
PPI Engineering
7/15/2020
ALB

Block V4 Inlet and Pipe

Hydrologic Watershed/Subwatershed:	2
Watershed/Subwatershed Area (AC):	37.13
Watershed/Subwatershed Q_{100H} (cfs):	57.22
100-Year Unit Flow (cfs/AC):	1.54
Inlet/Pipe Watershed Area (AC):	2.56
Inlet/Pipe Q_{100} (cfs):	3.95

Block V6 West Inlet and Culvert Pipe

Hydrologic Watershed/Subwatershed:	2
Watershed/Subwatershed Area (AC):	37.13
Watershed/Subwatershed Q_{100H} (cfs):	57.22
100-Year Unit Flow (cfs/AC):	1.54
Inlet/Pipe Watershed Area (AC):	1.09
Inlet/Pipe Q_{100} (cfs):	1.68

Block V6 East Inlet and Pipe

Hydrologic Watershed/Subwatershed:	2
Watershed/Subwatershed Area (AC):	37.13
Watershed/Subwatershed Q_{100H} (cfs):	57.22
100-Year Unit Flow (cfs/AC):	1.54
Inlet/Pipe Watershed Area (AC):	2.09
Inlet/Pipe Q_{100} (cfs):	3.22

Block W8 Inlet and Pipe

Hydrologic Watershed/Subwatershed:	1B
Watershed/Subwatershed Area (AC):	44.42
Watershed/Subwatershed Q_{100H} (cfs):	65.75
100-Year Unit Flow (cfs/AC):	1.48
Inlet/Pipe Watershed Area (AC):	2.54
Inlet/Pipe Q_{100} (cfs):	3.76

Block X10 Inlet and Pipe

Hydrologic Watershed/Subwatershed:	1D
Watershed/Subwatershed Area (AC):	41.89
Watershed/Subwatershed Q_{100H} (cfs):	65.42
100-Year Unit Flow (cfs/AC):	1.56
Inlet/Pipe Watershed Area (AC):	5.00
Inlet/Pipe Q_{100} (cfs):	7.81

Block Y14 Inlet and Pipe

Hydrologic Watershed/Subwatershed:	1D
Watershed/Subwatershed Area (AC):	41.89
Watershed/Subwatershed Q_{100H} (cfs):	65.42
100-Year Unit Flow (cfs/AC):	1.56
Inlet/Pipe Watershed Area (AC):	3.03
Inlet/Pipe Q_{100} (cfs):	4.73

Block Z18 Inlet and Pipe

Hydrologic Watershed/Subwatershed:	1C
Watershed/Subwatershed Area (AC):	55.55
Watershed/Subwatershed Q_{100H} (cfs):	82.64
100-Year Unit Flow (cfs/AC):	1.49
Inlet/Pipe Watershed Area (AC):	2.00
Inlet/Pipe Q_{100} (cfs):	2.98

APPENDIX J
WATER AVAILABILITY ANALYSIS

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

RESULTS OF AQUIFER TESTING OF TWO ONSITE WELLS AND NAPA COUNTY TIER 1 WATER AVAILABILITY ANALYSIS FOR STAGECOACH NORTH VINEYARD DEVELOPMENT PROJECT NAPA COUNTY, CALIFORNIA

Prepared for
STAGECOACH VINEYARD

Prepared by

Richard C. Slade & Associates LLC
Consulting Groundwater Geologists

RCS Job No. 217-NPA01

DECEMBER 2018

DRAFT

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INTRODUCTION

Provided herein are the key findings, conclusions, and our preliminary recommendations regarding the testing of two onsite water wells, along with the Water Availability Analysis (WAA) prepared by RCS for the proposed new vineyard development at the Stagecoach North Vineyard property in Napa County (County), California. This document was prepared to provide our hydrogeologic analyses in support of the preparation of an Environmental Impact Report (EIR) for the proposed project, and also to maintain conformance with Napa County Tier 1 requirements, as described in the Napa County WAA Guidelines (WAA 2015).

The Stagecoach North property is comprised of 169.6 acres and is located in the Soda Canyon area of Napa County, and is immediately adjacent to and contiguous with the existing Stagecoach Vineyard property. Figure 1, "Location Map," shows the boundaries of the Stagecoach North property (the subject property), superimposed on the United States Geological Survey (USGS) topographic map for the Yountville quadrangle. Property boundaries shown on Figure 1 were adapted from the County Assessor's parcel data; County parcel data are freely available on the Napa County GIS website. Also shown on Figure 1 are the locations of existing onsite wells (known herein as "Well SN-1" and "Well SN-2"), along with property boundaries for the Stagecoach Vineyard (SV) property, and the locations of the existing wells located on that SV property (as denoted by "SV-1A," "SV-2," etc.). Included on Figure 1 are the locations of offsite wells owned by others. Figure 2, "Aerial Photograph Map," shows the same property boundaries and well locations that are illustrated on Figure 1, but the base map for Figure 2 is an aerial photograph of the area; this aerial photograph was obtained from the USGS EarthExplorer website (the date of the imagery is June 3, 2016).

The 169.6-acre subject property is currently undeveloped, with the exception of the existing wells and the graded access roads to both of those well sites, as reported by the property owner and/or the project engineer, PPI Engineering, Inc. (PPI) of Napa, California. RCS understands that the proposed project is to develop a total of 91.3 acres of new vineyards. For this project, the future vineyard irrigation demands of the new vineyard development are proposed to be met using groundwater pumped from existing onsite Well SN-1 and Well SN-2.

The basic purpose of this report is to comply with Napa County's WAA guidelines for a "Tier 1" WAA (i.e., a Groundwater Recharge Estimate); those guidelines were promulgated by the County in May 2015. Because there are no known offsite wells located with 500 ft of the project wells on the Stagecoach North Vineyards property (Well SN-1 and Well SN-2), County requirements for a "Tier 2" WAA analysis (i.e., a Well Interference Evaluation) have been "presumptively met" per the WAA Guidelines.

Prior to acquisition of the property by E&J Gallo, RCS had been retained by the previous owners of the Stagecoach Vineyard property for various hydrogeologic services for the property, and the proposed Stagecoach North Vineyard development. In addition, in accordance with particular mitigation measures included as part of the "Stagecoach Vineyards Infill Development Project" (AES 2008), Stagecoach Vineyard has continued to retain RCS to summarize water level data and well production data collected over time by Stagecoach staff, and to prepare memoranda for submission to Napa County. Thus, RCS is familiar with the Stagecoach Vineyard properties and the surrounding area.

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SITE CONDITIONS

From our data review work, and from recent site reconnaissance visits to the subject property between April 1, 2016 and April 26, 2018, the following key items were noted and/or observed (refer to Figures 1 and 2):

a. The Stagecoach North property is comprised of a single parcel having a Napa County Assessor's Parcel Number (APN) of 032-010-086. This parcel is referred to herein as the "subject property." The total assessed area of the subject property, per the County Assessor's records, is 169.6 acres. There is currently a lot-line adjustment being pursued for the parcel, which would bring the adjusted parcel acreage up to 170.2 acres. To present a more conservative analysis, the smaller 169.6-acre parcel size will be utilized in this report for the purposes of calculating site-specific groundwater recharge.

b. Topographically, the subject property is located in the hills north of Rector Reservoir in the Soda Canyon area of Napa County. Based on the topographic contours presented in Figure 1, ground surface on the property slopes moderately to the southwest towards Rector Canyon and Rector Reservoir. A single ephemeral drainage is shown on the USGS topographic map within the boundaries of the subject property, as denoted by a dashed blue line (see Figure 1). This marked drainage flows north to south across the western portion of the subject property. Because this drainage is ephemeral, it would contain surface water runoff only during or immediately following a rainfall event. This drainage is located approximately 1,900 ft west of Well SN-1.

c. The subject property is currently undeveloped with the exception of a few graded, dirt roads which provide access to the two existing onsite wells. The subject property is primarily covered by bushes and trees. No structures were observed on the subject property during our site visits.

d. Offsite areas surrounding the subject property consist of: the existing vineyards of the Stagecoach Vineyard property; and various wineries and residences to the southwest, south, and southeast. Naturally vegetated and/or wooded hillsides (i.e., undeveloped areas) were also observed to the north and east.

e. As shown on Figures 1 and 2, two existing water wells, Well SN-1 and Well SN-2, are located in the southeastern portion of the subject property. Both Wells SN-1 and SN-2 were observed to be equipped with permanent pumps and equipped with flowmeter devices with totalizer dials that are used to monitor groundwater extraction volumes.

f. During the various site visits to the property, RCS geologists traveled along onsite roads and also along offsite roads that surround the Stagecoach North and Stagecoach Vineyard properties in an attempt to identify possible locations and/or the existence of nearby but offsite water wells owned by others, and to help verify offsite well locations provided by others. RCS refers to such work as "windshield surveys." In addition, RCS has performed previous work in the area on surrounding properties, for which similar "windshield surveys" for offsite wells had previously been performed. During these "surveys," RCS geologists try to identify possible well locations based on observation of a typical well-house enclosure, pressure tanks,

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storage tanks, power lines, or a wellhead itself. Possible well locations were also derived previously from review of aerial photos of the area obtained from freely-available public sources.

g. RCS geologists also contacted Napa County Planning, Building, and Environmental Service (PBES) in an attempt to acquire "Well Completion Reports" (also known as "driller's logs) that might exist for wells located on those offsite neighboring properties. In addition, RCS geologists also used the California Department of Water Resources (DWR) online Well Completion Report Map Application website to download driller's logs for wells within the immediate vicinity of the subject property.

   As a result of these inquiries and efforts, several driller's logs and/or well drilling permits were obtained for wells historically drilled in the area. Figures 1 and 2 show the approximate locations of known, reported, or possible offsite wells surrounding the subject property, as determined from field reconnaissance visits and well log research. None of these offsite wells (including all of the Stagecoach Vineyard wells) are known to be located within 500 ft of the two onsite project wells (Wells SN-1 and SN-2).

KEY CONSTRUCTION AND TESTING DATA FOR EXISTING ONSITE WELLS

DWR Well Completion Reports are available for Well SN-1 and Well SN-2. The Well Completion Report log numbers for those two wells are Log No. e0231245 for Well SN-1, and Log No. e0260575 for Well SN-2. Copies of these driller's logs are included in Appendix A. Table 1, "Summary of Well Construction and Pumping Data," provides a tabulation of key well construction data, original airlifting data, and pumping data that are available for these two onsite wells.

Well Construction Data

Key data listed on the available driller's logs and/or identified during our site visits are as follows:

a. Wells SN-1 and SN-2 were drilled and constructed in August 2014 and March 2015, respectively, by Dave Bess Pump & Well (Bess), of Napa, California. Well SN-1 was drilled using the direct mud rotary drilling method, whereas Well SN-2 was reported to have been drilled using the direct air rotary method.

b. Pilot hole depths (the borehole drilled before the well casing is placed downhole) were reported to be 720 feet below ground surface (ft bgs) in Well SN-1, and 590 ft bgs in Well SN-2.

c. These onsite wells were both cased with PVC well casing having a diameter of 8 inches; total casing depths were reported to be 715 ft bgs in Well SN-1, and 560 ft bgs in Well SN-2.

d. Casing perforations for the two onsite wells are factory-cut slots and have slot opening widths of 0.032 inches (32-slot). Perforations in Well SN-1 were placed intermittently between the depths of 380 ft and 715 ft bgs, whereas perforations in Well SN-2 were placed continuously between the depths of 280 ft and 560 ft bgs.

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e. Gravel pack materials shown on the driller's logs for these wells were generally listed as "filter pack" (in Well SN-1) or "pea gravel" (in Well SN-2).

f. Wells SN-1 and SN-2 were both reportedly constructed with sanitary seals consisting of either cement or bentonite (a type of clay with low permeability). The sanitary seals were set to a depth of 20 ft bgs in both wells.

Summary of Key Airlifting "Test" Data for Onsite Wells

The available driller's logs for the onsite wells provided the original, post-construction static water levels along with their original airlift test rates (as shown on Table 1). These data include:

- Initial static water levels (SWLs) following completion of well construction were reported to be 308 ft bgs in Well SN-1 on August 29, 2014, and 240 ft bgs in Well SN-2 on March 26, 2015.
- Maximum airlift rates reported for initial post-construction airlifting operations were estimated by the driller to be 90 gallons per minute (gpm) in Well SN-1, and 150 gpm in Well SN-2. As a rule of thumb, RCS geologists estimate normal operational pumping rates for a new well equipped with a permanent pump are typically on the order of only about one-half or less of the airlifting rate reported on a driller's log.
- "Water level drawdown" values during airlifting were not listed on the driller's logs, because water level drawdown cannot be measured during airlifting operations; thus the original post-construction specific capacity values for the onsite wells cannot be calculated from the data on the available driller's logs. Specific capacity, measured in gallons per minute per foot of water level drawdown (gpm/ft ddn), represents the ratio of the pumping rate in a well (in gpm) divided by the amount of water level drawdown (in ft ddn) created in the well while at that rate.

2016 Pumping Test Data for Well SN-1 and Well SN-2

Between April and May 2016, 48-hour constant rate pumping tests were conducted in onsite Wells SN-1 and SN-2 by LGS Drilling, Inc (LGS), of Vacaville, California; data for these pumping tests are available in in-house RCS files as a result of hydrogeological services previously provided by RCS for the previous property owner. Key water level and pumping data for those tests include:

a. Well SN-1

   - A SWL depth of 314.1 ft below the wellhead reference point (brp) was recorded by the pumper before the test began on May 1, 2016.
   - Well SN-1 was reportedly pumped at an average rate of 50 gpm and for a continuous pumping period of 48 hours (2,880 minutes).
   - A maximum pumping water level (PWL) of 388.7 ft brp was reported by the pumper at the end of the continuous 48-hour pumping period; this represents a maximum water level drawdown of 74.6 ft.
   - Based on the average constant rate of 50 gpm, the specific capacity of Well SN-1 was calculated to be 0.67 gpm/ft ddn, at the date of this 2016 test.

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b. Well SN-2

- A SWL depth of 238.6 ft brp was recorded by the pumper before the test began on April 25, 2016.
- Well SN-2 was reportedly pumped at an average rate of 150 gpm for a continuous period of 48 hours (2,880 minutes).
- A maximum PWL of 259.8 ft brp was recorded by the pumper at the end of the continuous 48-hour pumping period; this represents a maximum water level drawdown of 21.2 ft.
- Based on the average constant pumping rate of 150 gpm, the specific capacity of Well SN-2 was calculated to be 7.08 gpm/ft ddn at the date of this 2016 test.

Recent Aquifer Testing of Onsite Wells

In April 2018, RCS established the basic protocol for aquifer testing of Wells SN-1 and SN-2, and the field work for these tests was again conducted by LGS. These long-term pumping tests were performed in the subject wells in support of the EIR preparation effort, to determine if the onsite wells could pump at sufficient rates to meet the irrigation demands of the proposed new vineyards to be developed for the Stagecoach North property. Generally, aquifer testing of each well consisted of the following:

- Conduct a period of background water level monitoring (via the use of water level pressure transducers installed in each well) prior to turning on the pump.
- Perform a 48-hour constant rate pumping test in each well to determine if the well could be successfully pumped at the rates necessary for the proposed project.
- Observe water level drawdown interference, if any, in the other onsite and/or offsite wells selected to be monitored during each constant rate pumping test.
- Conduct a period of water level recovery monitoring and collect water level data (via pressure transducers) following each constant rate pumping test.

Results of the aquifer tests performed at both well sites are described in Appendix A. The 48-hour constant rate pumping tests performed in each well were executed successfully without undesirable events or pump failure. For the tests, Wells SN-1 and SN-2 were pumped at average rates of 54 gpm and 154 gpm, respectively. Water level data collected by the water level pressure transducers (data loggers) showed that pumping water levels did not decline to the depths of the test pumps installed in those two wells (i.e., the pumps did not “break suction”). These water level data also showed that pumping water levels in Well SN-1 were relatively stable throughout its 48-hour pumping test, whereas, pumping water levels in Well SN-2 were somewhat less stable, and were still declining at a rate of 0.23 ft/hour in the last 4 hours of its 48-hour constant rate pumping test.

Based on the results of the aquifer testing performed in Wells SN-1 and SN-2, it is the opinion of RCS that these two wells are capable of pumping the combined desired operational rate of 148 gpm on a normal operational basis during the irrigation season; note the sum of the actual pumping rates during the April 2018 pumping tests of Wells SN-1 and SN-2 was 208 gpm (discussed in detail under the heading “Proposed Project Groundwater Demands”). As noted above, detailed results and analysis of the water level and pumping data for each of the two aquifer tests performed are presented in Appendix A.

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NEARBY OFFSITE WELLS (STAGECOACH VINEYARD PROPERTY)

A number of offsite wells owned by Stagecoach Vineyard on the SV are known to exist to the south of the Stagecoach North (SN) property wells. The locations for these Stagecoach Vineyard (SV) wells are shown on Figures 1 and 2. As seen on Figures 1 and 2, the approximate distance to and direction from the nearest SS wells to the SN wells are as follows:

- Well SN-1: offsite Well SV-4 lies 900 ft to the southeast; offsite Well SV-15 is 2,130 ft to the southwest; and offsite Well SV-14 is 2,310 ft to the south.
- Well SN-2: offsite Well SV-4 is 530 ft to the south; offsite Well SV-17 is 2,100 ft to the southeast; and Well SV-9 is 2,440 ft to the southeast.

Thus, there are no known offsite wells that exist within 500 ft of the Stagecoach North wells. The nearest offsite well not owned by Stagecoach Vineyard is located approximately 1 mile to the southeast of Well SN-2.

LOCAL GEOLOGIC CONDITIONS

Figure 3, "Geology Map," illustrates the types, lateral extents, and boundaries between the various earth materials mapped at ground surface in the region by others. Specifically, Figure 3 has been adapted from the results of regional geologic field mapping of the Yountville Quadrangle, as published by the California Geological Survey (CGS) in 2005. As shown on Figure 3, key earth materials mapped at ground surface in the area from geologically youngest to oldest include the following:

a. Landslide deposits. Landslide deposits[1] (map symbol Qls) have been mapped by others in the region and also on the subject property (see the bright-yellow colored areas on Figure 3). Arrows within these mapped landslide areas show the general direction of the downslope movement within each landslide mass. As shown on Figure 3, small landslide outcrops are reportedly exposed at ground surface in the southeastern portion of the subject property near Wells SN-1 and SN-2. These landslide deposits are anticipated to be relatively thin in those areas of the property in which they reportedly have been mapped. Larger landslide masses have been mapped offsite, primarily in the hillsides further north and east of the property.

b. Sonoma Volcanics. The Sonoma Volcanics are comprised by a highly variable sequence of chemically and lithologically diverse volcanic rocks. These rock types include the following: dacitic flow-type rocks (map symbol Tsvdg); pumice breccia and pumice lapilli (map symbol Tsvdgp); andesitic flow-type rocks and flow breccias (may symbol Tsvasl); and ash flow tuff (map symbol Tsvt). As shown on Figure 3, andesitic lava flows and flow breccias (map symbol Tsvasl and shown in magenta colors) are exposed at ground surface across nearly the entirety of the subject property.

   Review of the driller's descriptions of the drill cuttings listed on the available driller's logs for Wells SN-1 and SN-2 reveals that while drilling both wells, typical rocks of the Sonoma Volcanics were encountered at each well site. Typical driller

[1] Note that it was not a part of our Scope of Hydrogeologic Services for this project to study, map, investigate, analyze, determine, or opine on the locations of these landslides, or on potential activity of the landslides, and/or on the potential impact that landslides might have on any of the onsite structures, or to any onsite wells used for the subject property.

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terminology for the drill cuttings on those logs included: “soft volcanics;” “hard black rock;” “hard, fractured black, green and brown rock;” “soft red volcanics;” “soft yellow ash.” Therefore, the Sonoma Volcanics are interpreted by RCS to extend to depths of at least 590 ft and 720 ft bgs in the vicinity of Well SN-2 and Well SN-1, respectively.

Franciscan Formation Greywacke. The geologically older (Cretaceous-aged) Franciscan Formation greywacke (map symbol KJfs) is exposed offsite at ground surface to the north of the subject property, as shown on Figure 3. These rocks consist mainly of well-consolidated to cemented, thickly bedded greywacke with minor amounts of thinly bedded shale. Based solely on RCS geologists interpretations of the driller’s descriptions of the drill cuttings listed on the available driller’s logs for Wells SN-1 and SN-2, these bedrock materials were not encountered in the subject boreholes for either of the two onsite wells and, instead, are interpreted to exist at depths greater than the drilled borehole depths of Wells SN-1 and SN-2. Hence, the Franciscan Formation is considered to underlie the Sonoma Volcanics at depths greater than approximately 700 ft beneath the Stagecoach North property.

LOCAL HYDROGEOLOGIC CONDITIONS

Earth materials exposed throughout the subject property can generally be classified into the following two basic categories, based on their relative ability to store and transmit groundwater to wells:

Potentially Water-Bearing Materials

The principal water-bearing materials beneath the subject property and its environs are represented by the hard, fractured volcanic flow rocks of the Sonoma Volcanics. The occurrence and movement of groundwater in these rocks tend to be controlled primarily by the secondary porosity within the rock mass, that is, by the fractures and joints that have been created in the harder volcanic flow-type rocks over time by various volcanic and tectonic processes. Specifically, these fractures and joints have been created as a result of the cooling of these originally molten flow rocks and flow breccias following their deposition, and also from mountain building or tectonic processes (faulting and folding) that have occurred over time after the rocks were erupted and hardened. Some groundwater can also occur in zones of deep weathering between the periods of volcanic events that yielded the various flow rocks, and also within the pore spaces created by the grain-to-grain interaction in the volcanic tuff and ash.

The amount of groundwater available at a particular drill site for a well constructed into the Sonoma Volcanics beneath the subject property would depend on such factors as:

- the number, frequency, size, continuity, and degree of openness of the fractures/joints in the subsurface.
- the degree of interconnection of the various fracture/joint systems in the subsurface
- the extent to which the open fractures may have been possibly in-filled over time by chemical precipitates/deposits and/or weathering products (clay, etc.)
- the amount of recharge from local rainfall that becomes available for deep percolation to the fracture systems

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- to a lesser extent, the size of the pore-spaces formed by the grain-to-grain interaction of volcanic ash particles

As stated above, the principal rock types exposed at ground surface on the subject property, and also known to be present in the subsurface beneath the property to depths of at least 600 to 700 ft, are a combination of hard, potentially well-fractured volcanic flow rocks of andesitic composition and volcanic tuffs and ash-flows. From our long-term experience with these harder flow rocks for numerous other water well construction projects in Napa County, pumping capacities in individual wells have ranged widely, from rates of 5 to 10 gpm, to rates of 200 gpm or more. Finer-grained, clay-rich, volcanic ash deposits and deeply weathered volcanic tuff units tend to have a much lower permeability and a potential to yield only limited groundwater flow rates to a new well.

Potentially Nonwater-Bearing Rocks

This category includes all geologically older and fine-grained sedimentary and/or crystalline rocks of the Franciscan Formation. These potentially nonwater-bearing rocks would underlie the volcanic rocks that exist beneath the subject property at depths greater than 590 ft to 720 ft bgs, depending on the location, as interpreted by RCS from the driller's descriptions listed on the available driller's logs for Wells SN-1 and SN-2.

In essence, these diverse rocks are well-cemented and well-lithified, and have an overall low permeability. Occasionally, localized conditions can allow for small quantities of groundwater to exist in these rocks wherever they may be sufficiently fractured or are relatively more coarse-grained. However, even in areas with potentially favorable conditions, well yields are often only a few gpm in these rocks, and the water quality can be marginal to poor in terms of total dissolved solids concentrations, and other dissolved constituents.

Geologic Structure

Several faults[2], as mapped by others, have been interpreted to exist in the vicinity of the subject property as shown by the dark-colored, solid and/or dashed lines on Figure 3 (CGS 2005). Also shown on Figure 3 are several fault traces of the "Soda Creek fault" and "Atlas Peak-Foss Valley lineament zone"; these fault traces, shown as green-colored lines, were mapped by the USGS in conjunction with the CGS in 2000 and are available as GIS files via the USGS "Quaternary Fault and Fold Database" website; none of these fault traces appear to transect the subject property. The possible impacts of these faults on groundwater availability in the region are unknown due to an absence of requisite data necessary to make that determination. Faults can serve to increase the number and frequency of fractures in the local volcanic rocks. If such fractures were to occur, they would tend to increase the amount of open area in the rock which, in turn, could increase the ability of the local volcanic rocks to store groundwater. Faults can also act as barriers to groundwater flow. However, it is unknown if these USGS and/or CGS mapped faults impact groundwater flow, as the spatially distributed water level data necessary to make such a determination are not available.

[2] Note that it is neither the purpose nor within our Scope of Hydrogeologic Services for this project to assess the potential seismicity or activity of any faults that may occur in the region

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PROJECT GROUNDWATER DEMANDS

For the purposes of this WAA, Wells SN-1 and SN-2 are considered to be the "project wells," as they will represent the only wells that will be used to meet water demands of the proposed new vineyard project. Since their construction in 2016, Wells SN-1 and SN-2 have been used to irrigate portions of the existing vineyards on the adjacent Stagecoach Vineyard property. The primary purpose of this periodic pumping was to keep the two Stagecoach North wells in good operating condition (i.e., preventing the wells from becoming stagnant and possibly encrusted with biological growths and/or slimes inside the well casing); and to diversify the pumping load on the Stagecoach Vineyard wells. Following permit approval and vineyard development for the Stagecoach North property, Wells SN-1 and SN-2 will be dedicated to the Stagecoach North property only, and will be the only wells used to meet irrigation demands of the proposed new vines on the subject property. Wells SN-1 and SN-2 will not be used to irrigate vineyards on the Stagecoach Vineyard property after Stagecoach North has been developed with vineyards.

Vineyard irrigation demands (met via groundwater pumped from Wells SN-1 and SN-2) for the proposed 91.3 acres of new vines for the Stagecoach North property were estimated by the vineyard manager to be the following:

- Estimated Average Annual Vineyard Irrigation Demand (provided by the Stagecoach by vineyard manager):

  = 82.7 gallons/vine/year * 1,815 vines/acre * 91.3 net acres of new vines
  = 13,704176 gallons/yr or 42.1 acre feet per year (AF/yr), or 0.46 AF/acre vine/yr

As discussed above, the Stagecoach North property is currently undeveloped and there are no existing onsite water demands. The adjacent Stagecoach Vineyard property to the south of the subject property is operated and managed by the same vineyard personnel that will manage Stagecoach North, thus it is expected that the two properties will be irrigated using relatively similar practices. Hence a comparison of the existing Stagecoach Vineyard water use to the estimated Stagecoach North water use is useful for the purposes of this document. Stagecoach Vineyard currently has a reported total planted vineyard acreage of 603 acres. Based on groundwater extraction records (totalizer meter readings) provided to RCS by Stagecoach personnel for the 2018 irrigation season, a total of 300 AF of groundwater was used to irrigate those 603 acres of existing vines on the Stagecoach Vineyard property; this represents a unit use of approximately 0.50 AF of groundwater per acre of vines. Note that as an industry standard, typical water use estimate for vineyard irrigation is on the order of 0.50 AF/ac/yr. This typical unit use is also reported in the Napa County WAA Guidelines (WAA 2015). Hence, the existing vineyard irrigation demand from the most recent irrigation season at the Stagecoach Vineyard is essentially the same as typical estimates of water use in the industry standards presented in the WAA Guidelines.

Therefore, RCS will assume that the vineyard irrigation demands for the proposed Stagecoach North vineyards will be approximately 0.50 AF/ac/yr. Thus, the total proposed water demand for the Stagecoach North vineyards is estimated by RCS to be approximately 45.7 AF/yr (0.50 AF/ac/yr times 91.3 acres of proposed vines).

As estimated by the Stagecoach Vineyard manager, due to the rocky soils at the Stagecoach North property (and other factors), the proposed new vines will require slightly more water during the initial four-year establishment period of newly planted vines than is required once the vines are mature. The vineyard manager estimates that approximately 20% more water than

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the average water demand of 0.5 AF/ac/yr will be necessary to irrigate the young vines than it would be for mature vines. Therefore, the proposed short-term average annual water demand during the four-year establishment period for the proposed new vines on the Stagecoach North property is calculated to be the following:

- Estimated Initial Establishment period Vineyard Irrigation Demand:
  = (20%) * (45.7 AF/yr) + (45.7 AF/yr)
  = (9.1 AF/yr) + (45.7 AF/yr)
  = 54.8 AF/yr (for four years), or 0.60 AF/ac/yr

Historic Water Use at Stagecoach Vineyard

In the September 2008 "Final Environmental Impact Report" prepared for the Stagecoach Vineyard development by Analytical Environmental Services (AES 2008), and in the supporting March 2007 report by RCS titled "Results and Analysis Of 48-Hour Constant Rate Pumping Test, Irrigation-Supply Well No. 12, Stagecoach Vineyard, Napa County, California" (RCS 2007) it was estimated by the Stagecoach vineyard managers at that time that Stagecoach Vineyard would require an estimated 0.33 AF/acre vine/year; recall that Stagecoach was under different ownership during that period. As mentioned above, groundwater volume extraction data (totalizer meter data) were collected over time by Stagecoach Vineyard staff. These data were tabulated by RCS to compare that previous estimate of water demand to actual groundwater use on the property for vineyard irrigation. Between 2014 and 2017, totalizer meter records reveal that annual groundwater use for the Stagecoach Vineyard ranged between 320 and 390 AF/year, or between 0.53 AF/ac/yr and 0.65 AF/ac/yr, respectively (assuming 603 total acres of vines were irrigated). Therefore, less groundwater was used in the 2018 irrigation season (0.50 AF/ac/yr) under the current project applicant's management than in the previous irrigation seasons for which totalizer data are available

The current owners and vineyard managers for Stagecoach have altered vineyard irrigation practices at the property to help increase water use efficiency. Changes implemented at Stagecoach Vineyard have led to reduced groundwater use at the vineyard when compared to use under the prior ownership.

PROPOSED PUMPING RATES

To determine an appropriate estimated combined pumping rate necessary from Wells SN-1 and SN-2, it will be assumed that the proposed vineyard irrigation demands (45.7 AF/yr) at the subject property will be required during a 24-week irrigation season each year (from May to October), with the wells pumping at roughly 10 hours each day; this is the typical irrigation schedule reported to RCS by the Stagecoach vineyard manager. Based on these irrigation schedule assumptions, and in order to meet the proposed vineyard irrigation demands of the vineyard project, Wells SN-1 and SN-2 would need to pump at a total combined rate of about 148 gpm to meet the estimated average annual vineyard irrigation demand of 45.7 AF/yr, and about 177 gpm to meet the four-year establishment period vineyard irrigation demand. These pumping rates assume that the Stagecoach North wells would be pumped 10 hours/day, 7 days/week, during the entire 24-week irrigation season each year (as projected by the vineyard manager). This equates to a 42% operational basis during the irrigation season. Pumping rates and pumping water level data reported by LGS for the constant rate testing in April 2018 of Wells SN-1 and SN-2 show that the wells were successfully pumped for 48 continuous hours at average rates of 54 gpm and 154 gpm, respectively. Thus, it appears the combined pumping

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rates of the two project wells (204 gpm) is more than sufficient to meet the instantaneous groundwater flow demands required for the vineyard development project during each 24-week irrigation season described above during both the establishment period and the long term average irrigation period.

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Long-term rainfall data are essential for estimating the average annual recharge that may occur at the Stagecoach North property. Average annual rainfall totals that occur specifically at the Stagecoach North are not directly known, because there is no onsite rain gage. Rainfall data are collected at the Stagecoach Vineyard property, however. Data for this Stagecoach Vineyard rain gage are available between August 2011 and August 2016. The average annual rainfall for this 5-year period was calculated to be 23.2 inches (1.93 ft). Rainfall data are not available for the period between September 2016 and January 2018 because the company that maintained the gage and stored the data is no longer in business; Stagecoach staff is working to receive those data from that company. The rain gage was subsequently replaced in 2018. Because the period of rainfall record for this gage is relatively short-term (5 years), and were collected during a period of significant statewide drought[3] (DWR 2015), and are missing recent data, RCS does not consider the data from this gage to be representative of the long-term average water rainfall in the vicinity of the Stagecoach North property.

Rainfall data also exist for the nearby "Atlas Peak" rain gage, which is located roughly 4 miles southeast of the subject property. Data for this rain gage are available from the California Data Exchange Center (CDEC) website; this website is maintained by the DWR. Data from the CDEC website for this gage are available beginning in water year (WY) 1987-88 (October 1987 – September 1988), but WY 1988-89, WY 1994-5, WY 1995-9, WY 2004-05, and WY 2006-07 appear to have erroneous and/or missing data. RCS removed these erroneous and/or missing rainfall data before calculating an average water year rainfall for this gage; no rainfall data were "added" to the data set. With these assumed erroneous data points removed from the data set, then an average water year rainfall of 40.3 inches (3.36 ft) is calculated at this gage from WY 1998-89 through WY 2017-18. This rain gage is located at a similar elevation (±1,690 ft asl) to that of the Stagecoach North property (between ±1,600 ft and ±2,100 ft asl, depending on location on the property), and therefore the average annual rainfall at the subject property could be similar to that experienced at this known gage location.

The Napa One Rain website also provides rainfall for a rain gage labeled as "Atlas Peak," located approximately 4 miles southeast of the subject property; the Napa One Rain website is maintained by Napa County. This gage is reported to be located near and at a similar elevation as the CDEC Atlas Peak rain gage discussed above, but it is unclear if the two gages are the same. Data for this Napa One Rain Atlas Peak rain gage are only available for the relatively short period of WY 2007-08 through WY 2017-18. The average water year rainfall at this Napa One Rain Atlas Peak rain gage is calculated to be approximately 37.8 inches (3.15 ft). Because the period of rainfall record for this gage is short (11 years) and includes 7 years of drought (as defined by DWR), RCS does not consider the data from this gage to be representative of the long-term average water year rainfall in the vicinity of the Stagecoach North property.

The nearest rain gage to the Stagecoach North property known to RCS with a significantly longer data record is located approximate 13 miles south at the Napa State Hospital. The data

[3] This definition of drought is discussed herein under the heading "Possible Effects Of 'Prolonged Drought'"

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for this gage are available from the Western Regional Climate Center (WRCC 2018) website. For this rain gage, the period of available record is listed as January 1893 through September 2018; data for this gage are listed by calendar year, not water year. Note that there are several missing months and/or years of rainfall data missing between 1897 and 1902, and between 1915 and 1916. For the available period of record, the average (mean) annual rainfall at this Napa State Hospital gage is reported to be 24.7 inches (2.06 ft). This rainfall gage is located at a lower elevation (±60 ft asl) than that of the subject property, and therefore the average annual rainfall at the subject property is likely to be higher than that experienced at this known gage location. Also, because this rain gage is located roughly 13 miles south of the subject property, it is less likely that these data are representative of the long-term average annual rainfall at the subject property.

To help corroborate the average water year rainfall data derived from the CDEC and/or Napa One Rain gages, RCS reviewed the precipitation data published by the PRISM Climate Group at Oregon State University. This data set, which is freely available from the PRISM website contains "spatially gridded average annual precipitation at 800m grid cell resolution." The date range for this dataset includes the climatological period between 1981 and 2010. These gridded data provide an average annual rainfall distributed across the subject property. Using this data set, RCS determined that the average rainfall for the subject property for the stated date range is approximately 38.7 inches (3.23 ft).

An additional rainfall data source, an isohyetal map (a map showing contours of equal average annual rainfall) was prepared by the County for all of Napa County, and is freely available for download from the online Napa County GIS database (a copy of this map is not provided herein). As described in the metadata for the file (also available via the download page at the web link shown above), the isohyets are based on a 60-year data period beginning in 1900 and ending in 1960. As stated in the metadata for the file, the contour interval for the map is reported to be "variable due to the degree of variation of annual precipitation with horizontal distance", and therefore the resolution of the data for individual parcels is difficult to discern. The subject property appears to be situated within the boundaries of the 35-inch average annual rainfall contour on the County map. Thus, based our interpretation of this actual isohyetal contour map, the long-term average annual rainfall at the subject property may be on the order of 35 inches (2.92 ft), using these rainfall data.

Table 2, "Comparison of Rainfall Data Sources," provides a comparison of the data collected from the different rainfall sources discussed above. Based on those rainfall data sources and as summarized on Table 2, RCS will consider the long-term average annual rainfall at the subject property is 35 inches (2.92 ft), as derived from the Napa County isohyetal map. The 35-inch per year estimate is based on the data source with a relatively long period of record (60 years) when compared to the nearby rainfall data sources discussed above that exist at different elevations; and/or are located at a significant distance from the subject property; and/or have a shorter period of available data. Other rain gage sources that appear to be more proximal and/or site-specific to the subject property, including the Atlas Peak rain gage and PRISM data set, lists average rainfall amounts that are higher than the 35 inches per year. Thus, our rainfall recharge calculations presented herein are considered to be conservative.

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ESTIMATES OF GROUNDWATER RECHARGE

Groundwater recharge on a long-term average annual basis at the Stagecoach North property can be estimated as a percentage of average rainfall that falls on the subject property and becomes available to deep percolate into the aquifer systems underlying the property over the long-term. The actual percentage of rain that is able to deep percolate can be variable, based on numerous conditions, such as the slope of the land, the soil type that exists at the property, the evapotranspiration that occurs on the property, the intensity and duration of the rainfall, etc. Therefore, RCS has considered various analyses of deep percolation into the rocks of the Sonoma Volcanics, as relied upon by other consultants and government agencies for prior projects in Napa Valley.

Recharge volumes estimated herein are based on the long-term average annual rainfall values determined for the subject property using the available rainfall data presented above. Note that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall that occurred during the period over which the average was calculated. Therefore, the following recharge calculations also include consideration of drought year conditions.

Historic Nearby Rainfall Recharge Estimates.

A Draft Environmental Impact Report (DEIR) was prepared by Analytical Environmental Services (AES) in 2007 for the Stagecoach Vineyard Erosion Control Plan (ECP) titled "Stagecoach Vineyards Erosion Control Plan, Application No.P06-0042-ECPA". RCS prepared a report for that EIR effort titled "Results and Analysis of 48-Hour Constant Rate Pumping Test, Irrigation-Supply Well No. 12, Stagecoach Vineyards, Napa County, California" (dated March 2007). Therein, RCS estimated that 7% of the long-term average annual rain that fell on the Stagecoach Vineyard property would become available to deep percolate into the groundwater beneath that property. That estimate was based on a number of references available at that time, including USGS Water Resources Investigation 77-82 (USGS 1977), and USGS Water-Resources Investigations Report 03-4229 (USGS 2003). Since then, multiple new hydrologic and hydrogeologic studies have become available for the area that suggest the 7% deep percolation rate estimated in 2007 is quite conservative.

Updated Napa County Hydrogeologic Conceptual Model (LSCE&MBK, 2013)

Estimates of groundwater recharge as a percentage of rainfall were presented for a number of watersheds (but not all watersheds) in Napa County in the report titled "Updated Napa County Hydrogeologic Conceptual Model" (LSCE&MBK, 2013) prepared for Napa County. Watershed boundaries within Napa County are shown on Figures 8-3 and 8-4 in that report. At the request of RCS, those watershed boundaries were provided to RCS by MBK Engineers (MBK). Figure 4, "Watershed Boundaries," was prepared for this project using those watershed boundaries for which data are available. As shown on Figure 4, the subject property is located within the watershed referred to by MBK as the "Napa River Watershed near Napa." As shown on Table 8-9 on page 97 of the referenced report (LSCE&MBK, 2013), 17% of the average annual rainfall that occurs within this watershed was estimated to be able to deep percolate as groundwater recharge. Note that, as shown on Table 8-8 of LSCE&MBK (2013), several sub-watershed areas are tributary to the "Napa River Watershed near Napa."

As stated above, the total surface area of the subject property is 169.6 acres. Assuming a conservative amount of 35 inches (2.92 ft) of rainfall occurs on the subject property on a long-

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term average annual basis, then the total volume of rainfall that would fall each year directly on the property over the long term would be approximately 495.2 AF/yr (169.6 acres x 2.92 ft). Assuming 17% of that average annual rainfall volume would be able to deep percolate to the groundwater beneath the subject property over the long term, then the average annual groundwater recharge at the subject property would be approximately 84.1 AF/yr. This estimated annual recharge volume is greater than the total estimated future (proposed) average annual groundwater demand of 45.7 AF/yr, and short-term (establishment) average annual groundwater demand of 54.8 AF/yr.

A slightly more site-specific estimate of the deep percolation of rainfall at the Stagecoach North property can be made using the data from the LSCE&MBK (2013) reported in conjunction with the PRISM rainfall data set. Figure 5A, "Watershed Geology," shows the same watershed boundaries (LSCE&MBK 2013) shown on Figure 4, but it has been superimposed on a geologic base map of the region (USGS 2007); Figure 5B shows the geologic legend for that map. Importantly, a brown line is shown on the map that separates the alluvial deposits of the Napa Valley from the hillside areas of the County; this brown line is adapted from DWR Bulletin 118-03 (DWR 2003). The tan to light yellow-colored areas within the brown line along the floor of Napa Valley represent the Napa Valley subbasin of the Napa-Sonoma Valley Groundwater Basin, as defined in that DWR report.

As discussed above, the referenced report (LSCE&MBK 2013) estimated that 17% of the average annual rain that falls within the "Napa River Watershed near Napa" is available to deep percolate to recharge the groundwater. It is likely that, in reality, the percentage of rainfall that deep percolates into the alluvial deposits of the valley floor portion of the "Napa River Watershed near Napa" is higher than the percentage of rainfall that deep percolates into the geologic materials that are exposed throughout the hillside areas of the watershed. The total area of the brown-colored groundwater basin boundary within the "Napa River Watershed near Napa" shown on Figure 5A is roughly 45.6 square miles (sq mi). The remainder of the "Napa River Watershed near Napa" that is not underlain by the brown-outlined groundwater basin is comprised by a total of 170.3 sq mi. By assuming that the deep percolation percentage of rainfall onto the groundwater basin portion of the watershed (underlain by alluvium) is higher than it is in other portions of the watershed that are underlain by different geologic materials, then an adjusted estimate of the appropriate percentage of infiltration in the hill and mountain areas can be calculated. To do so, the amount of rain that falls in each of the areas must be determined. This can be accomplished using a PRISM dataset and the GIS system defined above. Because the PRISM dataset is spatially distributed for equal-sized areas throughout the County, then the average rainfall can be calculated for any size or shaped area within the County. Using the PRISM data set, and the assumptions stated above, Table 3, "Calculation of Theoretical Rainfall Recharge Percentage, Napa River Watershed near Napa," was created to determine the approximate percentage of rainfall that may be available for deep percolation.

As shown on Table 3, and assuming the average rainfall as calculated using the PRISM data set, three scenarios are presented in which the deep percolation percentage on the floor of Napa Valley is adjusted to values higher than 17%. The results of the three scenarios listed on Table 3 are as follows:

- Scenario 1 assumes a valley floor (alluvium) deep percolation percentage of 20%, with a resultant deep percolation percentage for the volcanic rocks in the adjoining hill and mountain area of the watershed of 16%.

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- Scenario 2 assumes the deep percolation of rainfall in the alluvium is 25%, then the percentage of rainfall that is calculated to deep percolate at the subject property (and throughout the remaining watershed) is 15%.
- Scenario 3 assumes a deep percolation percentage in the alluvium of 30%, and this yields a deep percolation percentage into the volcanic rocks in the adjoining hill and mountain areas of 14%.

Therefore, based on the analyses presented in Table 3, a value of 14% is an appropriate estimate for the percentage of rainfall that could become available to deep percolate to recharge the groundwater beneath each subject property. Assuming a deep percolation of rainfall volumes of 14%, and using the known surface area of the subject property, then the average annual groundwater recharge at the Stagecoach North property is estimated to be 69.3 AF/yr (169.6 acres x 2.92 ft of rainfall x 14% deep percolation). This recharge estimate is also greater than the long-term and short-term average annual groundwater demand for the subject property (45.7 and 54.8 AF/yr, respectively).

Note that a Water Availability Analysis was prepared by RCS in support of an EIR for the nearby Bloodlines LLC Vineyards Erosion Control Plan Project (#P16-00090-ECPA); that Draft EIR (DEIR) was recently circulated for public comment in December 2018. The Bloodlines LLC "northern property" as described in the DEIR is located on a parcel contiguous with the east side of the Stagecoach Vineyard property, and is underlain by similar types of volcanic rocks. RCS used the same methodology described above to estimate a rainfall recharge percentage for that property.

USGS Basin Characterization Model (USGS 2014)

Another source for estimates of deep percolation data can be derived from "Basin Characterization Model" (BCM) data published by the United States Geological Survey. This Basin Characterization Model (BCM) data "provides historical and projected climate and hydrology data at a 270-meter resolution" (USGS 2014). The model is described as grid-based, and includes calculations using precipitation runoff, recharge, and evapotranspiration for each of the grid cells; the grid cells are reported to be 18 acres in size (USGS 2014). Importantly, because these data are grid-based and are spatially distributed throughout the entire state of California, calculations can be performed for any polygon (such as for the Stagecoach North property boundaries) within the dataset using GIS software.

Spatially-gridded data sets from the BCM for average precipitation (BCM data variable "ppt") and model-derived calculations of recharge (BCM data variable "rch") were downloaded via the California Landscape Conservation Cooperative Climate Commons Website (http://climate.calcommons.org/). These data sets represented the 30-year historical averages for dates ranging from 1981 through 2010.

An assessment of the groundwater recharge potential (as a percentage of rainfall) for the watershed-wide assessment of the Rector Reservoir Watershed can also be made using the BCM data. Such use is consistent with the recommended "watershed-scale evaluations" described in the "limitations of use" section of the document that is distributed with the BCM

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dataset[4]. Figure 6, "Rector Reservoir Watershed Map" illustrates the approximate watershed area that is tributary to the Rector Reservoir. The watershed boundary shown on Figure 6 was derived from GIS data available from the California Department of Forestry and Fire Protection (CDFFP 1999).

Using the watershed boundaries of Rector Reservoir watershed and zonal statistics calculations in GIS software, the BCM dataset was used to calculate an average annual rainfall total and an annual average recharge volume. The results of those calculations are presented in Table 4 "Watershed-scale Calculated Rainfall Recharge Percentage Using BCM Dataset". Then, the boundaries of the "Napa Watershed near Napa" were used in a similar analysis, and are also presented in Table 4. As shown in Table 4, the watershed-scale calculations using the BCM data suggest that the calculated rainfall recharge percentage for the "Rector Reservoir Watershed" is roughly 93% of the calculated rainfall recharge percentage for the "Napa River Watershed near Napa" (this is calculated as 28% ÷ 30% = 93%). This same ratio between the larger "Napa River Watershed near Napa" watershed and the smaller "Rector Reservoir Watershed" can be applied to the actual calculated data presented in the LSCE&MBK 2013 report. In Table 8-9 of that LSCE&MBK 2013 report, the rainfall deep percolation percentage for the "Napa River Watershed Near Napa" was estimated to be 17%. Taking 93% of the LSCE&MBK-reported percentage (17%) yields a deep percolation percentage of 15.8% for the "Rector Reservoir Watershed" in which the Stagecoach North property is located. This value is larger than the 14% deep percolation percentage calculated above, and helps corroborate the use of a 14% value.

ESTIMATE OF GROUNDWATER IN STORAGE

To help evaluate possible impacts to the local volcanic rock aquifer system(s) that may occur as a result of pumping for the proposed project, the volume of groundwater extracted for the project can be compared to an estimate of the volume of groundwater currently in storage strictly beneath the subject property. To estimate the amount of groundwater currently in storage beneath the subject property, the following parameters are needed:

a) Approximate surface area of property = 169.6 acres

b) Depth of Well SN-2 = 560 ft bgs; Well SN-2 is the shallower of the two wells on the subject property, and thus construction data for this well provide a more conservative estimate of the minimum thickness of currently saturated rocks with the Sonoma Volcanics that might exist beneath the property. Based on the depth of Well SN-1, and on the data listed on the driller's log for Well SN-1, rocks of the Sonoma Volcanics likely extend to a greater depth than that of Well SN-2, and thus, it is likely that the saturated zone beneath the property could extend deeper than is estimated using well SN-2 data.

c) To present a conservative calculation of groundwater in storage, RCS has assumed that the current saturated thickness of the aquifer(s) beneath the subject property is approximately 310 vertical feet. This value is calculated using Well SN-2 data by

[4] In the "limitations of use" section of the document that is distributed with the USGS BCM (2013) data, the statement is made that "The user of this data should be aware that these model outputs are intended for watershed-scale evaluation. Use of the data for analyses at a scale smaller than the planning watershed is not intended and could yield misleading results."

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subtracting the RCS-measured SWL of 251 ft bgs in this well (measured on April 26, 2018) from the reported depth to bottom of the perforations in the well at 560 ft bgs. Based on the available water level data presented in this report, this April 2018 SWL is the deepest SWL measured by RCS geologists for this well since its construction in 2016, and thus this value is used for this calculation to provide a conservative analysis of the minimum volume of groundwater currently in storage beneath the property. Further, as discussed in subpart (b) above, the saturated volcanic rock aquifers beneath the subject property, based on water level data from the other onsite well (Well SN-1), is actually much thicker; this would tend to create an even greater volume of groundwater in storage in that area.

d) Approximate average specific yield of the Sonoma Volcanics = 2%. The specific yield is essentially the ratio of volume of water that drains from the saturated portion of the geologic materials (due to gravity) to the total volume of rocks. Specific yield of the Sonoma Volcanics can vary greatly depending on a number of factors, including the degree and interconnection of the pore spaces and/or fracture zones within the rocks. A conservative estimate by Kunkel and Upson for the specific yield of the Sonoma Volcanics ranges from 3% to 5% (USGS 1960). For other nearby properties for which RCS has performed similar analyses, an even more conservative estimate for specific yield of 2% was used. Hence, to present a conservative analysis, we will assume a specific yield of 2% for the Sonoma Volcanic rocks that underlie the subject property, but the actual value, in reality, could be higher.

e) Thus, a conservative estimate of the groundwater currently in storage (S), beneath the subject property (as of April 2018) is calculated as:

S = property area (a, above) times current saturated thickness (c, above) times average specific yield (d, above) = (169.6 ac)(310 ft)(2%) = 1,052 AF

In contrast, the average annual groundwater use and the short-term (establishment) period groundwater use for the property are estimated to be 45.7 and 54.8 AF/yr, respectively. Hence, the estimated groundwater demand for the proposed project represents only about 4% to 5% of the groundwater conservatively estimated to currently be in storage in the volcanic rocks beneath the subject property based on water level data for April 2018. Furthermore, this percentage does not include annual groundwater recharge that will occur from rainfall into the onsite aquifers. Based on the foregoing, the estimated groundwater demands of the proposed project and the entire subject property should not cause a net deficit in the volume of groundwater within the aquifers beneath the site so as to impact nearby wells to a point they would not support permitted land uses.

POSSIBLE EFFECTS OF "PROLONGED DROUGHT"

California has experienced a number of periods of extended drought throughout its history. Here, drought is defined as a meteorological drought, that is, a period in which the total annual precipitation is less than the long-term average annual precipitation (DWR 2015). For similar projects in the County, Napa County PBES has asked RCS to consider what the effects on groundwater availability at a particular property might be if a period of "prolonged drought" were to occur in the region, assuming the project were to operate in the future as described herein. Recharge volumes estimated in this document are based on the long-term average rainfall

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values determined for the subject property using available data. Recall that a calculation of average annual rainfall for any long-term period always includes periods of below-average rainfall and above-average rainfall that occurred during the period over which the average was calculated. Therefore, it is our opinion that the preceding calculations do inherently include consideration of drought year conditions.

However, to help understand what potential conditions might exist in the local volcanic rocks beneath the property during a "prolonged drought period", a "prolonged drought" must be defined. As discussed by DWR, "there is no universal definition of when a drought begins or ends, nor is there a state statutory process for defining or declaring drought" (DWR 2015). California's most significant historical statewide droughts were defined by DWR as occurring during the following periods (DWR 2015):

- WY 1928-29 through WY1933-34 – six years
- WY 1975-76 through WY 1976-77 – two years
- WY 1986-87 through WY 1991-92 – six years
- WY 2006-07 through WY 2008-09 – three years
- Recent drought – WY 2011-12 through WY 2015-16[5] – five years

Table 5, "Drought Period Rainfall as Percentage of Average," shows the average amount of rainfall that occurred during each drought period for which rainfall data exist at the three rain gages discussed above (under the heading "Rainfall") and shown on Table 2; that drought period rainfall amount is also expressed on Table 5 as a percentage of the total rainfall that occurred.

As shown on Table 5, the amount of rain that might fall during a "prolonged drought" is variable, and would depend on the period of record for the specific rain gage. Clearly, the WY 1975-76 to WY 1976-77 drought period recorded by the Napa State Hospital rain gage and reported by the WRCC had the lowest drought period rainfall at 48% (drought period average was 11.8 inches), compared to the long-term average (24.7 inches), and it lasted two years. The WY 1928-29 to WY 1933-34 drought period lasted for six years, but rainfall during this drought was 70% of the average annual rainfall at the WRCC rain gage. It is important to note that the drought year percentage listed on Table 5 is completely dependent on the period of record for each individual gage. An example of this is the Napa One Rain gage data; because the period of record for this gage is short, and includes many drought years, then the last available drought year period (WY 2011-12 to WY 2015-16) rainfall percentage is shown to be 89% of the long-term average.

Hence, for the purposes of this analysis, we will assume the following in regard to the "prolonged" drought period:

- A "prolonged" drought period rainfall is conservatively considered to be 48% of the average annual rainfall that occurs in the region (using the rainfall data from the WRCC Napa State Hospital rain gage).

[5] The DWR 2015 drought document was published in February 2015, and lists the recent significant drought through the 2013-14 water year only; the drought continued throughout the State into WY 2015-16. Due to the rains in WY 2016-17, various sources, including the National Drought Mitigation Center website (NDMC 2018), declared an end to the drought in Northern California in 2017, which included Napa County. As of November 30, 2018, the area of Napa County in which the subject property lies, is currently mapped as "moderate drought."

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- A “prolonged drought period” is estimated to last 6 years, which is the longest drought period on record according to DWR (DWR 2015); see Table 5. This six-year period is a conservative estimate, because the 48%-average figure corresponds with a two-year drought period, not a six-year drought period.
- The first four years of the “prolonged drought period” will coincide with the four-year establishment period for the new vines at the Stagecoach North property during which groundwater for irrigation is higher than all subsequent years when the vines are mature.

To meet six years of estimated groundwater demand for the subject property, a total onsite groundwater extraction of 310.6 AF is estimated to be required for the subject property (54.8 AF/yr times 4 years plus 45.7 AF/yr times 2 years). Assuming groundwater recharge is reduced to 48% of the average annual recharge during such a theoretical “prolonged drought period”, then the resulting groundwater recharge that might occur during the six-year drought period for the subject property is calculated as follows:

- As shown herein under the heading “Estimates of Groundwater Recharge,” a conservative estimate of the average annual groundwater recharge at the subject property is estimated to be 69.3 AF/yr. Taking 48% of this annual volume yields a drought period recharge volume of 33.3 AF/yr.
- Assuming a drought period duration of 6 continuous years, then a total of 199.8 AF (33.3 AF/yr times 6 years) of water would be available to recharge the volcanic rocks beneath the property by virtue of deep percolation of the direct rainfall that occurs solely within the boundaries of the subject property.

Therefore, assuming a theoretical six-year drought period in which only 48% of the average annual rainfall might occur, a conservative estimate of the total drought-period recharge at the subject property (199.8 AF) would be less than the estimate of total onsite groundwater demand (310.6 AF) that may occur over the same 6-year period (assuming the vineyards are initially established during the first year of the “prolonged” drought). With those estimated water demands, there is total recharge “deficit” of about 111 AF that might occur (calculated by subtracting the 199.8 AF of groundwater recharge over the entire 6-year period from 310.6 AF of total onsite groundwater extractions over the entire 6-year period). Water to meet this deficit would be (and is) available during drought periods from the 1,052 AF of groundwater currently estimated to be in storage beneath the subject property.

As conservatively estimated above, 1,052 AF of groundwater are currently in storage beneath the property (using water levels measured in April 2018). Hence, the theoretical six-year long drought period groundwater “recharge deficit” of 111 AF would represent about 11% of that volume of groundwater calculated to currently be in storage beneath the property. Temporarily removing an average of 18.5 AF of groundwater from storage for six consecutive drought years (approximately 111 AF of “deficit” over the entire 6-year period) may cause water levels to decrease somewhat beneath the subject property, but removal of such a relatively small percentage of groundwater from storage over an entire 6-year period of time is not expected to significantly impact groundwater levels beneath the property. Again, this drought analysis is quite conservative, and assumes an extreme drought (48% of average rainfall occurring every year for six consecutive years) that coincides with the initial planting of the Stagecoach North vineyard, when water demands during the “establishment period” are highest.

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CUMULATIVE IMPACT ANALYSIS

Cumulative Impact Area

For a similar project in the area for which RCS provided services, the Napa County PBES requested that RCS provide a cumulative assessment of groundwater resources in the region. Further, PBES recommended that RCS consider all existing and proposed projects in the northern half of the "Rector Reservoir Watershed." RCS believes that assessment area is appropriate for this project, and that area is defined herein as the Cumulative Impact Area (CIA) for the project. The resulting CIA is shown on Figure 7, "Cumulative Impact Area," and is adapted from the Rector Reservoir Watershed Boundary. RCS obtained the Rector Reservoir Watershed Boundary from GIS data available from the website of the California Department of Forestry and Fire Protection (http://frap.fire.ca.gov/data/frapgisdata-sw-calwater_download). Also shown on Figure 7 are the subject property boundaries, as well as existing offsite residences, and the boundaries of offsite existing and planned vineyard and orchard areas. The entire CIA, as defined herein, including the Stagecoach North property, encompasses as area of approximately 4,198 acres.

In general, the CIA has been developed with various residences, vineyards, and a small amount of orchards. The Stagecoach North property is currently undeveloped. Table 6, "Summary of Cumulative Impact Area (CIA)," was prepared to summarize the key site-specific information that was used to perform our CIA analysis. Data used to compile and create this table were generated from information provided to RCS by Stagecoach personnel and/or GIS data and information, for parcels, land-use type, and agriculture (i.e., vineyard and orchards), as available from the Napa County GIS website. Per discussions with the Napa County GIS Department Coordinator Mr. Matt Lamborn, GIS boundary data for vineyard and orchard areas included on Figure 7 are current through October 2018. Future and/or planned ECP vineyard areas were also provided to RCS by Mr. Lamborn; these data are reportedly current through July 2018. The lateral extent of these ECP areas generally coincide with those vineyard areas shown on Figure 7 (existing vineyard areas are shown in purple, whereas ECP areas are shown in light blue), but some of those ECP areas are larger than the visible vineyard areas. To present a conservative analysis, RCS geologists included those ECP areas outside the visible vineyard areas shown on Figure 7 as existing vineyard areas; this assumption likely overestimates the actual existing vineyard acreage in the watershed. Note that some of the ECP areas when viewed on an aerial photo appear to be in areas where either RCS is confident there is no future vineyard planned (as with some of the Stagecoach Vineyard ECP areas), and/or it appears that development is unlikely (due to topography, areas located in drainage, etc.). In reality, these areas will likely never be developed, and by including those areas, RCS is providing a more conservative analysis. Also, orchard areas are shown in a green color on Figure 7.

Notable on Figure 7 and Table 6 are the following:

- An estimated total of 34 single-family residences were determined to exist within the CIA based on land use data available from the Napa County GIS website. It assumed that each of these residences meets its domestic demands via groundwater pumped from an onsite water well(s). Note that there are no existing residences nor any planned future residences for the Stagecoach North property.
- The total estimated "agricultural" acreage within the CIA is 1,230 acres, and includes the following:

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- The Stagecoach Vineyard property is currently developed with 603 acres of planted vines, per the vineyard manager.
- The total acreage of existing vineyards within the CIA (not including the Stagecoach Vineyard property) was estimated to be approximately 356 acres, based on GIS data from Napa County (current through October 2018).
- The estimated acreage of planned and/or future ECP areas outside of the existing vineyards in the CIA is approximately 266 acres (through July 2018).
- The total acreage of orchards (as of October 2018) within the CIA is shown to be approximately 5 acres.

Each single family residence is conservatively estimated to require approximately 1 AF/yr. Based on the total estimated "agricultural" acreage of approximately 1,230 acres, current groundwater demands for irrigation purposes in the CIA are estimated to be 615 AF/yr, assuming that 0.5 AF/ac/yr of groundwater is required for agricultural irrigation, per WAA Guidelines (WAA 2015). Because there are 34 residences within the CIA, approximately 34 AF/yr of water are also required. Hence, the total estimated groundwater demand within the CIA could be approximately 649 AF/yr. For comparison, the Stagecoach North project has a proposed groundwater demand of 45.7 AF/yr. This represents an increase of roughly 7% of the total groundwater use within the CIA. With the proposed project, the total CIA demand during an average year is estimated to be 694.7 AF/yr. This total increases slightly to 703.8 AF/yr during the four-year vineyard "establishment" period at Stagecoach North.

Using the same assumptions employed to estimate recharge for the Stagecoach North property, RCS estimated the average annual groundwater recharge within the entire CIA. Assuming rainfall occurs within only the boundaries of the entire CIA, the amount of potential groundwater recharge to the entire CIA is estimated as follows:

a) CIA area = 4,198 acres (includes the 169.6-acre Stagecoach North property)

b) Average annual rainfall = 35 inches (2.92 ft)

c) Average annual rainfall onto the CIA = a * b = 12,258 AF

d) Estimated percentage of rainfall that might be available for deep percolation and become groundwater = 14% of the long-term average annual rainfall onto the CIA = 0.14 * 12,258 AF/yr = 1,716 AF/yr

Effect of Ground Slope Angle on Recharge Potential

Any estimate of the percentage of rainfall that becomes available for deep percolation that relies on estimates of rainfall, evapotranspiration, and surface water outflow for an entire watershed (such as those estimates provided by LSCE&MBK 2013), inherently includes the effects of slope angle in the estimate. However, to provide a more complete consideration of the potential effects of ground slope angle on groundwater recharge in the CIA, analysis of those effects is provided below.

Many basic geologic references assume that recharge potential is reduced on steeper slopes, as steeper slopes can increase surface water runoff rates, and therefore less time is available for rainfall to deep percolate. On page 56 of LSCE&MBK 2013, it is asserted that deep percolation recharge from rainfall is "significantly reduced" for land areas with slope angles greater than 30 degrees. On page 11 of LSCE&MBK 2013, an assessment of slope angles

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(inclinations) greater than 30 degrees is also mentioned, and this was attributed to a prior LSCE report, namely "LSCE 2011" therein; that document is likely to be the reference listed as "2011a" on page 134 of LSCE&MBK 2013. In that referenced document (LSCE 2011), the statement is made on page 29 that "Areas in which the slope of the land surface exceeds 30 degrees, beyond which recharge potential is significantly reduced…" No other references or data are presented in any of the above-referenced documents to quantify the qualitative description of "significantly reduced." Because the various factors that affect groundwater recharge are likely interrelated (Yeh 2009), assigning a value to define the amount to which recharge on steep slopes is diminished is extremely difficult. No references were reviewed by RCS that quantify the possible reduction of deep percolation that might occur as a function of slope angle/percentage.

Estimates of the deep percolation of rainfall for the entire "Napa River Watershed near Napa" were based on water balance calculations by others that included rainfall throughout the entire watershed. As discussed above, those watershed-scale calculations inherently include all slopes within the watershed, including slopes greater than 30 degrees. Therefore, to evaluate the specific recharge potential of the CIA and to also include assumptions about the varying recharge potential based on slope, then the deep percolation percentage used for slopes less than 30 degrees within the entire watershed would have to be increased to offset the decrease in the percentage for slopes greater than 30 degrees. When factoring in ground surface slope to our estimates of rainfall recharge for the CIA portion of the Rector Reservoir Watershed, it was determined that approximately 305 acres of the 4,198 total acres of the CIA consist of slopes greater than greater than 30 degrees; note that no portion of the subject property is considered to have slopes greater than 30 degrees.

Table 7, "Estimated Recharge Based on Slope Deep-Percolation Assumption", shows a range of values for different assumptions for the amount of deep percolation that might occur on slopes greater than 30 degrees in the CIA. To create Table 7, deep percolation values were first calculated for the entire "Napa River Watershed near Napa." That is, the deep percolation percentage for the slopes within the watershed that are less than 30 degrees were increased to offset the diminished deep percolation percentage for the slopes greater than 30 degrees. A range of values were calculated assuming a range of "diminishment factors" of 25%, 50%, 75%, and 100%. Once the deep percolation percentages for slopes less than and greater than 30 degrees were calculated for the entire watershed, then those same resultant percentages shown on Table 7 were applied to the CIA.

If the assumption is made that deep percolation that occurs on the approximately 305 acres is diminished by a factor of 100% (i.e., no deep percolation occurs), then the average annual recharge that is estimated to occur in the CIA would be approximately 1,824 AF/yr; this calculation assumes the average annual rainfall for the entire CIA is approximately 35 inches per year. This recharge estimate is much larger than the average CIA groundwater demands of approximately 694.5 AF/yr, and larger than the 703.8 AF/yr estimated to be necessary during the short-term vineyard irrigation period at the proposed Stagecoach North property.

As discussed above, during a significant drought year, it is conservatively estimated that 48% of the long-term average annual rainfall may occur on the CIA. Assuming groundwater recharge is reduced to 48% of the average annual recharge during a six-year theoretical "prolonged drought period", then a total of approximately 5,253 AF of groundwater recharge might occur during the six-year drought period on the CIA. To meet six years of the estimated average annual groundwater demand for the CIA, a total groundwater extraction of 4,222.8 AF/yr is estimated to

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be needed for the CIA (703.8 AF/yr time six years) ", assuming the drought coincides with the four-year establishment period at Stagecoach North. Thus, the estimated water demand of the CIA (including the project) represents about 80% of the total rainfall recharge during a theoretical six-year "prolonged" drought. The proposed water demands of the Stagecoach North property alone over a similar six-year period (310.6 AF total) represent only 5% of the recharge volume estimated for the CIA during this theoretical six-year drought period.

Rector Reservoir

Two previously-published documents were reviewed that discuss the water supply to Rector Reservoir: the "Rector Creek Reservoir Watershed Sanitary Survey, 2009 Update", prepared by Ridge to River Incorporated Environmental Services, dated July 10, 2009 (RTR 2009); and the "Rector Reservoir Water Yield Study" prepared by the California Department of Water Resources (DWR), dated May 2013 (DWR 2013).

Rector Reservoir collects surface water runoff from the surrounding tributary watershed area for various water supply purposes. Water collected in the reservoir is distributed to various downstream uses, including the Yountville Veteran's Home (YVH), occasionally the City of Napa, the Department of Fish and Game (DFG) fish hatchery, and others (page 6, DWR 2013). Inflow to the reservoir is the sum of streamflow from Rector Creek and other tributaries within the watershed area, as well as hillslope runoff and direct precipitation on the surface of the reservoir. (page 30, DWR 2013). It is noted that Rector Reservoir "fills up almost every year and spills over during the winter" (page 3, RTR 2009). The document goes on to state that "Thus, even in dry years when precipitation is less than 26 inches, the reservoir is expected to fill." (RTR 2009)

Summer flows in Rector Creek are maintained by spring flow in the Creek. Although no references for direct measurements of spring flow have been located by RCS, the DWR 2013 study includes an analysis in which monthly "natural flows" in Rector Creek were computed using available data and various statistical methods. Table 8, "Rector Creek Natural Flows," is derived from Table 4 in the DWR 2013 report; calculated streamflow data are available on a monthly basis in the DWR 2013 study. By conservatively assuming that the "natural flow" in the Creek in the non-rainy portion of the year (June, July, August and September) is caused solely by spring flow, an estimate of average Rector Creek spring flow can be made.

As shown on Table 8, calculated discharge rates were averaged for two time periods: one is for the entire period of record, from 1914 to 2011; the second is for 1995 through 2011 (1995 has been chosen because that was the approximate year when development of the Stagecoach Vineyard began, which is the largest vineyard development in the northern half of the Rector Creek Watershed). The average flow rates calculated for the 1995 through 2011 period are higher than the average Creek flow rate for the entire period of record, which suggests that the relatively recent increase in groundwater extractions for vineyards in the area has not affected the surface flow into Rector Creek.

In February 2018, concerns were raised by the California State Water Resources Control Board about the volume of water in storage in Rector Reservoir, and a water shortage advisory for the town of Yountville and the Veterans Home was issued. Ensuing rains through March 2018 increased the level of storage in the reservoir and allayed the shortfall concerns. It was later opined by others that the shortfall in reservoir storage was due to an "error in dam operation" or due to "higher than average" volumes of water being discharged from the reservoir to Rector Creek for environmental issues (Yountville Sun 2018).

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WATER LEVEL DATA

Water level elevation monitoring programs are ongoing at the Stagecoach North and Stagecoach Vineyard properties. Water level data collection was initiated at the Stagecoach North wells in July 2016 (via the use of water level pressure transducers, or "data loggers"), and data collection is ongoing. Specific information includes the following:

Stagecoach North Property Water Level Data

Beginning in July 2016, Stagecoach North Vineyards staff initiated a water level monitoring program in onsite Wells SN-1 and SN-2 by installing a water level pressure transducer (data logger) into each of those wells. Figures 8A and 8B, "Water Level Data," show the water level data collected by the Stagecoach-owned monitoring devices in Wells SN-1 and SN-2, respectively, that were monitored between July 7, 2016 and September 18, 2018. Also shown on Figures 8A and 8B are the following: the original, post-construction static water levels for each well; occasional manual water level measurements collected by RCS geologists during each site visit to the property; and monthly rainfall totals (in inches), as available from the CDEC Atlas Peak rain gage. In addition, a schematic drawing of each well is shown to the right of its respective hydrograph, so that monitored water levels can be compared to the top of the casing perforations in each well, and to the depth of the pump intake in each well.

Seasonal water level fluctuations shown on Figure 8 reveal that annually, water levels are generally shallowest in the winter/spring months and deepest in the summer/fall months. These fluctuations coincide with typical irrigation periods for the region and the lack of rainfall recharge during these drier, summer months. Water levels also appear to respond reasonably well to rainfall events, particularly Well SN-2. During the WY 2016-17 when total rainfall in the region was considered to be above average, water levels generally recovered to the previous year's water level elevation. Below average rainfall in the region in WY 2017-18 was followed by a slight decrease in static water levels, as shown on Figure 8A and 8B.

Stagecoach Vineyard Property Water Level Data

Monitoring data provided to the County by Stagecoach Vineyard staff for the Stagecoach Vineyard property were reviewed as a part of the subject Stagecoach North work; the Stagecoach North property is located north of and is contiguous with the Stagecoach Vineyard property. A Memorandum titled "Presentation of Monitoring Data, Stagecoach Vineyards, Soda Canyon Area, Napa County, California", dated April 2, 2018, prepared by RCS is provided in Appendix B. As described therein, water level data were provided for Stagecoach Vineyard Wells SV-3, SV-4, SV-7, and SV-12. In addition to the water level data, the hydrographs provided in the Memorandum included the accumulated rainfall departure curve for two sets of rain gage data: one set was for the CDEC Atlas Peak gage, which is discussed earlier in this report, and the second was for a rain gage maintained by Stagecoach Vineyard at their property. These accumulative rainfall departure curves were used to help define trends in rainfall over the period of record for rain gages. In general, whenever the accumulative rainfall departure curve descends over time to the right, the total rainfall during that period was generally at or below the long-term average annual rainfall. Conversely, whenever the curve ascends over time to the right, the total rainfall during that period was generally at or above the long-term average annual rainfall.

As shown on the hydrographs for the Stagecoach Vineyard wells provided in Appendix B, water level monitoring began in roughly 2008 in the Stagecoach Vineyard wells. Data are relatively

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sparse from the inception of monitoring through 2015, at which time the frequency of water levels measurement collection greatly increased. For Stagecoach Vineyard Wells SV-4, SV-7, and SV-12, water levels appear to have declined by roughly 40 ft to 50 ft between 2008 and 2018. Because the water level data in the early part of the record are sparse, typical seasonal trends cannot be discerned. These declining trends do appear to follow the cumulative departure of rainfall curves on the graphs suggesting that the water level changes in the Stagecoach Vineyard wells responded to changes in rainfall in the region during the monitoring period, which coincided with the most recent statewide drought period (DWR 2015). For Stagecoach Well SV-7, water levels appear to be more stable over time, compared to the hydrograph for the two other Stagecoach Vineyard wells. However, that assessment is based on a data record that includes only two measurements between 2010 and 2015. Data from Stagecoach Well SV-3 are not sufficient to be used for water level trend analysis.

Available data suggest that changes in water levels in the area of the Stagecoach Vineyard properties appear to be heavily influenced by changes in rainfall over time, based on the apparent correlation of water level trends and rainfall accumulated departure trends in the period of record. Also, new vineyard management practices implemented by the current property owners appear to have reduced the volume of groundwater extracted annually from onsite wells for vineyard irrigation purposes. Such decreases could positively affect water level trends overtime in the future.

KEY CONCLUSIONS AND RECOMMENDATIONS

1. The existing Stagecoach North property is currently undeveloped and covered by trees and bushes. No structures or houses were observed on the property. The total assessed acreage is 169.6 acres.
2. The proposed project consists of developing 91.3 acres of new vines on the property.
3. There are two existing onsite water wells, and they are both located in the southeastern portion of the property (Well SN-1 and Well SN-2). No offsite wells are known to exist within 500 ft of onsite Wells SN-1 and SN-2.
4. Because the property is currently undeveloped, there are no existing groundwater demands for the property. However, the two existing onsite wells have historically been used periodically to irrigate a portion of vineyards located on the adjacent Stagecoach Vineyard property, although the Stagecoach North wells are not required for Stagecoach Vineyard irrigation; the Stagecoach Vineyard wells have sufficient capacity to meet vineyard irrigation needs. Reportedly, Wells SN-1 and SN-2 also pumped occasionally for the purposes of keeping the wells operational and in good condition by not allowing the water to become stagnant. In addition, pumping the Stagecoach North wells was an opportunity to rotate groundwater production around the Stagecoach property and allow the new owners to test/understand operational factors in the water system.
5. The future average annual groundwater demand for the proposed vineyard on the Stagecoach North property was estimated by the vineyard manager to be 42.1 AF/yr, or 0.46 AF/ac/yr. Monitoring data reveal that approximately 300 AF of groundwater were used in 2018 to irrigate the 603 acres of vines on the Stagecoach Vineyard property to the south; this equates to a unit use of approximately 0.50 AF/ac/yr of groundwater. The Stagecoach North and Stagecoach Vineyard properties are

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owned and operated by the same entities and personnel. Therefore, it is reasonable to assume that water use practices on the Stagecoach North property in the future will be similar to water use practices on the Stagecoach Vineyard property, which has been developed with vineyards for several years. Based on the data above, RCS estimates that the average annual water demand for the Stagecoach North vineyard development will be approximately 45.7 AF/yr (or 0.50 AF/ac/yr times 91.3 acres of proposed vines). During the four-year vineyard establishment period, the water demand for the Stagecoach North project is estimated to be approximately 54.8 AF/yr (0.60 AF/ac/yr).

6. Future irrigation demands for the subject property will be met by pumping groundwater from Well SN-1 and Well SN-2. Well SN-1 and SN-2 will reportedly no longer provide groundwater to the Stagecoach Vineyard property in the future.

7. As reported by the vineyard manager, the anticipated irrigation season at Stagecoach North is expected to be approximately 24 weeks long each year, and the wells would be pumped each day for a continuous period of 10 hours during that season. With these assumptions, to meet the average and establishment period irrigation demands at the subject property (45.7 AF/yr and 54.8 AF/yr, respectively), Wells SN-1 and SN-2 would need to pump at a total combined rate of about 148 gpm and 177 gpm, respectively (for 10 hours/day, every day, during each 24-week irrigation season in the future).

8. Based on the results of the separate constant rate pumping tests conducted in Wells SN-1 and SN-2 in April 2018 (Wells SN-1 and SN-2 were pumped at constant rates of 54 and 154 gpm, respectively, and for a continuous period of 48 hours), using the pumping data generated from the pumping tests performed in April 2018, the combined pumping capacity of the two project wells is currently on the order of 200 gpm. Hence, Wells SN-1 and SN-2 appear to be more than capable of pumping at the rates needed to meet the future groundwater demands of the proposed project (177 gpm is the necessary combined pumping rate from the onsite wells during the short-term establishment period).

9. Aquifer testing, which included a background water level monitoring period, a constant rate pumping test, and a water level recovery period, were performed in both Well SN-1 and Well SN-2 between April 3 and 19, 2018. During this aquifer test, water level measurements were automatically recorded by water level pressure transducers that were installed by RCS geologists into Wells SN-1, SN-2, SV-4, SV-14, and SV-15; occasional manual water level measurements were also collected by the pumper in these wells. Results of the pumping tests of Wells SN-1 and SN-2 revealed the following for each well:

    - Well SN-1 was pumped at an average rate of 54 gpm for a period of 48 continuous hours. Based on a static water level of 322.9 ft brp, a maximum water level drawdown of 70.9 ft was created; this calculated to a current specific capacity value of 0.76 gpm/ft ddn. Results of the Well SN-1 pumping test also showed that water levels were relatively stable during the entire 48-hour pumping test. Following 3 days of water level recovery, water levels in this well were 97% recovered (97% of the total water level drawdown observed during testing). Water levels fully

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recovered to pre-test SWLs on May 11, 2018. During the pumping portion of the Well SN-1 pumping test, no definitive water level drawdown impacts were induced in onsite Well SN-2, and offsite Wells SV-4, SV-14, and SV-15.

- Well SN-2 was also pumped for a continuous period of 48 hours during its aquifer test, and its average pumping rate during this test was 154 gpm. Pumping data from this test revealed that the total water level drawdown was 23.4 ft in SN-2. Based on the pre-test static water level of 254.4 ft brp, the specific capacity value for this well was calculated to be 6.58 gpm/ft ddn. Results of the Well SN-2 pumping test also revealed that water levels did not become stabilized at the end of the pumping test, and were still slowly declining at a rate of 0.23 ft/hr in the last 4 hours of testing. Recovery water level data was recorded in this well for an additional period of 3 days, and after those 3 days, water levels had not completely recovered to their pre-test static water levels. After 3 days of water level recovery following the end of the pumping test, water levels had recovered to 65% (up to a depth of 262.5 ft brp). Water levels fully recovered to pre-test SWLs on June 2, 2018. No definitive water level impacts were observed in Well SN-1, and offsite Wells SV-4, SV-14, and SV-15 during the pumping test of Well SN-2.

10. Although existing Wells SN-1 and SN-2 appear to be able to pump at rates necessary to meet the average annual demand and four-year establishment period demand of the proposed project, it is possible that new wells may be drilled and constructed at Stagecoach North in the future. Additional wells will allow for distribution of the groundwater demand across the property, and allow each onsite well to produce groundwater at a lower pumping rate. Additional wells will also provide increased operational flexibility, so that pumping regimes can be adjusted as monitoring data is gathered on an ongoing basis. Importantly, construction of additional wells at the Stagecoach North property will not increase the groundwater volume extracted on an annual basis.

11. Groundwater recharge at the subject property on an average annual basis is estimated to be 69.3 AF/yr; this value is based on conservative estimates of the average annual rainfall at the property (35 inches per year) and conservative estimates of average rainfall (14%) that could be available to deep percolate into the fractures and jointed rocks of the Sonoma Volcanics that underlie the subject property.

12. Conservative estimates of recharge that may occur during a “prolonged drought” (as defined herein) show that, over a theoretical six-year period of continuous drought in the which only 48% of the average annual rainfall might occur, a total of 199.8 AF of rainfall recharge is estimated to occur strictly within the boundaries of the subject property. These estimates also assumed that the drought coincided with the four-year establishment period for the new vines, during which the groundwater demand is 20% higher than the annual average. This theoretical drought period recharge estimate of 199.8 AF is less than the estimated groundwater demand of the proposed project of 310.6 AF for the same continuous six-year period. Hence, the theoretical six-year long drought period groundwater recharge “deficit” of about 111

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AF would represent about 11% of the volume of groundwater in storage (estimated to be approximately 1,052 AF). Rainfall recharge during years of average and above-average rainfall would then replenish groundwater in storage that is used to meet the groundwater demand of the entire property during a theoretical six-year drought.

13. Estimates of groundwater recharge within the CIA during average and drought rainfall years exceed estimated groundwater demands within the CIA (this analysis includes the proposed Stagecoach North development project).
14. The continued ongoing monitoring of water levels in Wells SN-1 and SN-2, and any possible future new wells, via the use of automatically-recording water level pressure transducers is strongly recommended.
15. We also recommend the continued monitoring of flow rates and cumulative pumped volumes from Wells SN-1 and SN-2 (and any possible future new wells) via the installed totalizing flow meter (that records totalizing values). By continuing to observe the trends in groundwater levels and future well production volumes over time by qualified professionals, potential declines in water levels and well production in the onsite wells can be addressed in a timely manner.

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Table 1
Summary of Well Construction and Pumping Data
Stagecoach North Property

Reported Well Designation	DWR Well Log No.	Date Drilled	Method of Drilling	Pilot Hole Depth (ft bgs)	Casing Depth (ft bgs)	Casing Type	Casing Diameter (in)	Borehole Diameter (in)	Sanitary Seal Depth (ft bgs)	Perforation Intervals (ft bgs)	Type and Size (in) of Perforations	Gravel Pack Interval (ft) and Size	Current Status of Well	Post-Construction Yield Data					
														Date & Type of Yield Data	Duration of "Test" (hrs)	Estimated Flow Rate (gpm)	Static Water Level (ft)	Pumping Water Level (ft)	Estimated Specific Capacity (gpm/ft ddn)
Stagecoach North Well 1 (SN-1)	e0231245	August 2014	Direct Mud Rotary	720	715	PVC	8	12	20 (cement)	380-400 500-520 640-715	Factory-cut 0.032"	20-720 Filter Pack	Active	8/29/14 Air	4	90	308	ND	ND
														5/1/16 Pump	48	50	314.1	388.7	0.67
														4/14/18 Pump	48	54	322.9	393.8	0.76
Stagecoach North Well 2 (SN-2)	e0260575	March 2015	Direct Air Rotary	590	560	PVC	8	14	20 (benonite)	280-560	Factory-cut 0.032"	20-590 pea gravel	Active	3/26/15 Air	2	150	240	ND	ND
														4/25/16 Pump	48	150	238.6	259.8	7.08
														4/9/18 Pump	48	154	254.4	277.8	6.58

Notes: ft bgs = feet below ground surface
SWL = static water level
brp = below reference point, generally top of well head
Reported pump depth settings: SN-1 = ±670 ft bgs; SN-2 = ±525 ft bgs.

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Table 2
Comparison of Rainfall Data Sources
Stagecoach North Property

Rain Gage and/or Data Source	Years of Available Rainfall Record	Average Annual Rainfall in Inches (ft)	Approximate Elevation of Rain Gage (ft asl)	Distance of Rain Gage from Subject Property[1] (mi)	Elevation Relative to Subject Property
Stagecoach South	August 2011 through August 2016[2]	23.2 (1.93)	1,450	0.5	Similar
CDEC Atlas Peak	WY 1987-88 through WY 2017-18[3]	40.3 (3.36)	1,660	4.0	Similar
Napa One Rain Atlas Peak	WY 2007-08 through WY 2016-17	37.8 (3.15)	1,660	4.0	Similar
WRCC Napa State Hospital	January 1983 through September 2018[4]	24.7 (2.06)	60	13.0	Lower
PRISM Climate Group	1981 to 2010	38.7 (3.23)	---	---	---
Napa County Isohyetal Map	1900 to 1960	35.0 (2.92)	---	---	---

Notes:

1. The subject property is located at an elevation between ±1,600 and ±2,100 ft asl
2. Missing data between September 2016 and January 2018. Rain gage was replaced in early-2018.
3. Erroneous and/or missing data in WY 1987-88, WY 1994-95, WY 1995-96, WY 2004-05, WY 2006-07.
4. Several months and/or years of rainfall data missing between 1897 and 1902, and between 1915 and 1916.

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Table 3
Calculation of Theoretical Rainfall Recharge Percentage
Napa River Near Napa Watershed

Portion of "Napa River Watershed Near Napa" (See Figure 4)	Area		Average Rainfall per PRISM Dataset (1980-2010)	Rainfall Volume	Scenario 1		Scenario 2		Scenario 3	
					Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume
	(sq mi)	(acres)	(in)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)
Valley Floor Portion of Watershed	45.5	29,120	34.7	84,205	20%	16,841	25%	21,051	30%	25,262
Hillside Area Portion of Watershed	172.8	110,592	39.3	362,189	16%	58,964	15%	54,754	14%	50,544
Entire Watershed	218.3	139,712	38.3	445,914	17%	75,805	17%	75,805	17%	75,805

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Table 4
Watershed-scale Calculated Rainfall Recharge Percentage
Using BCM Dataset

Watershed	Average Annual Rainfall (in)	Average Annual Recharge (in)	Calculated Rainfall Recharge Percentage
Rector Reservoir (CDFFP 1999)	36.9	10.3	28%
Napa River Watershed Near Napa (LSCE&MBK 2013)	38.3	11.3	30%

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Table 5
Drought Period Rainfall as Percentage of Average

Statewide Drought Period as Defined by DWR (DWR 2005)	Drought Duration (years)	Average Rainfall by Rain Gage								
		Napa Hospital Raingage WRCC Period of Record - 1893 through Sept 2015			Atlas Peak Raingage CDEC Period of Record - WY 1988-89 to WY 2017-18			Atlas Peak Raingage, Napa OneRain Period of Record - WY 2007-08 to WY 2017-18		
		[A] Total Gage Average (in)	[B] Drought Period Ave. (in)	[B÷A] Drought Period Rainfall as % of Average	[C] Total Gage Average (in)	[D] Drought Period Ave. (in)	[D÷E] Drought Period Rainfall as % of Average	[E] Total Gage Average (in)	[F] Drought Period Ave. (in)	[F÷E] Drought Period Rainfall as % of Average
WY 1928-29 to WY 1933-34	6	24.7	17.3	70%	ND	ND	ND	ND	ND	ND
WY 1975-76 to WY 1976-77	2	24.7	11.8	48%	ND	ND	ND	ND	ND	ND
WY 1986-87 to WY 1991-92	6	24.7	18.5	75%	40.3*	38.7*	96%	ND	ND	ND
WY 2006-07 to WY 2008-09	3	24.7	18.1	73%	40.3	23.4	58%	37.8*	29.4*	78%
WY 2011-12 to WY 2015-16	5	24.7	21.0	85%	40.3	29.3	73%	37.8	34.8	92%

* Raingage data does not extend through the entire drought period

ND = No rainfall data avaialble for the corresponding drought period.

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Table 6
Summary of Cumulative Impact Area (CIA)
Northern Rector Reservoir Watershed

Land Use Type	Estimated Area Via Napa County GIS Data (acres)	Estimated Average Annual Agricultural Demand[(1)] (AF/acre/yr)	Total Estimated Average Annual Agricultural Demand (AF/yr)
Stagecoach South Vineyards	603	0.5	302
Other Vineyard Areas (within CIA)	356		178
Planned and/or Future ECP (outside existing vineyard ares)	266		133
Orchard	5		3
Total Current Agricultural Water Demand (AF/yr)			**615**

1. Estimated water demand for vineyard irrigation = 0.5 AF/yr/acre

Land Use Type	Estimated Number of Residences	Estimated Domestic Demand[(2)] (AF/residence/yr)	Total Estimated Domestic Demand (AF/yr)
Residence	34	1.0	34
Total Current Domestic Demand (AF/yr)			**34**

2. Estimated water demand for residence = 1 AF/yr

Total Current Estimated Groundwater Demand in CIA (Vineyard + Orchard + Domestic)	**649**
Total Proposed Stagecoach North Water Demand (Average)	**45.7**
Total Proposed Stagecoach North Water Demand (Establishment Period)	**54.8**

Note: AF/yr = acre-feet per year; AF/ac/yr = acre-feet per acre of planted vine or orchard per year

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Table 7
Estimated Recharge Based on Slope Deep Percolation Assumption
Cumulative Impact Area (CIA)

Region	Area	Average Rainfall [1]	Rainfall Volume	Reduced Recharge Assumption based on Slope Angle									
				Deep Percolation/Not Slope Dependent		Deep Percolation on >30° Slope Diminished by 25%		Deep Percolation on >30° Slope Diminished by 50%		Deep Percolation on >30° Slope Diminished by 75%		Deep Percolation on >30° Slope Diminished by 100%	
				Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume	Deep Percolation Percentage	Deep Percolation Volume
	(acres)	(in)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)	(%)	(AF)
Entire Napa River Watershed Near Napa Hillside (Non Valley Areas Only)													
<30° Slope	96,362	38.3	307,555	14.00%	43,057.75	14.52%	44,647.36	15.03%	46,236.97	15.55%	47,826.58	16.07%	49,416.19
>30° Slope	14,230	38.3	45,417	14.00%	6,358.44	10.50%	4,768.83	7.00%	3,179.22	3.50%	1,589.61	0.00%	-
TOTAL =	110,592			TOTAL =	49,416.19	TOTAL =	49,416.19	TOTAL =	49,416.19	TOTAL =	49,416.19	TOTAL =	49,416.19
Rector Reservoir Watershed (CIA)													
<30° Slope	3,892.6	35.0	11,353	14.00%	1,589.48	14.52%	1,648.16	15.03%	1,706.84	15.55%	1,765.52	16.07%	1,824.20
>30° Slope	305.4	35.0	891	14.00%	124.71	10.50%	93.53	7.00%	62.35	3.50%	31.18	0.00%	-
TOTAL =	4,198.0			TOTAL =	1,714.2	TOTAL =	1,741.7	TOTAL =	1,769.2	TOTAL =	1,796.7	TOTAL =	1,824.2

Note: The entire "Napa River Watershed near Napa" values are used to calculate the change in deep percolation percentage of <30° slopes based on the deep percolation volume of 14,230 AF calculated using the assumptions shown. Deep percolation percentage values determined for the entire watershed are then used for site specific calculations.

[1] Average Rainfall for "Napa River Watershed near Napa" per PRISM Dataset (1980-2010); average rainfall for "Rector Reservoir Watershed (CIA)" per Napa County isohyetal map (1900-1960).

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Table 8
Rector Creek Natural Flows

Monthly Natural Flow (acre-feet)													
Water Year (WY)	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Total**
1913-14	0	698	4941	15131	7077	4988	1445	842	266	167	189	182	35.926
-15	29	50	765	2888	6825	2965	293	658	161	102	115	106	14,955
-16	0	15	1886	10898	4089	3100	163	433	136	86	99	115	21,021
-17	3	35	1385	1218	4483	1354	852	200	59	37	42	48	9.718
-18	0	4	127	128	3376	1261	534	77	24	15	17	216	5,782
-19	2	338	610	994	5451	2019	163	218	69	43	49	132	10,088
1919-20	5	9	550	384	392	847	2485	50	20	10	12	24	4.787
-21	4	1009	3008	6565	2680	2729	483	364	114	72	81	60	17.189
-22	3	244	1247	1426	3949	1778	380	199	61	38	43	40	9,408
-23	89	479	3633	4187	1780	1122	4000	262	86	53	71	118	15,879
-24	1	2	26	445	1902	593	76	51	13	8	12	9	3,139
-25	211	547	1865	2127	6565	2645	1865	523	140	89	100	105	16,782
-26	2	116	281	1312	4706	941	5425	273	84	53	64	55	13,312
-27	81	2268	4474	3803	6159	2780	5344	578	189	117	132	121	26,047
-28	5	742	1661	1978	2478	2875	1861	284	87	55	62	57	12.144
-29	0	325	1048	1195	1824	1206	1189	112	69	28	32	29	7,056
1929-30	0	0	1836	1510	2339	1918	1813	211	63	40	45	63	9,837
-31	10	76	175	1645	777	1103	250	127	30	17	19	18	4,245
-32	42	167	3241	3267	1918	1263	818	270	69	42	48	44	11,189
-33	0	14	354	1819	916	1973	53	199	43	27	31	30	5,459
-34	98	167	1699	1597	2892	886	472	169	51	29	35	38	8,136
-35	23	576	1441	3295	1876	3242	3662	375	119	75	92	80	15,057
-36	16	41	241	2251	5014	1763	1922	276	97	56	64	60	11.8
-37	0	1	377	923	4778	2965	772	252	93	53	62	56	10,333
-38	9	402	1898	2611	7769	5369	2226	693	219	138	156	157	21,648
-39	25	55	190	569	906	228	12	31	10	6	7	6	2,046
1939-40	0	6	117	5452	7206	4490	1154	612	183	115	131	127	19.593
-41	36	136	5803	7899	7145	5316	4643	999	314	197	224	206	32,917
-42	17	177	2991	4226	5642	3248	4451	699	202	128	144	133	22.057
-43	16	383	1185	5129	2357	2256	1440	292	93	58	66	61	13,335
-44	4	17	117	886	3838	1760	1875	245	66	40	46	41	8,934
-45	88	518	1453	1505	3939	2393	394	259	74	47	53	49	10,772
-46	402	943	4406	4933	2136	1757	495	257	75	48	54	53	15,560
-47	0	332	663	697	1937	2263	530	144	59	29	33	30	6,717
-48	479	826	945	797	872	1820	4938	216	59	37	42	56	11,086
-49	5	24	517	608	2089	2921	70	160	48	31	41	32	6,546
1949-50	0	219	470	3164	2833	1701	1179	230	66	43	49	45	10,000
-51	209	1332	4537	5810	2999	2579	1126	401	119	75	85	78	19.352
-52	70	550	3700	8429	4339	4376	766	605	200	123	139	128	23.422
-53	0	109	4306	5044	1690	2948	3139	439	135	84	97	87	18,078
-54	4	310	564	•3152	2944	2615	2283	294	93	58	84	62	12.462
-55	1	332	1451	1823	1323	759	2727	140	44	28	32	69	8.729
-56	0	119	10474	10427	7464	4303	1946	766	240	151	171	178	36,239
-57	120	206	204	605	3418	1376	1761	325	61	38	43	214	8.371
-58	367	639	1236	2776	7741	4697	5394	789	251	157	178	165	24,391
-59	0	1	31	2239	3497	942	294	125	38	24	27	443	7.659
1959-60	0	0	77	882	3672	1542	1109	214	49	31	35	32	7,643
-61	4	185	548	1338	1413	1754	847	145	44	27	33	59	6,397
-62	0	208	639	885	5512	2613	304	250	79	50	57	52	10,650
-63	1383	2372	2914	3814	2358	3129	4142	447	137	86	98	94	20,974
-64	104	357	147	1725	643	326	93	90	84	0	68	0	3.638
-65	408	162	3146	5098	1801	650	3041	542	116	44	73	88	15,168
-66	79	263	522	4027	4339	3157	274	96	73	64	89	76	13,059
-67	82	818	5349	10394	3217	4603	6238	987	249	94	90	94	32,214
-68	150	112	181	3264	6862	5883	1208	128	79	93	72	87	18,118
-69	130	564	978	7129	6453	3326	1714	731	117	98	89	69	21,397
1969-70	122	122	1854	10886	3918	2391	190	127	104	91	98	73	19,975
-71	157	964	5999	3494	1239	1948	1099	347	85	56	162	97	15,647
-72	109	108	371	284	487	220	161	127	103	102	109	8	2.282
-73	178	579	730	5969	6874	3471	1005	102	100	87	97	109	19,299
-74	116	2150	4239	6291	1833	5541	2698	183	130	117	84	128	23,510
-75	134	131	217	310	2824	4990	1636	155	125	87	133	102	10.844
-76	137	107	105	103	109	157	126	99	101	85	0	175	1,304
-77	148	159	157	107	138	165	213	207	140	109	126	126	1.794
-78	92	307	725	5256	3384	4524	2441	825	263	84	44	35	17,982
-79	118	134	162	1553	3365	1918	918	211	75	54	38	135	8,682
1979-80	54	149	968	3982	4775	3110	616	15	37	5	206	248	14,164
-81	47	258	358	681	198	523	46	0	0	0	0	0	2.11
-82	91	2524	5574	4693	3963	4644	6721	797	157	224	221	169	29,779
-83	157	1491	4392	11896	11218	9255	2430	1922	592	268	314	311	44,246
-84	264	2360	5808	1741	1119	1827	794	77	130	185	155	26	14,486
-85	144	649	851	979	1685	1188	163	122	108	125	86	108	6,208
-86	68	110	123	747	9585	4367	677	153	19	0	18	358	16,224
-87	0	1	55	467	3240	1768	113	102	32	20	23	21	5,843
-88	22	169	1686	2526	1072	778	1973	177	51	31	35	33	8,551
-89	0	290	713	824	701	2981	419	132	42	26	30	164	6,323
1989-90	248	266	0	288	307	20	50	247	230	66	84	96	1,902
-91	102	83	76	33	177	1430	295	316	24	64	81	73	2,753
-92	30	67	258	385	4120	2367	661	168	65	36	41	37	8,234
-93	197	337	2354	8319	5790	3539	1361	615	191	119	135	124	23,080
-94	22	170	831	1090	2664	629	1270	176	41	26	29	27	6,973
-95	10	532	1279	14937	3259	7672	1590	1006	317	199	225	207	31,232
-96	0	0	2334	3722	5495	2661	2852	609	164	103	117	107	18.166
-97	33	253	5566	9379	3229	2790	489	441	140	87	121	99	22,627
-98	16	624	1394	4067	9560	4179	2361	882	254	160	181	172	23,852
-99	5	817	1404	1320	4650	2152	1818	265	84	53	59	58	12,685
1999-2000	5	109	224	1087	5121	1607	1523	273	74	46	52	59	10,179
-01	110	206	348	855	3891	1249	885	142	46	28	32	57	7,848
-02	9	925	5123	5968	2523	2670	332	375	110	59	78	72	18.255
-03	0	268	8683	7061	2954	2740	4363	558	164	103	126	120	27,139
-04	103	140	3140	5782	8440	2636	127	91	93	79	78	69	20,779
-05	408	770	3966	5239	3634	3700	1376	683	189	117	132	122	20,338
-06	2	71	7441	6366	4023	5049	4549	771	239	151	171	157	26,991
-07	1	124	822	862	3491	648	1175	128	36	23	26	41	7.376
-08	42	78	559	5227	3090	1330	180	215	66	42	47	43	10,917
-09	21	218	691	756	5557	1660	406	285	70	44	49	50	9,807
2009-10	352	607	833	813	194	1214	3572	177	35	22	25	23	7.866
-11	145	399	2701	3020	4087	4903	441	554	194	113	127	119	16,803
Average WY 1913-14 to WY 2010-11									**113**	**72**	**83**	**94**	**362**
Average WY 1994-95 to WY 2010-11									**134**	**84**	**97**	**93**	**407**

Note: The "Rector Reservoir Water Yield Study" was prepared by the California Department of Water Resources, dated May 2013 (DWR 2013).

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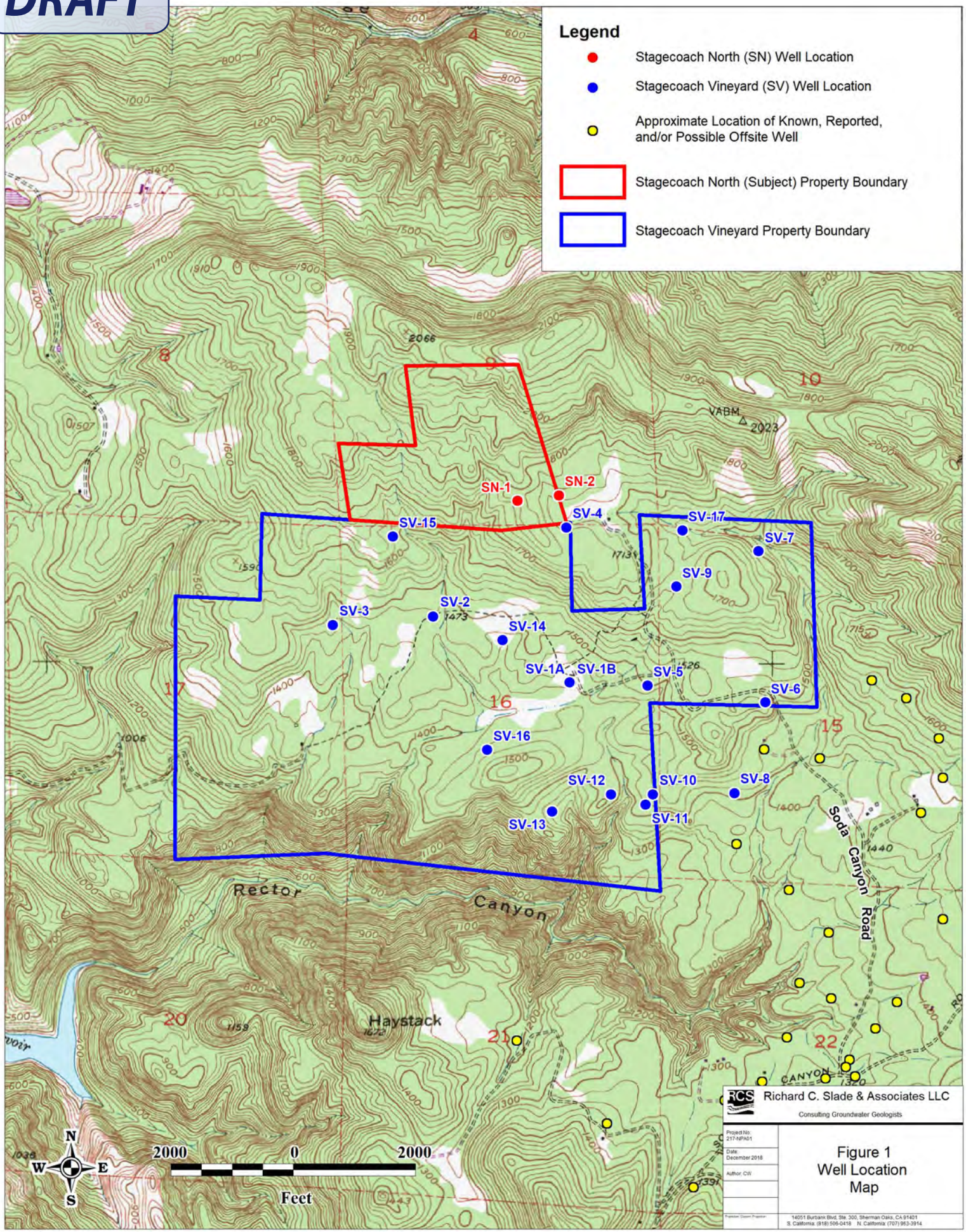

Richard C. Slade & Associates LLC
Consulting Groundwater Geologists

Project No: 217-NPA01
Date: December 2018
Author: CW

Figure 1
Well Location Map

14051 Burbank Blvd, Ste. 300, Sherman Oaks, CA 91401
S. California: (818) 506-0418 N. California: (707) 963-3914

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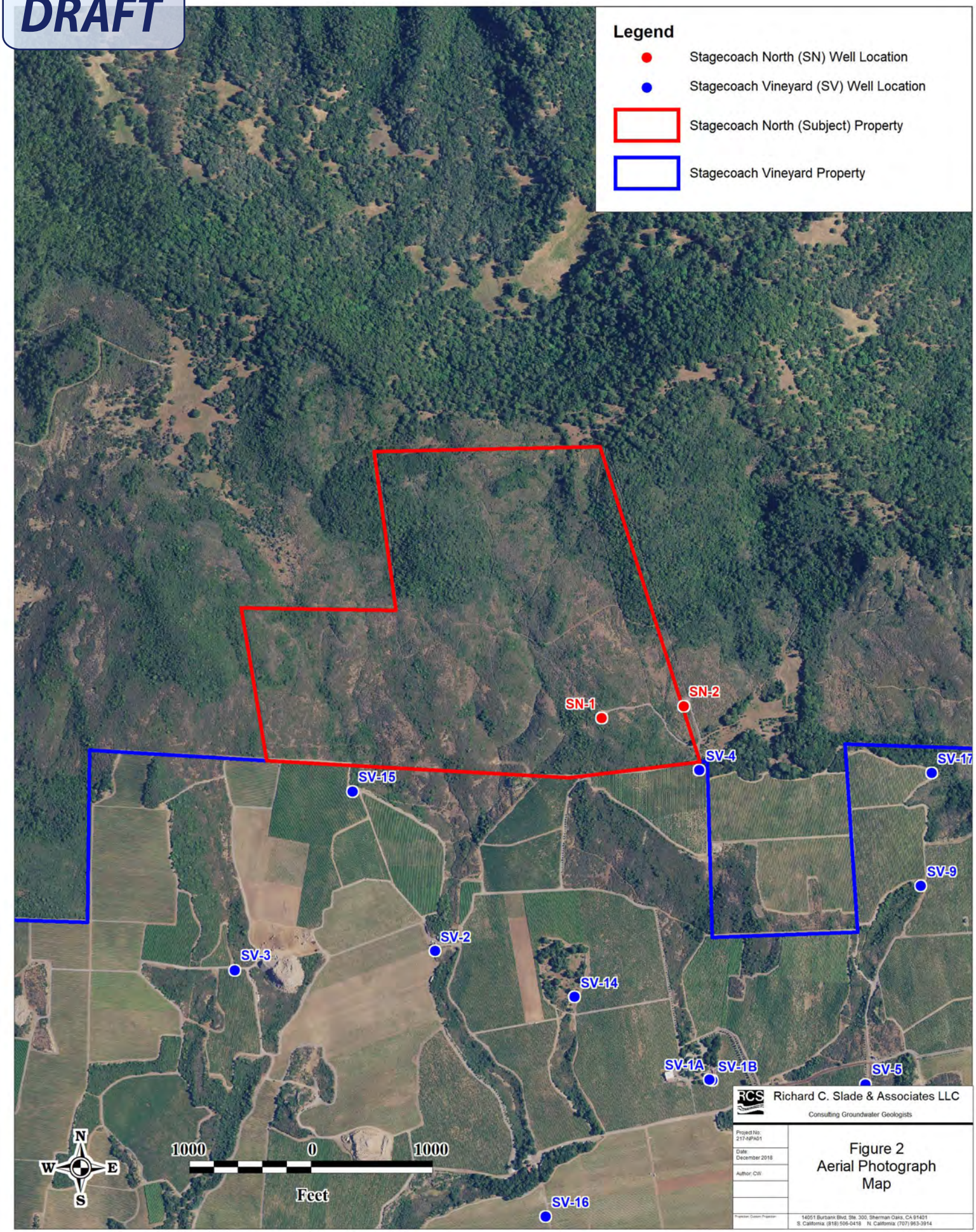

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Consulting Groundwater Geologists

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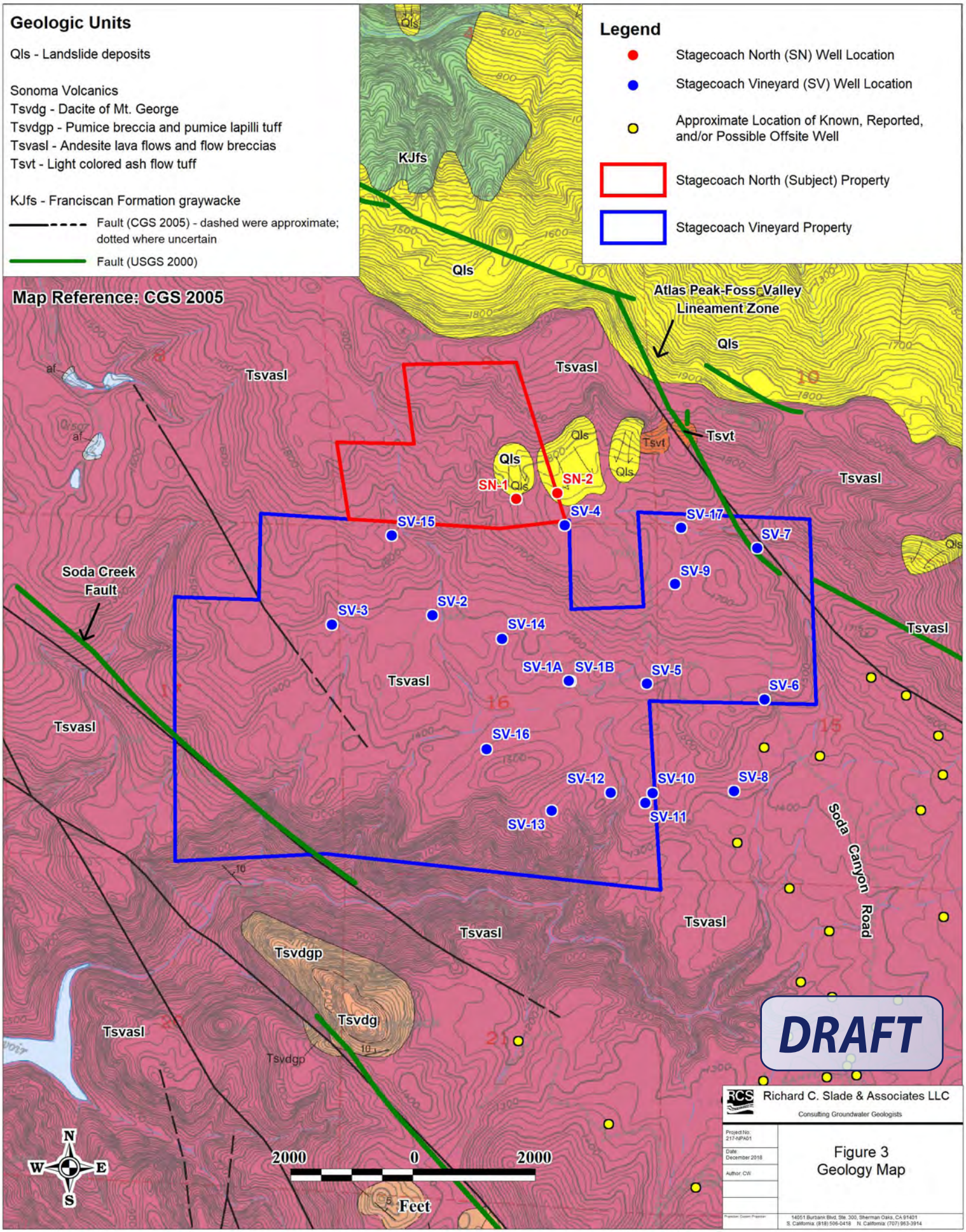
Figure 2
Aerial Photograph
Map

14051 Burbank Blvd, Ste. 300, Sherman Oaks, CA 91401
S. California: (818) 506-0418 N. California: (707) 963-3914


Geologic Units
Qls - Landslide deposits
Sonoma Volcanics
Tsvdg - Dacite of Mt. George
Tsvdgp - Pumice breccia and pumice lapilli tuff
Tsvasl - Andesite lava flows and flow breccias
Tsvt - Light colored ash flow tuff
KJfs - Franciscan Formation graywacke
Fault (CGS 2005) - dashed were approximate; dotted where uncertain
Fault (USGS 2000)
Legend
Stagecoach North (SN) Well Location
Stagecoach Vineyard (SV) Well Location
Approximate Location of Known, Reported, and/or Possible Offsite Well
Stagecoach North (Subject) Property
Stagecoach Vineyard Property
Map Reference: CGS 2005
Atlas Peak-Foss Valley Lineament Zone
Soda Creek Fault
Soda Canyon Road
SN-1
SN-2
SV-1A
SV-1B
SV-2
SV-3
SV-4
SV-5
SV-6
SV-7
SV-8
SV-9
SV-10
SV-11
SV-12
SV-13
SV-14
SV-15
SV-16
SV-17
Tsvasl
Tsvdg
Tsvdgp
Tsvt
Qls
KJfs
af
N
S
E
W
2000
0
2000
Feet
DRAFT
Richard C. Slade & Associates LLC
Consulting Groundwater Geologists
Project No: 217-NPA01
Date: December 2018
Author: CW
Figure 3
Geology Map
14051 Burbank Blvd, Ste. 300, Sherman Oaks, CA 91401
S. California: (818) 506-0418 N. California: (707) 963-3914

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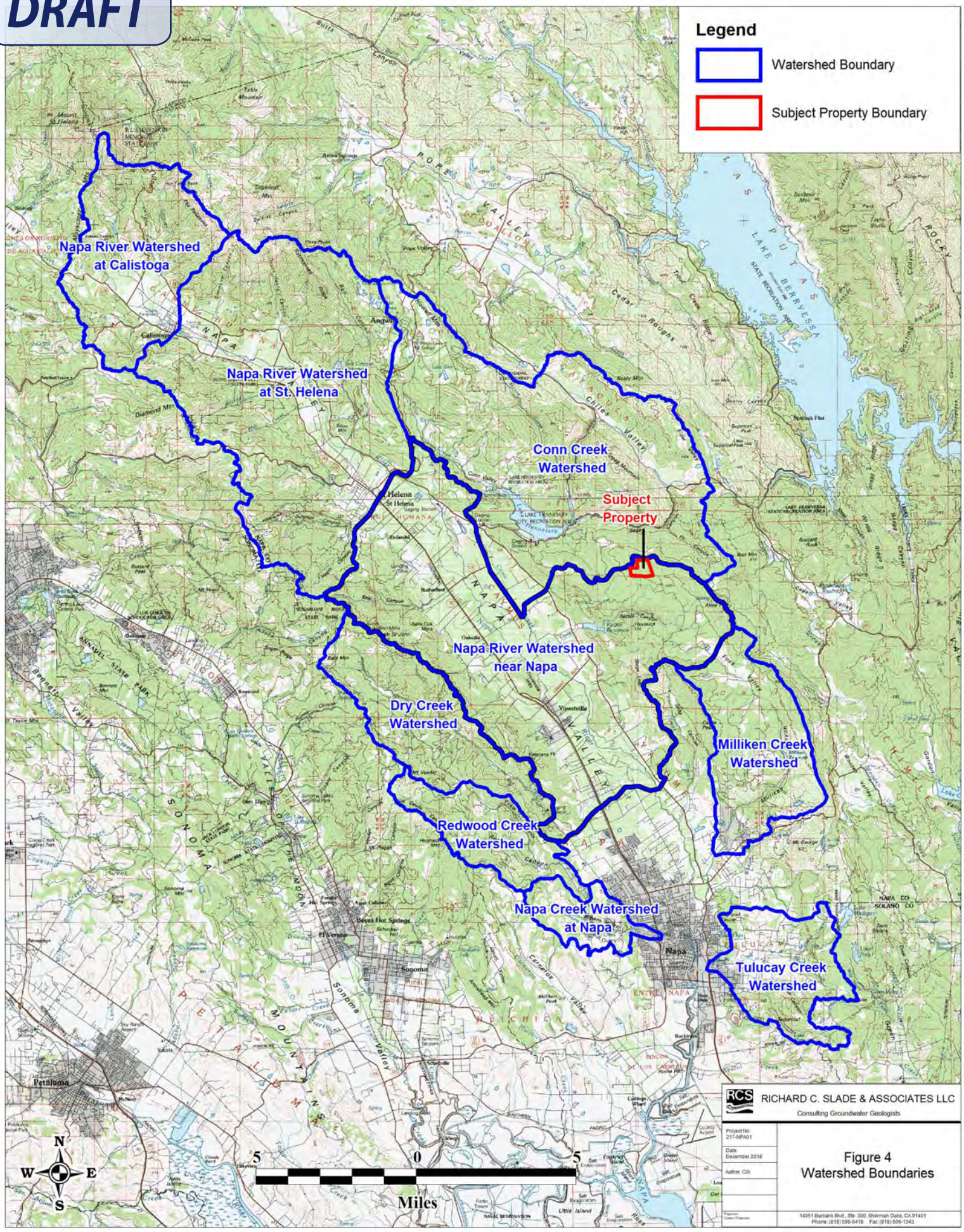

RICHARD C. SLADE & ASSOCIATES LLC
Consulting Groundwater Geologists

Project No: 217-NPA01
Date: December 2018
Author: CW

Figure 4
Watershed Boundaries

14051 Burbank Blvd., Ste. 300, Sherman Oaks, CA 91401
Phone: (818) 506-0418 Fax: (818) 506-1343

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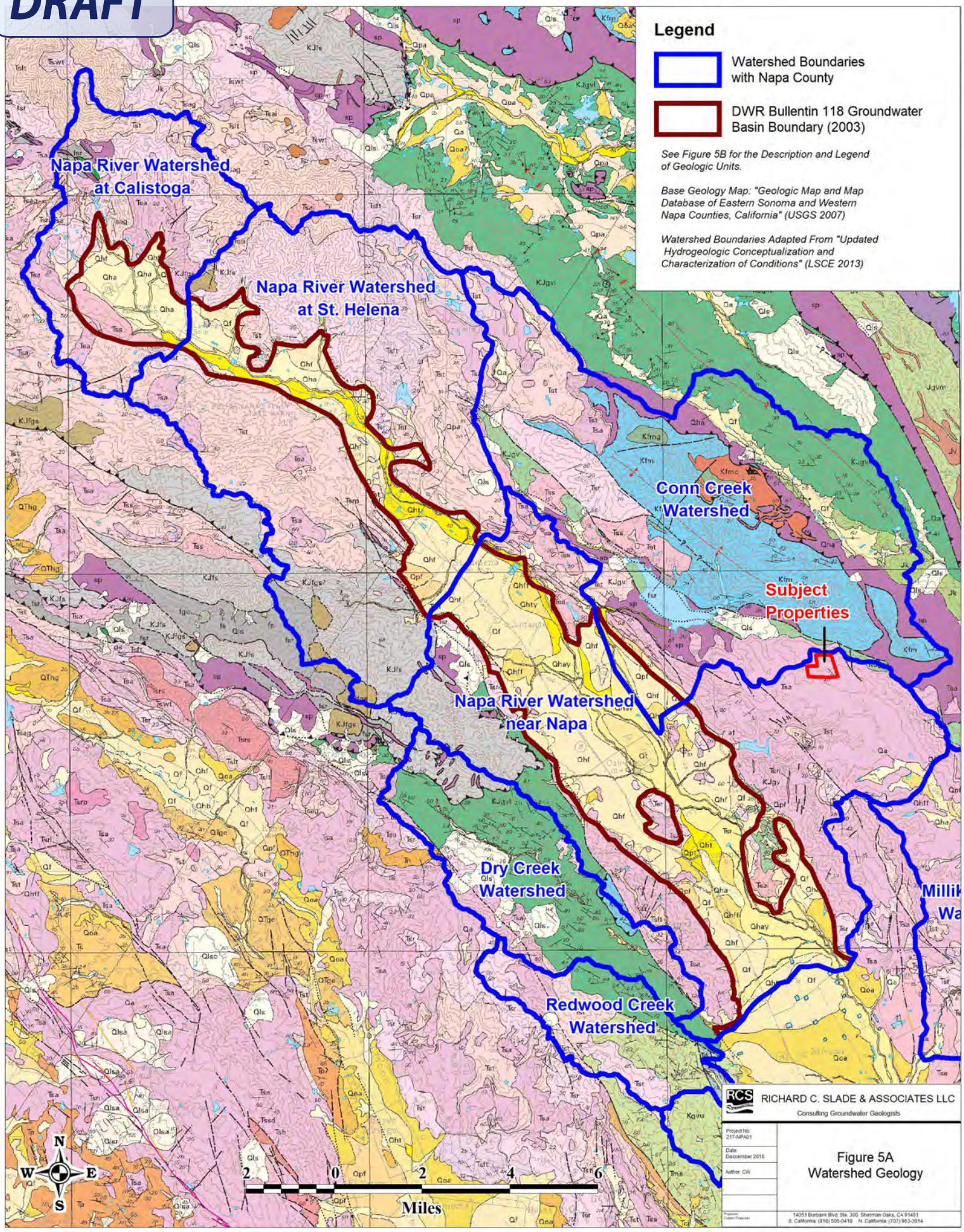

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Consulting Groundwater Geologists

Project No: 217-NPA01
Date: December 2016
Author: CW

Figure 5A
Watershed Geology

14051 Burbank Blvd. Ste. 300, Sherman Oaks, CA 91401
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LIST OF MAP UNITS

[Some unit exposures on the map are too small to distinguish the color for unit identification. These units are labeled where possible, and unlabeled units are attributed in the database.]

SURFICIAL DEPOSITS

- af — Artificial fill (Historic)
- afbm — Artificial fill over Bay mud (Historic)
- alf — Artificial levee fill (Historic)
- Qhc — Stream channel deposits (late Holocene)
- Qhay — Younger alluvium (late Holocene)
- Qhty — Terrace deposits (late Holocene)
- Qha — Alluvium (Holocene)
- Qht — Terrace deposits (Holocene)
- Qhf — Alluvial fan deposits (Holocene)
- Qhff — Fine-grained alluvial fan deposits (Holocene)
- Qhl — Natural levee deposits (Holocene)
- Qhb — Basin deposits (Holocene)
- Qhbm — Bay mud (Holocene)
- Qa — Alluvium (Holocene and late Pleistocene)
- Qt — Terrace deposits (Holocene and late Pleistocene)
- Qf — Alluvial fan deposits (Holocene and late Pleistocene)
- Qls — Landslide deposits (Holocene and late Pleistocene)
- Qlsa — Andesitic composition
- Qlsr — Rhyolitic composition
- Qpa — Alluvium (late Pleistocene)
- Qpt — Terrace deposit (late Pleistocene)
- Qpf — Alluvial fan deposits (late Pleistocene)
- Qoa — Alluvium (late and early Pleistocene)
- Qlso — Landslide deposits (late and early Pleistocene)

Clear Lake Volcanics

- Qr — Rhyolite (Pleistocene)
- QTob — Olivine basalt (Pleistocene and Pliocene)
- QTr — Tuff (Pleistocene and(or) Pliocene)
- Tr — Rhyolite (Pliocene)

- QTc — Cache Formation (Pleistocene and(or) Pliocene)
- QTge — Glen Ellen Formation (early Pleistocene? and Pliocene)
- QThg — Huichica and Glen Ellen Formations, undivided (early Pleistocene? and Pliocene)

Sonoma Volcanics

- Tsv — Sonoma Volcanics, undivided (Pliocene and late Miocene)
- Tsr — Rhyolite flows
- Tsrr — Rhyolite plugs
- Tsrs — Soda rhyolite flows
- Tsrp — Perlitic rhyolite
- Tsrb — Rhyolite breccia
- Tsa — Andesite to basalt lava flows
- Tsal — Andesite to dacite plugs
- Tsb — Basalt flows
- Tsfd — Basalt or andesite lava flows and sediments
- Tst — Pumiceous ash-flow tuff
- Tswt — Welded ash-flow tuff
- Tstx — Tuff(?)
- Tsag — Agglomerate
- Tslt — Tuff breccia
- Tsft — Tuff
- Tss — Volcanic sand and gravel
- Tsad — Diatomite

- Twg — Wilson Grove Formation (late Pliocene to late Miocene)
- Tc — Sand and gravel of Cotati (Pliocene and late Miocene)
- Tp — Petaluma Formation (early Pliocene and late Miocene)
- Tdr — Donnell Ranch Volcanics (late Miocene)
- Tn — Neroly Sandstone (late Miocene)
- Tci — Cierbo Sandstone (late Miocene)
- Tbm — Burdell Mountain volcanics (late and middle? Miocene)
- Tms — Unnamed sandstone (middle Miocene)
- Tkt — Kirker Tuff (early Miocene and(or) Oligocene)
- Td — Unnamed sandstone (Eocene and Paleocene)
- Ts — Unnamed sandstone (Eocene? or Paleocene?)

GREAT VALLEY COMPLEX

Great Valley sequence

- KJgv — Sandstone, shale, and conglomerate (Late Cretaceous to Late Jurassic)
- Kgvu — Sandstone, shale, and conglomerate (Late Cretaceous)
- Kv — Venado Formation (Late Cretaceous)
- KJgvl — Sandstone and shale (Early Cretaceous and Late Jurassic)
- KJsp — Sedimentary serpentinite member
- Jk — Knoxville Formation (Late Jurassic)
- Jsp — Sedimentary serpentinite member
- Jgvm — Mélange

Coast Range ophiolite

- Jv — Basaltic pillow lava and breccia (Jurassic)
- Jmi — Mafic intrusive complex (Jurassic)
- Jgb — Gabbro (Jurassic)

- sp — Serpentinite (Jurassic)
- sc — Silica-carbonate rock
- spm — Serpentinite-matrix mélange

FRANCISCAN COMPLEX

- fsr — Mélange, including blocks, mapped locally, of:
- sp — Serpentinite
- fs — Graywacke
- ch — Chert
- fgc — Greenstone and chert
- gs — Greenstone
- hg — High-grade metamorphic rocks
- Kfss — Sandstone (Late Cretaceous, Turonian?)
- Kfm — Metagraywacke (Late and Early Cretaceous)
- Kfmc — Metachert (Late and Early Cretaceous)
- Kfmg — Metagreenstone (Late and Early Cretaceous)
- KJfs — Graywacke and melange (Early Cretaceous and Late Jurassic)
- KJfc — Chert (Cretaceous to Jurassic)
- KJfgc — Greenstone and chert (Cretaceous to Jurassic)
- KJfgs — Greenstone (Cretaceous to Jurassic)

MAP SYMBOLS

- **Contact**—Depositional or intrusive contact, dashed where approximately located, dotted where concealed
- **Fault**—Dashed where approximately located, small dashes where inferred, dotted where concealed, queried where location is uncertain, orange denotes Quaternary-active fault, magenta denotes Holocene active-fault
- **Reverse or thrust fault**—Dashed where approximately located,small dashes where inferred, dotted where concealed, queried where location is uncertain; sawteeth on upper plate
- **Anticline**—Dashed where approximately located, dotted where concealed
- **Syncline**—Dashed where approximately located, dotted where concealed
- Strike and dip of bedding
- Strike and dip of bedding, top indicator observed
- Strike and dip of bedding, approximate
- Overturned bedding
- Overturned bedding, top indicator observed
- Crumpled bedding
- Air photo attitude
- Vertical bedding
- Horizontal bedding
- Strike and dip of foliation
- Strike and dip of foliation and bedding
- Vertical foliation
- Strike and dip of joint

Legend from "Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, California" (USGS 2007)

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FIGURE 5B
DESCRIPTION AND LEGEND OF GEOLOGIC UNITS

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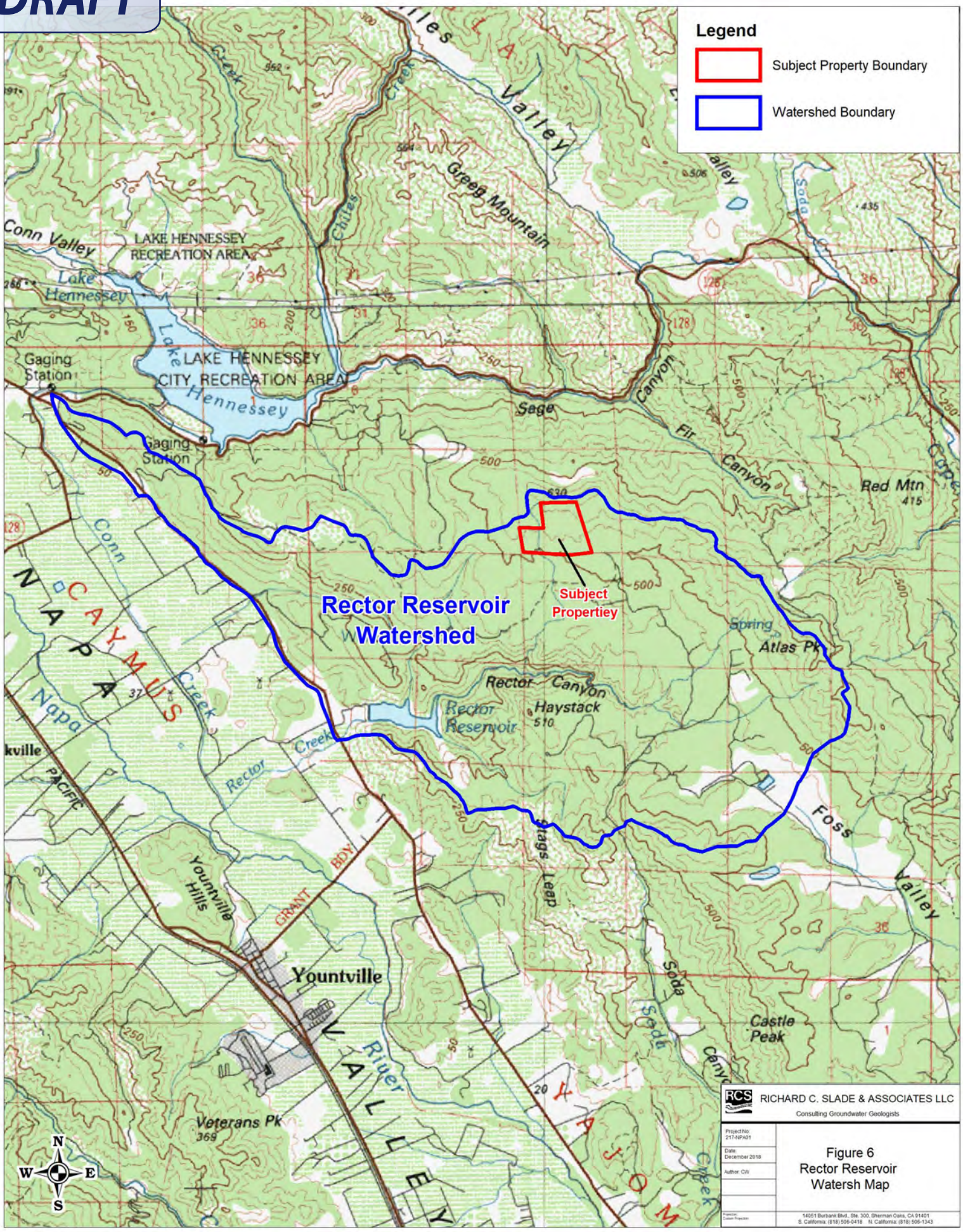

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Date: December 2018
Author: CW

Figure 6
Rector Reservoir
Watersh Map

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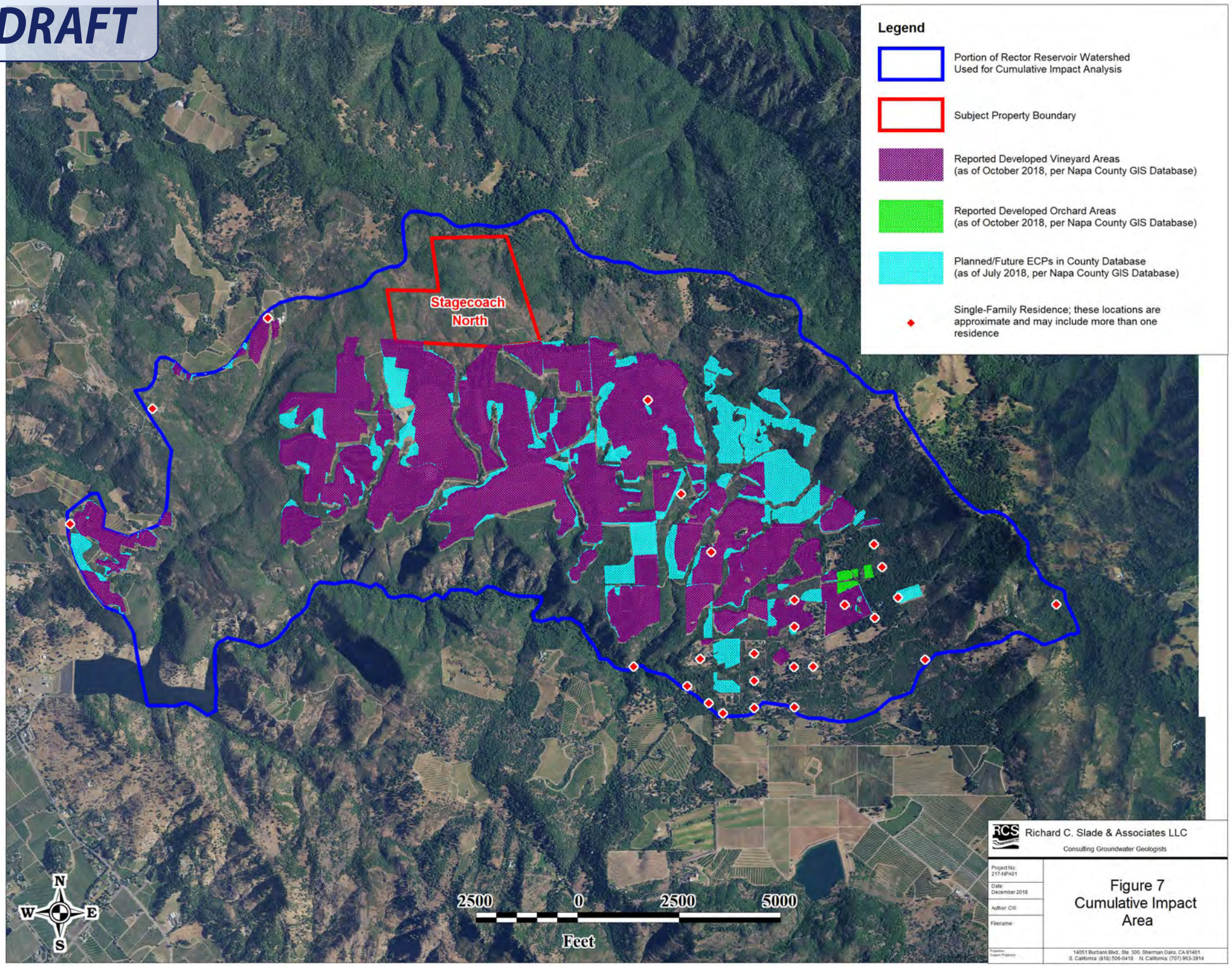

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Figure 7
Cumulative Impact Area

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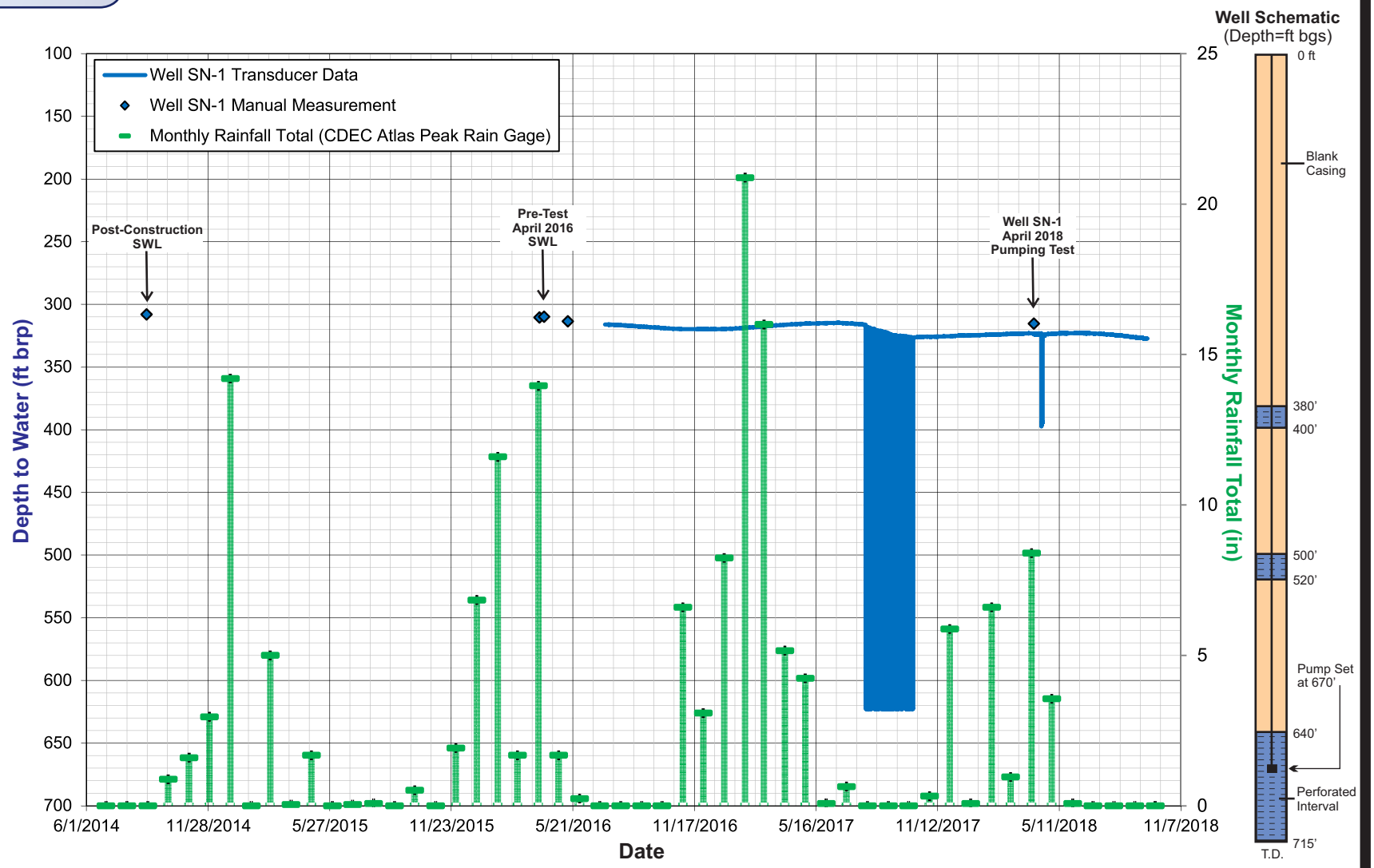

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FIGURE 8A
WATER LEVEL HYDROGRAPH
STAGECOACH NORTH WELL SN-1

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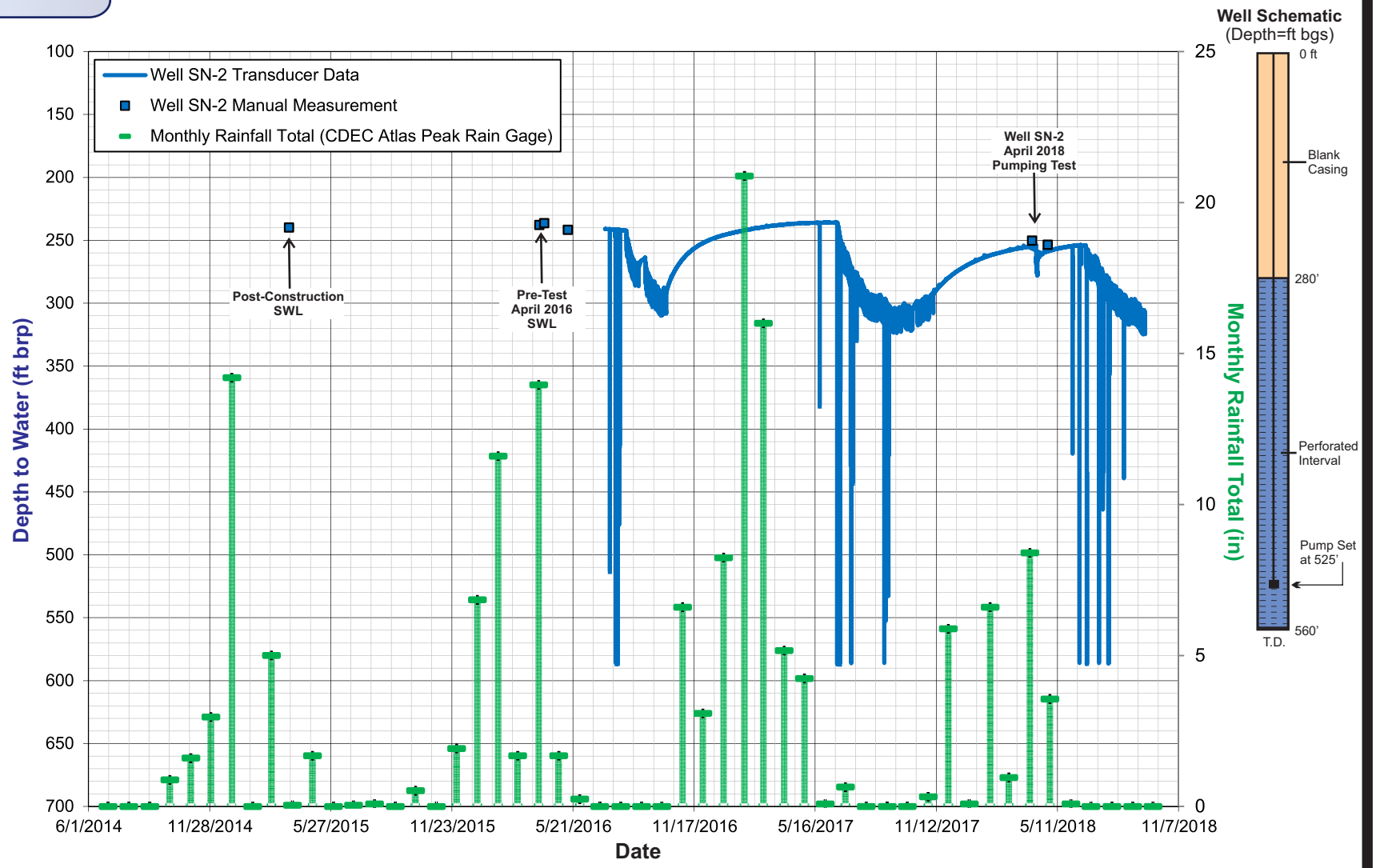

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FIGURE 8B
WATER LEVEL HYDROGRAPH
STAGECOACH NORTH WELL SN-2

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APPENDIX A

DWR WELL COMPLETION REPORTS AND AQUIFER TESTING RESULTS

FIGURES
A1 – Water Level Data During Background Water Level Monitoring Period
A2 – Water Level Data During Constant Rate Pumping Test, Well SN-2
A3 – Water Level Data During Constant Rate Pumping Test, Well SN-1

Well Completion Reports for Well SN-1 and Well SN-2

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Results of Aquifer Testing of Two Onsite Wells

Constant rate pumping tests were performed in Wells SN-1 and SN-2 in April 2018. The purpose of these pumping tests was to determine if these onsite wells could pump at rates sufficient to meet the proposed water demands of the project. Wells SN-1 and SN-2 were constructed in August 2014 and March 2015, respectively, in order to provide the groundwater needed to meet the water demands estimated to be required for the Stagecoach North vineyard development. These pumping tests were also performed in order to permit the collection of data necessary for RCS to help meet the requirements of the County's Water Availability Analysis.

Specifically, these pumping tests were designed by RCS to meet the following criteria:

- Determine if Wells SN-1 and SN-2 can pump at sufficient rates to meet the proposed irrigation water demands of the subject property (approximately 45.7 AF/yr).
- Monitor the amount of self-induced drawdown created in the pumping well by virtue of its own pumping.
- Monitor the amount of water level decline (i.e., water level drawdown interference), if any, that might be induced in another water level observation well by virtue of the subject pumping test of the pumping well.
- Monitor water level recovery rates in the pumping well following the end of the pumping test.
- Help determine the aquifer parameters of transmissivity and storativity for the fractured rock aquifer systems in the rocks of the Sonoma Volcanics that supply the groundwater pumped by the onsite wells. Storativity cannot be determined using water level drawdown from the pumping but, instead, can be calculated only if water level drawdown interference is induced in another water level observation well being monitored during the individual pumping tests.

Pumping Test Protocol

The logistics and protocol for the subject aquifer (pumping) tests of Wells SN-1 and SN-2 were developed by RCS geologists and provided to LGS Drilling, Inc. (LGS), who was the pumping contractor retained by the subject property to perform the pumping tests. Key portions of these aquifer tests included: a period of baseline water level monitoring prior to the start of pumping; the main pumping portion of the constant rate pumping test for each well; and a final period of monitoring of water level recovery following the constant rate pumping portion of each test. Based on field conditions and the project groundwater demands for the subject property at the time of the subject tests, the key protocol were generally followed for these aquifer tests. Provided below is a summary of the key aquifer testing protocol:

- Transducer Installation – Water level pressure transducers were installed into onsite Wells SN-1 and SN-2 and offsite water level observation Wells SV-4, SV-14, and SV-15 by RCS geologists during a site visit to the subject property on April 3, 2018. A barometric pressure transducer was also installed by the RCS geologist near the wellhead of Well SV-4. All six installed transducers were operational and collected water level and/or barometric pressure readings between April 3 and 19, 2018.

  A 300 psi water level transducer was installed in each of the five wells; the transducer manufacturer and model type were In-Situ LevelTROLL™ 400. The

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accuracy of the 300 psi transducer, as reported by the transducer manufacturer is ±0.0658 ft. The barometric pressure transducer that is also installed at Well SV-4 has a manufacturer-reported accuracy of ±0.0691 ft.

- Baseline Water Level Monitoring – The purpose of the baseline water level monitoring was to record groundwater level fluctuations that may have been occurring in the area prior to the start of the constant rate pumping portions of each aquifer test. Changes in such background (baseline) water levels can occur due to natural water level fluctuations in the aquifer and/or water level declines caused by possible water level drawdown interference from other pumping wells in the area. Baseline monitoring began on April 3, 2018, after the transducers had been installed in the five water level observation wells that were monitored during the tests. None of these five monitored observation wells (SN-1, SN-2, SV-4, SV-14, and SV-15) were pumped from that date up until the start of the initial constant rate pumping test at Well SN-2 on April 9, 2018. Notably, transducer data show that during this roughly 6-day baseline monitoring period, none of the monitored wells were pumped.
- Constant Rate Pumping Tests – The key portion of each aquifer test, the 48-hour constant rate pumping test, was performed at Wells SN-1 and SN-2 on the dates and at the average pumping rates, as follows:

  Well SN-1 – April 14 to 16, 2018, at an average rate of 54 gpm

  Well SN-2 – April 9 to 11, 2018, at an average rate of 154 gpm

  Water levels were continually collected by all transducers during the pumping tests at a frequency of one measurement every minute; the barometric pressure transducer was collecting measurements once every 10 minutes. Occasional manual water level measurements were also collected in Wells SN-1, SN-2, SV-4, SV-14, and SV-15 by the pumper to help corroborate the transducer-collected measurements in those wells. Following review of the datasets, the collected manual measurements (via the LGS pumper) were determined by RCS geologists to be in general agreement, and this corroborated the transducer-collected water level data.
- Water Level Recovery Monitoring – Following the end of the pumping portion of each of these constant rate pumping tests, water level recovery data were then collected for a period of approximately 3 days at each transducer-monitored well site.
- Discharge of Pumped Groundwater – During the 48-hour pumping periods at the SN-1 and SN-2 well sites, groundwater was discharged to an onsite area pre-approved by the vineyard manager.

Results of April 2018 Aquifer Tests

Water level data collected between April 3 and 19, 2018 for Wells SN-1 and SN-2 (the pumping wells) and the three observation wells (Wells SV-4, SV-14, and SV-15) are shown on Figures A1 through A3. It is important to note that, although not shown independently on these graphs herein, barometric pressure data were also collected during the aquifer tests. Transducer data shown for each monitored well were corrected using those barometric data (that is, changes is barometric pressure were factored out of each data set, so that the graphed water level data now reflect only changes in water levels in the wells). It is also noteworthy to mention that during the entire aquifer testing period, barometric pressure measurements ranged in the area

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varied by a maximum of 1.02 pounds per square inch (psi); this approximately equates to a water level change of 2.36 ft.

Background Water Level Monitoring

As previously noted, background water levels were monitored by the transducers for a period of roughly 6 days prior to the start of the initial constant rate pumping test at Well SN-2. Below is a summary of those pre-test (background) water level observations for each well (refer to Figure A1, "Water Level Data During Background Water Level Monitoring Period"):

1. Onsite Wells
    - Well SN-1 – Static water levels recorded by the transducer in Well SN-1 during the background water level monitoring period appeared to be relatively stable at a depth of approximately 323.8 ft brp, between April 3 and 6, 2018. Between April 6 and 7, 2018, water levels appeared to have increased slightly from a depth of 323.8 ft to 323.5 ft brp, before slightly declining and becoming stable once again at a depth of 323.8 ft brp prior to the constant rate pumping test at Well SN-2 on April 9, 2018.
    - Well SN-2 – During the 6-day background monitoring period, water levels are shown to have been stable at a depth of approximately 254.8 ft brp between April 3 and 6, 2018. Similar to Well SN-1, water levels then increased slightly from 254.8 ft to 254.4 ft brp between April 6 and 7, 2018. Thereafter, water levels appeared to remain relatively stable (at a depth of 254.4 ft brp) prior to the start of the constant rate pumping test of this well on April 9, 2018.
2. Offsite Wells
    - Well SV-4 – Water levels in this offsite observation well were shown to have increased slightly between April 3 and 7, 2018, from a depth of 295.3 ft to 294.8 ft brp, and then remained stable at a depth of 294.8 ft brp prior to the start of the constant rate pumping test at Well SN-2.
    - Well SV-14 – Similar to Well SV-4, water levels in Well SV-14 appeared to have increased slightly from 279.0 ft to 278.8 ft brp between April 3 and 7, 2018, and were stable thereafter prior to the constant rate test of Well SN-2 on April 9, 2018.
    - Well SV-15 – As observed in the other monitored wells, water levels in Well SV-15 also appeared to show a slight increase from approximately 426.0 ft to 425.6 ft brp between April 3 and 9, 2018. Water levels then remained stable at a depth of approximately 425.6 ft brp between April 7 and 9, 2018, prior to the start of the constant rate test.

As observed during the background water level period in each of the five transducer-monitored wells, water levels appeared to increase slightly in each well (on the order of 0.2 ft to 0.4 ft), depending on the well. Although these increases are minor, they do occur at similar times and indicate that possibly other nearby offsite wells (or wells on the Stagecoach Vineyard property) may have been pumping during the initial portion of the background water level monitoring period. Based on those data shown on Figure A1 and as discussed above, the offsite well or wells in question may have been shut down on or around April 6, 2018.

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Also, water levels recorded by the transducers in these wells were observed to oscillate by approximately 0.2 ft. These oscillations were observed to generally occur every few minutes and are likely the result of the stated accuracy of the transducer.

Well SN-2

Constant Rate Pumping Test

Pumping for the constant rate pumping test portion of the aquifer test for Well SN-2 began on April 9, 2018, and continued for 48 continuous hours (2,880 minutes) at an average pumping rate of 154 gpm. The average pumping rate was determined from totalizer dial readings recorded by the LGS pumper throughout the pumping period. Figure A2, "Water Levels During Constant Rate Pumping Test, Well SN-2," graphically illustrates the water levels as recorded by the pressure transducer and via occasional manual water level measurements obtained by the pumper in Well SN-2. Also shown on Figure A2 are the water level data collected from the four observation wells (Wells SN-1, SV-4, SV-14, and SV-15) that were also monitored during the aquifer testing of Well SN-2. Below is a summary of the water level data collected from the pumping well (Well SN-2), and from the four water level observation wells during the pumping and water level recovery portions of the Well SN-2 constant rate pumping test:

- Well SN-2 (pumping well) – A pre-test static water level of 254.4 ft brp was measured in this well just before its pump was turned on to begin the subject pumping test. After 48 hours (2,880 minutes) of continuous pumping at a rate of 154 gpm, the maximum pumping water level (PWL) in pumping Well SN-2 was measured at a depth of 277.8 ft brp, as shown on Figure A2. This represents a total drawdown at the end of the 48-hour constant rate pumping test of 23.4 ft and the calculated specific capacity for this well is 6.58 gpm/ft ddn. As shown on Figure A2, water levels in this pumping well did not appear to be completely stable by the end of the pumping test. Specifically, in the last 4 hours of the pumping period, the PWL in this well was decreasing at a rate of about 0.23 feet per hour. Also, this final PWL of 277.8 ft brp was about 2 ft above the top of the uppermost perforations in the well (at a depth of 280 ft bgs).

  Following pump shut-off, water level recovery data were then collected for an additional period of 3 days prior to the start of the constant rate pumping test in Well SN-1. Water levels in Well SN-2 during this time period were observed to recover to a depth of 262.5 ft brp on April 14, 2018 (72 hours after the end of the pumping period); this depth represents a water level recovery of roughly 65%. Water levels continued to recover (increase) slowly in this well throughout the remainder of the aquifer testing period, which ended on April 19, 2018. Note that water levels continued to slowly recovery during the 2-day pumping test period of Well SN-1 between April 14 and 16, 2018. A water level recovery measurement of 260.5 ft brp was recorded on April 19, 2018. This depth is 6.1 ft below the initial, pre-test static water level in this well (at 254.4 ft). Transducer data shown on Figure 8B (see "Water Level Data" section herein) reveal that water levels in Well SN-2 eventually recovered to pre-test SWLs on June 2, 2018 at a depth of 254.5 ft brp.

- Observation Wells
  - Well SN-1 – Water levels in Well SN-1 remained stable at a depth of 323.8 ft brp during the constant rate pumping test of Well SN-2, and only fluctuated a couple

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tenths of a foot during the entire testing period. Therefore, no definitive water level drawdown impact was observed in Well SN-1 during the 48-hour constant rate pumping test of Well SN-2. Note that Well SN-1 is located approximately 680 ft west of Well SN-2.

- Well SV-4 – Water levels in Well SV-4 were observed to have slowly increased by a total of 0.4 ft during the 48-hour test period at Well SN-2. Thus, no definitive water level drawdown impact was detected in the transducer data for Well SV-4 while performing the pumping test at Well SN-2. Well SV-4 lies approximately 530 ft south of Well SN-2.
- Well SV-14 – Similar to Well SV-4, water levels in Well SV-14 appeared to have slightly increased during the 48-hour pumping period of Well SN-2. Transducer data for Well SV-14 show that water levels increased by approximately 0.3 ft (from 278.8 ft to 278.5 ft brp) over the entire 48-hour testing period at Well SN-2. Thus, no definitive water level drawdown impact was detected in the transducer data for Well SV-14 while performing the 48-hour constant rate test at Well SN-2. Well SV-14 is approximately 2,550 ft southwest of Well SN-2.
- Well SV-15 – Water levels in Well SV-15 increased by approximately 0.4 ft (from 425.8 ft to 425.4 ft brp) during the constant rate pumping test of Well SN-2. Therefore, based on the transducer data, no definitive water level drawdown impact was observed in Well SV-15 during the constant rate pumping test of Well SN-2. Well SV-15 is located approximately 2,800 ft southwest of Well SN-2.

Well SN-1

Constant Rate Pumping Test

Pumping at Well SN-1 for the constant rate pumping test began on August 14, 2018, and continued for 48 continuous hours (2,880 minutes) at an average pumping of 54 gpm, as calculated from totalizer dial readings recorded by the LGS pumper during the test. Figure A3, "Water Levels During Constant Rate Pumping Test, Well SN-1," graphically illustrates the water levels as recorded by the pressure transducer and via occasional manual water level measurements obtained by the pumper in Well SN-1. Below is summary of the water level data collected from Well SN-1 (the pumping well) and from the four observation wells during the pumping portion and subsequent water level recovery portion of the Well SN-1 aquifer test.

- Well SN-1 (pumping well) – A pre-test SWL of 322.9 ft brp was measured in this well just before the pump was turned on to begin the constant rate pumping test. After 48 hours of continuous pumping, the final PWL in Well SN-1 was measured at a depth of 393.8 ft brp, as shown on Figure A3. This represents a total water level drawdown during the 48-hour constant rate pumping test of 70.9 ft and calculates to a specific capacity for this well of 0.76 gpm/ft ddn. In the first hour of the pumping test, the pumping rate was reportedly adjusted a few times by the pumper, thus causing the minor increases/decreases in water levels that were observed in the transducer data for Well SN-1 in the early part of testing. As shown on Figure A3, water levels appeared to be relatively stable during the 48-hour pumping test. In the last 4 hours of the pumping test, PWLs are shown to have remained stable at a depth of 393.8 ft brp.

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Following pump shut-off, water level recovery data showed that water levels in Well SN-1 recovered to a depth of 324.7 ft brp approximately 3 days (72 hours) into the recovery period. This represents a recovery of 97% of the total drawdown recorded during the pumping portion of the test. Water levels fully recovered to pre-test SWLs on May 11, 2018.

- Observation Wells
  - Well SN-2 – Water levels in Well SN-2 appeared to have increased by 1.2 ft (from 262.5 ft to 261.3 ft brp) during the constant rate pumping test of Well SN-1. Therefore, no definitive water level drawdown impact was observed in Well SN-2 during the 48-hour constant rate pumping test at Well SN-1. Note that Well SN-2 is located approximately 680 ft east of Well SN-2.
  - Well SV-4 – Water levels recorded by the transducer in Well SV-4 also showed no definitive water level drawdown impact while performing the 48-hour constant rate pumping test at Well SN-1. Water levels in Well SV-4 were observed to have increased by approximately 0.4 ft (294.4 ft to 294.0 ft brp) during the 48-hour testing period. Well SV-4 is approximately 900 ft southeast of Well SN-1.
  - Well SV-14 – Similar to Well SV-4, water levels in Well SV-14 appeared to have slightly increased during the 48-hour pumping period of Well SN-1. Transducer data for Well SV-14 show that water levels slowly increased approximately 0.4 ft (from 278.7 ft to 278.3 ft brp) over the entire 48-hour pumping test of Well SN-1. Thus, no definitive water level drawdown impact was detected in the transducer data for Well SV-14 while performing the 48-hour constant rate test of Well SN-1. Well SV-14 lies approximately 2,310 ft south of Well SN-1.
  - Well SV-15 – Water levels recorded by the transducer installed in Well SV-15 showed no definitive water level decline performing the 48-hour constant rate pumping test at Well SN-1, because water levels in Well SV-15 increased 0.5 ft (from 425.6 ft to 425.1 ft brp) during the testing period. Well SV-15 is situated approximately 2,130 ft southwest of Well SN-1.

Specific Capacity Data

A useful indicator of well performance or efficiency (in terms of changes in water level drawdown over time with respect to pumping rate) is the specific capacity of a well, which can be calculated from the results of the aquifer test or from data generated during regular periods of pumping and water level monitoring. In general, when groundwater is pumped from an active water well, a hydraulic gradient is established toward the well, and a cone of water level depression forms within the local aquifer system, with the pumping well being located at the locus of this cone. In general, the greater the pumping rate (and/or the longer the duration of pumping), the greater is the water level drawdown in the pumping well (drawdown represents the vertical distance between the non-pumping, or static, water level and the resulting pumping water level in the well). As an indication of the relative efficiency or productivity of a well, the term “specific capacity” is commonly used to define the amount of water (in gallons per minute) that the well will yield for each foot of water level drawdown created while the well is pumping at a particular rate. The specific capacity of a well is calculated using the pumping rate of the well (in gpm) divided by the total water level drawdown (in ft) created in that well while pumping at

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that rate, and is expressed in units of gallons per minute per foot of water level drawdown (gpm/ft ddn).

The specific capacity of a well depends on several factors, including the hydrogeologic characteristics and thickness of the local aquifer system, the method of well construction, the type and degree of well development performed, the age and current condition of the casing, perforations, and gravel pack, and the pumping rate and pumping duration of the pumping event being monitored. Hence, it is difficult to compare specific capacity values from one well to another even if the two wells are in the same aquifer system.

During the constant rate pumping tests performed in Wells SN-1 and SN-2 in April and May 2016 and April 2018, the specific capacity values for these wells were calculated to be:

- Well SN-1: 0.67 gpm/ft ddn in May 2016, and 0.76 gpm/ft ddn in April 2018
- Well SN-2: 7.08 gpm/ft ddn in April 2017, and 6.58 gpm/ft ddn in April 2018

Thus, the specific capacity in each well has remained relatively stable in the 2 years since aquifer testing was last performed in the onsite wells. In general, the higher the specific capacity value for a well, the more productive (or efficient) a well is with respect to pumping rates and resulting drawdowns. Specific capacity is essential in determining changes in well performance over time, and helping to determine when a well is in need of rehabilitation.

Calculation of Aquifer Parameters

Important aquifer parameters such as transmissivity (T) and storativity (S) can often be determined using data collected during a pumping test of a well. Transmissivity is a measure of the rate at which groundwater can move through an aquifer system, and therefore is essentially a measure of the ability of an aquifer to transmit water to a pumping well. Transmissivity is expressed in units of gallons per day per foot of aquifer width (gpd/ft). Storativity (S) is a measure of the volume of groundwater taken into or released from storage in an aquifer for a given volume of aquifer materials; storativity is dimensionless and has no units. Storativity calculations can only be made using water level drawdown data, if any, monitored in an observation well during a pumping test; storativity cannot be calculated using water level drawdown data acquired solely from a pumping well of another well; storativity cannot be calculated using water level data acquired solely from a pumping well. However, there were no definitive water level drawdown impacts in any of the water level observation wells that were monitored during the pumping tests of Wells SN-1 and SN-2.

Water level drawdown and recovery data collected during the constant rate pumping tests of Wells SN-1 and SN-2 were input in to the software program AQTESOLV (version 4.5 Professional). No observation well drawdown data were input into the analytical software program since there were no definitive water level drawdown impacts observed during the pumping tests. Numerous analytical solutions were then applied in attempt to determine transmissivity values using automatic and/or manually curve fitting procedures. The solutions utilized consisted of unconfined, confined, semi-confined (leaky), and/or fractured aquifer solutions.

Also, certain assumptions must be made about the aquifer the aquifer when using these solutions. In general, for the solutions used, key assumptions are: that the aquifer has an infinite areal (lateral) extent; that the pumping wells fully penetrates the aquifer system(s); and that water is instantaneously released from storage with the decline of hydraulic head. Also, for

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the purposes of this analysis, the assumption is made that the saturated aquifer thickness for each well is as follows:

- Well SN-1: 390 ft (as of April 14, 2018)
- Well SN-2: 305 ft (as of April 9, 2018)

These values were determined by taking the approximate vertical distance between the static water level in each well (prior to the start of each pumping test) and the bottom of the casing perforations in each well.

Based on the analytical solutions used via the AQTESOLV software, transmissivity values were shown to vary, depending on well location. For those curve-fitting solutions that best matched the latter time portion of the water level data acquired during each test and during the water level recovery period in the each pumping well, transmissivity values observed in each onsite well ranged between the following values:

- Well SN-1: 754 gpd/ft to 38,790 gpd/ft
- Well SN-2: 957 gpd/ft to 4,325 gpd/ft

Note that because there was no definitive water level drawdown interference in any of the monitored wells during the pumping tests of Well SN-1 and Well SN-2, a storativity value could not be calculated.

In similar analyses done for other RCS projects for wells constructed within Sonoma Volcanic rock materials, transmissivity values have varied from about ±1,000 gpd/ft to ±30,000 gpd/ft. Therefore, the transmissivity values determined from the aquifer testing performed in each well are seen to fall within this range.

An independent evaluation of transmissivity, using data from each pumping test were made via the empirical relationship T≈1,750*(Q/s), where (Q/s) is the specific capacity of the pumping well and 1,750 is an empirical constant for the semi-confined aquifer system assumed to exist in the fractured volcanic rocks of the Sonoma Volcanics. Applying this relationship to the specific capacity value calculated for each well during its respective pumping test yields the following transmissivity values:

- Well SN-1: 1,330 gpd/ft
- Well SN-2: 11,515 gpd/ft

These values are somewhat similar to transmissivity values determined via the analytical solutions and the pumping test data for each well, depending on the type of curve-fitting solution used.

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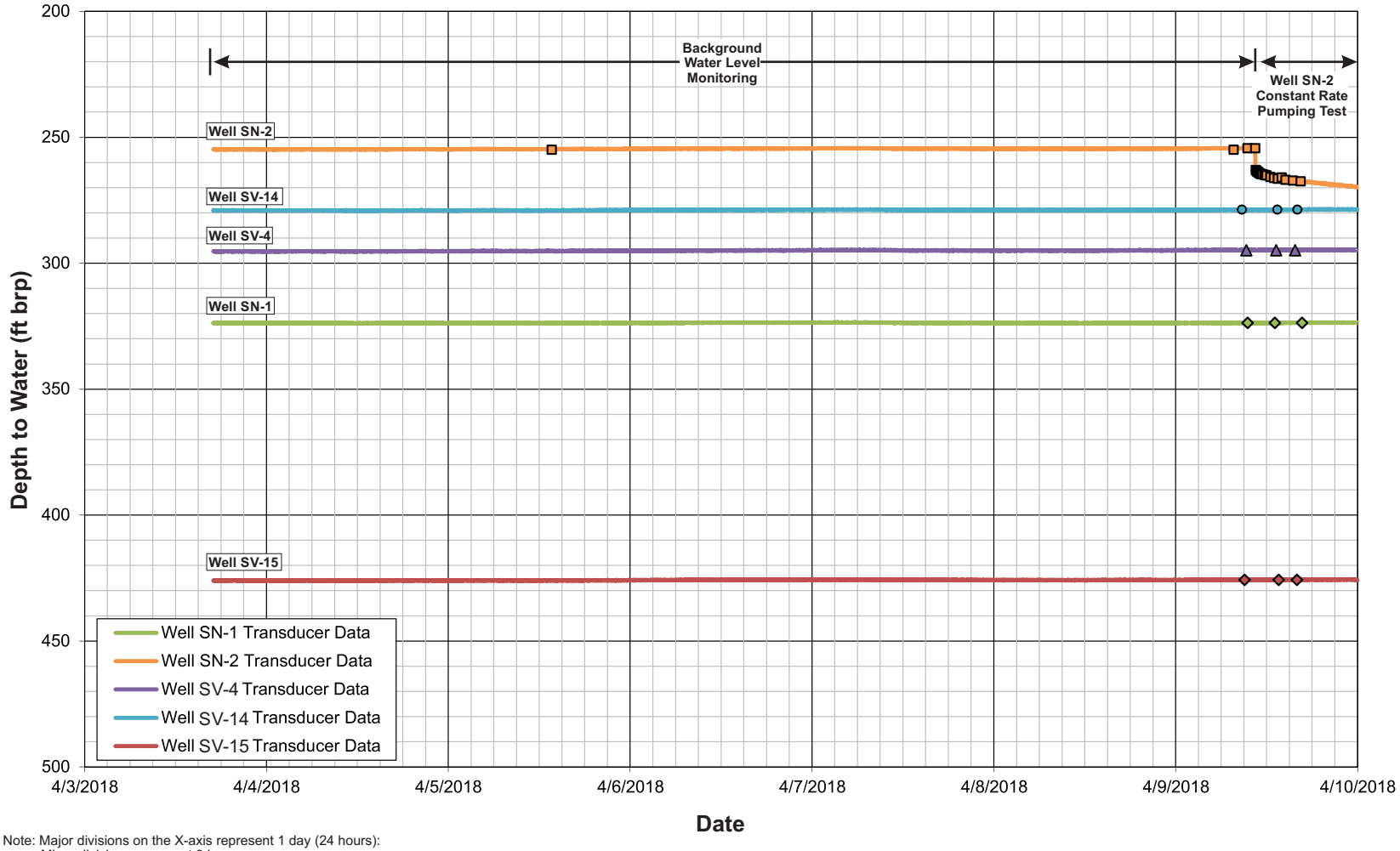

Note: Major divisions on the X-axis represent 1 day (24 hours):
Minor divisions represent 3 hours.

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FIGURE A1
WATER LEVEL DATA DURING BACKGROUND WATER LEVEL MONITORING PERIOD

Job No. 217-NPA01 **December 2018**

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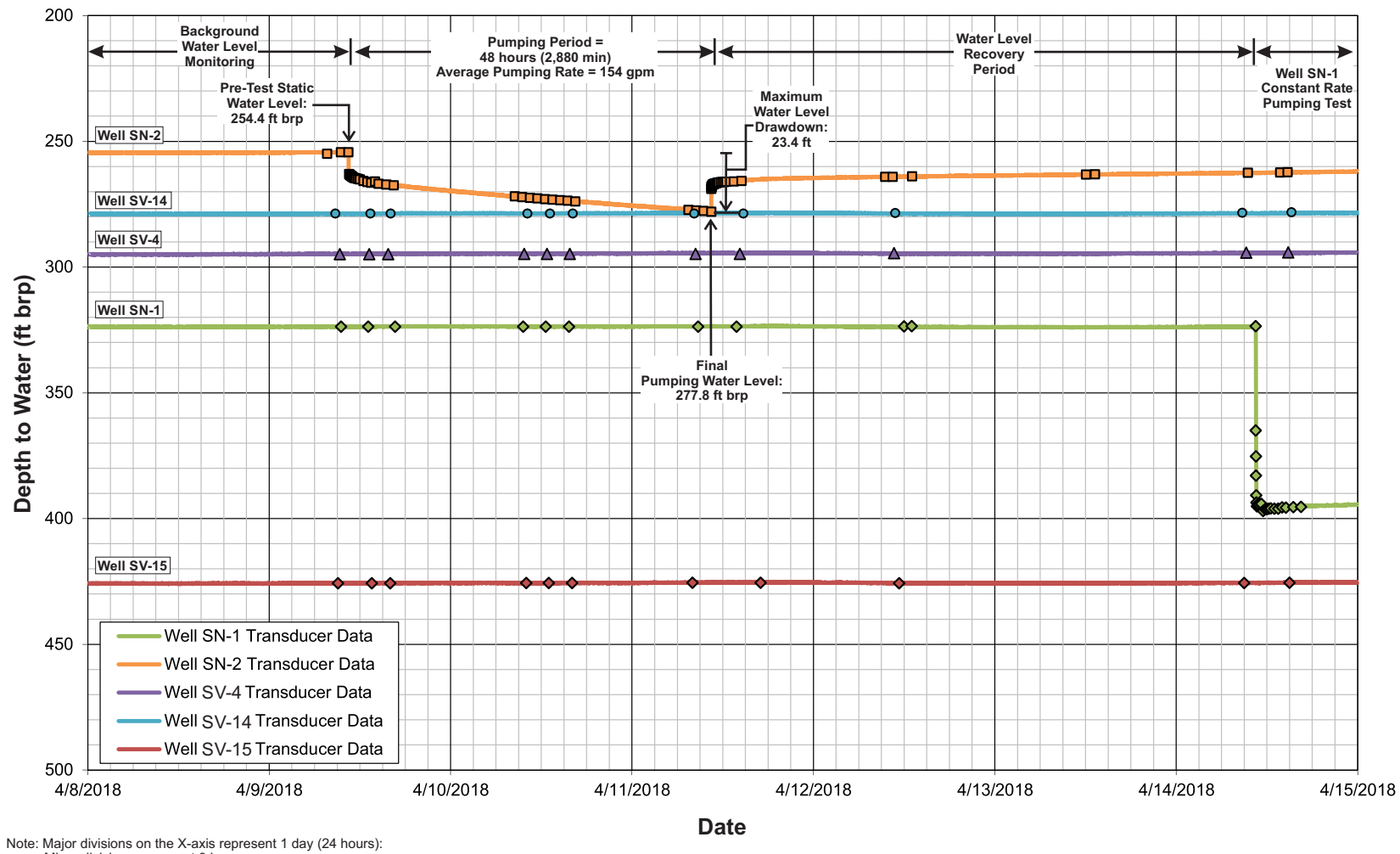

Note: Major divisions on the X-axis represent 1 day (24 hours):
Minor divisions represent 3 hours.

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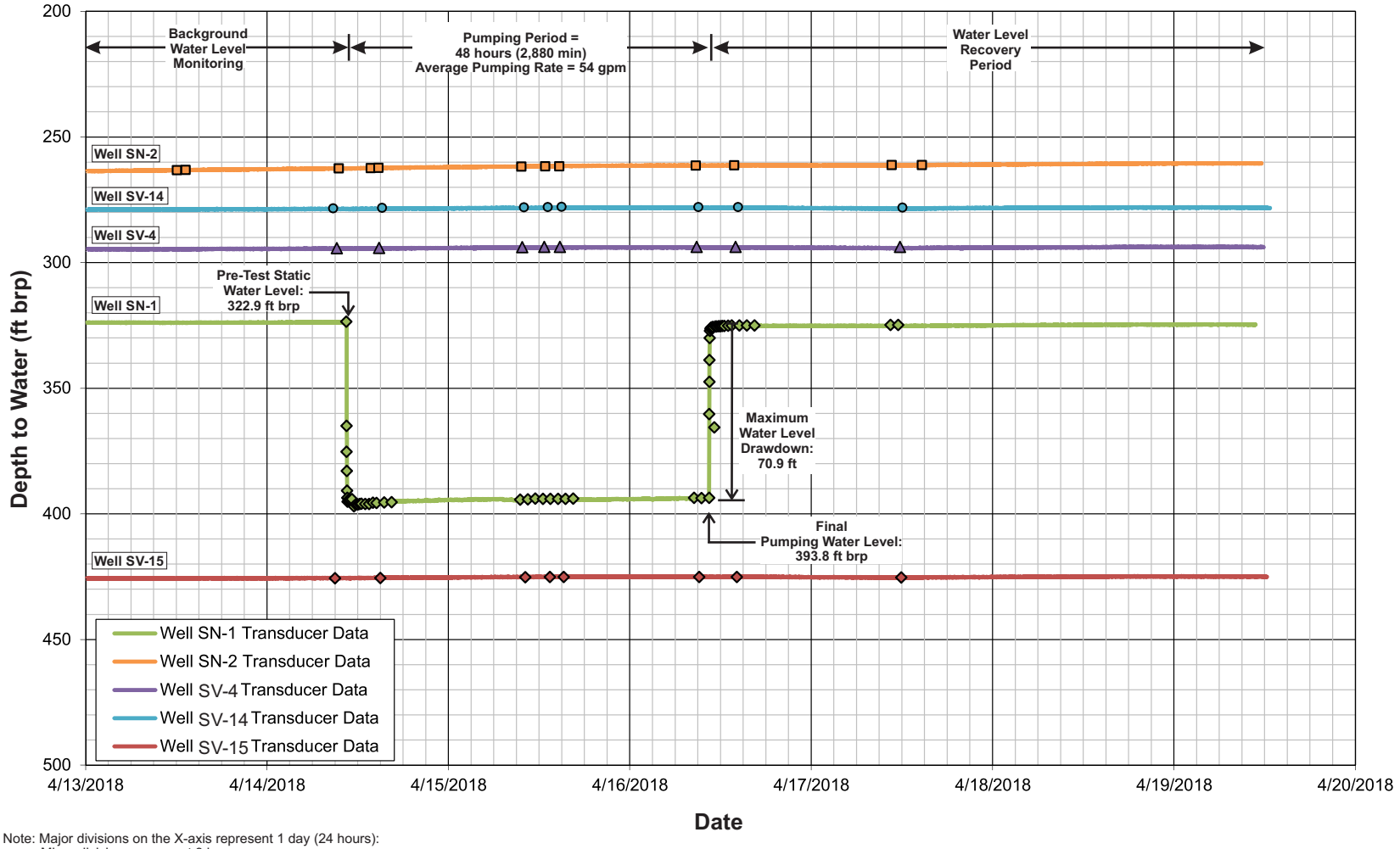
FIGURE A2
WATER LEVEL DATA DURING CONSTANT RATE PUMPING TEST
STAGECOACH NORTH WELL SN-2

Job No. 217-NPA01 **December 2018**

DRAFT



Note: Major divisions on the X-axis represent 1 day (24 hours):
Minor divisions represent 3 hours.

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FIGURE A3
WATER LEVEL DATA DURING CONSTANT RATE PUMPING TEST
STAGECOACH NORTH WELL SN-1

Job No. 217-NPA01 **December 2018**

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0231245

Page 1 of 1

Owner's Well Number Well #1 knief land SN-1

Date Work Began 07/28/2014 Date Work Ended 8/6/2014

Local Permit Agency Planning, Building & Environmental

Permit Number E14-00579 Permit Date 7/21/14

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ○ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Direct Rotary Drilling Fluid Bentonite mud

Depth from Surface Feet	to Feet	Description: Describe material, grain size, color, etc
0	30	Soli hard rock
30	45	Red rock soft layer
45	140	Very hard black rock
140	400	soft brown and black rock (20-40 gpm @ 380)
400	420	Solid rock
420	520	Fractured hard black rock
520	600	soft black and green rock (60-80gpm total)
600	640	very soft black rock cave in (tested@ 100gpm)
640	720	Same material drilled with mud

Total Depth of Boring 720 Feet

Total Depth of Completed Well 715 Feet

Well Owner

Name Kruog Vineyards

Mailing Address Soda Canyon Rd.

City Napa State CA Zip 94558

Well Location

Address Soda Canyon Rd

City Napa County Napa

Latitude ___ Deg ___ Min ___ Sec N Longitude ___ Deg ___ Min ___ Sec W

Datum ___ Decimal Lat ___ Decimal Long ___

APN Book 032 Page 010 Parcel 086

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary.

Please be accurate and complete

Activity

- (●) New Well
- ○ Modification/Repair
  - ○ Deepen
  - ○ Other ___
- ○ Destroy

Describe procedures and materials under GEOLOGIC LOG

Planned Uses

- (●) Water Supply
  - ☐ Domestic ☐ Public
  - ☑ Irrigation ☐ Industrial
- ○ Cathodic Protection
- ○ Dewatering
- ○ Heat Exchange
- ○ Injection
- ○ Monitoring
- ○ Remediation
- ○ Sparging
- ○ Test Well
- ○ Vapor Extraction
- ○ Other ___

Water Level and Yield of Completed Well

Depth to first water 380 (Feet below surface)

Depth to Static Water Level 308 (Feet) Date Measured 08/29/2014

Estimated Yield * 90 (GPM) Test Type Constant Rate

Test Length 4 0 (Hours) Total Drawdown 0 (Feet)

*May not be representative of a well's long term yield

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	380	12	Blank	PVC Sch 80		8		
380	400	12	Screen	PVC Sch 80		8	Milled Slots	0.032
400	500	12	Blank	PVC Sch. 80		8		
500	520	12	Screen	PVC Sch. 80		8	Milled Slots	0.032
520	640	12	Blank	PVC Sch 80		8		
640	715	12	Staggered	PVC Sch 80		8	Milled Slots	0.032

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Cement	
20	720	Filter Pack	

Attachments

- ☐ Geologic Log
- ☐ Well Construction Diagram
- ☐ Geophysical Log(s)
- ☐ Soil/Water Chemical Analyses
- ☐ Other ___

Attach additional information, if it exists

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name D. Bess Pump & Well (Person, Firm or Corporation)

1115 Mt. George ave (Address) Napa (City) CA (State) 94558 (Zip)

Signed [signature] (C-57 Licensed Water Well Contractor) 8/26/14 (Date Signed) 487027 (C-57 License Number)

DWR 188 REV 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0260575

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude / Longitude

APN/TRS/Other

Page 1 of 1

Owner's Well Number Krupp Knief #2 (SN-2)

Date Work Began 03/05/2015 Date Work Ended 3/25/2015

Local Permit Agency planning, Building and Environmental

Permit Number E14-00578 Permit Date 7/21/14

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Air Drilling Drilling Fluid Air

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	200	Soft volcanics
200	250	Hard black rock
250	300	Same rock but fractured and 20 gpm
300	400	soft yellow ash
400	490	Hard fractured black, green and brown rock
490	510	soft red volcanics
510	565	soft yellow volcanics and ash
565	590	Hard fractured black rock

Total Depth of Boring 590 Feet

Total Depth of Completed Well 560 Feet

Well Owner

Name Krupp Vineyards

Mailing Address Soda canyon rd

City napa State ca Zip 94558

Well Location

Address Soda canyon rd

City napa County Napa

Latitude ___ Deg ___ Min ___ Sec N Longitude ___ Deg ___ Min ___ Sec W

Datum ___ Decimal Lat. ___ Decimal Long. ___

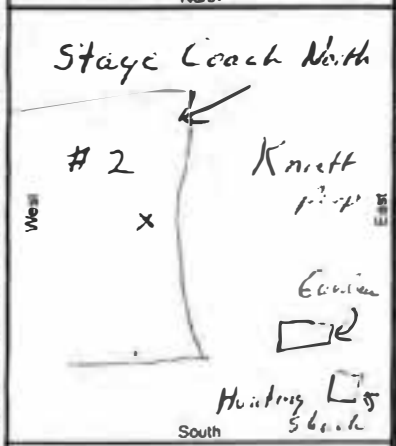
APN Book 032 Page 010 Parcel 086

Township ___ Range ___ Section ___

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North



Sketch or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

◉ Water Supply
☐ Domestic ☐ Public
☑ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
○ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water 240 (Feet below surface)

Depth to Static Water Level 240 (Feet) Date Measured 03/26/2015

Estimated Yield * 150 (GPM) Test Type Air Lift

Test Length 2.0 (Hours) Total Drawdown 0 (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	20	14	Blank	PVC Sch. 80		8		
20	280	14	Blank	PVC Sch. 80		8		
280	560	14	Staggered	PVC Sch. 80		8	Milled Slots	0.032

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	20	Bentonite	seal
20	590	Filter Pack	pea gravel

Attachments

☐ Geologic Log
☐ Well Construction Diagram
☐ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if available

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name D. Bess pump & Well (Person, Firm or Corporation)

1115 mt george ave (Address) napa (City) CA (State) 94558 (Zip)

Signed ___ (C-57 Licensed Water Well Contractor) Date Signed ___ 487027 (C-57 License Number)

DWR 188 REV 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

APPENDIX B

APRIL 2, 2018 MEMORANDUM

"PRESENTATION OF MONITORING DATA, STAGECOACH VINEYARDS"

DRAFT

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

April 2, 2018

MEMORANDUM

To: Mr. Trini Amador
E&J Gallo
Stagecoach Vineyards
Sent via email (trini.amador@ejgallo.com)

From: Anthony Hicke and Richard Slade
Richard C. Slade & Associates LLC

Job No. 217-NPA01

Re: Presentation of Monitoring Data
Stagecoach Vineyards
Soda Canyon Area, Napa County, California

Dear Mr. Amador,

Per our recent conversation, provided herein is an updated presentation of monitoring data for the Stagecoach Vineyards property, prepared in accordance with the Stagecoach Vineyards Environmental Impact Report (EIR) Mitigation Measure 4.6-4. Data in this Memorandum, which have been updated using data collected through March 19, 2018, include water level and groundwater extraction records for specific onsite wells. Data used to prepare the hydrographs and charts presented herein have been collected over time by Stagecoach personnel beginning in 2008. A previous monitoring Memorandum was provided by RCS to Stagecoach Vineyards on July 29, 2016.

Figure 1, "Well Location Map", shows the locations of all known Stagecoach wells. For the current monitoring period, data were provided to RCS for Stagecoach Wells 3, 4, 7, and 12. Note that monitoring was to occur in Stagecoach Wells 3, 4, and 12 (not Well 7) according to EIR Mitigation Measure 4.6-4. As discussed in the July 29, 2016 monitoring Memorandum by RCS, Stagecoach staff included monitoring of Well 7 as an alternative monitoring point to Well 3 in accordance with the EIR Mitigation Measure 4.6-4, because Well 3 is no longer used. Data received for Well 3 are included within this Memorandum, however.

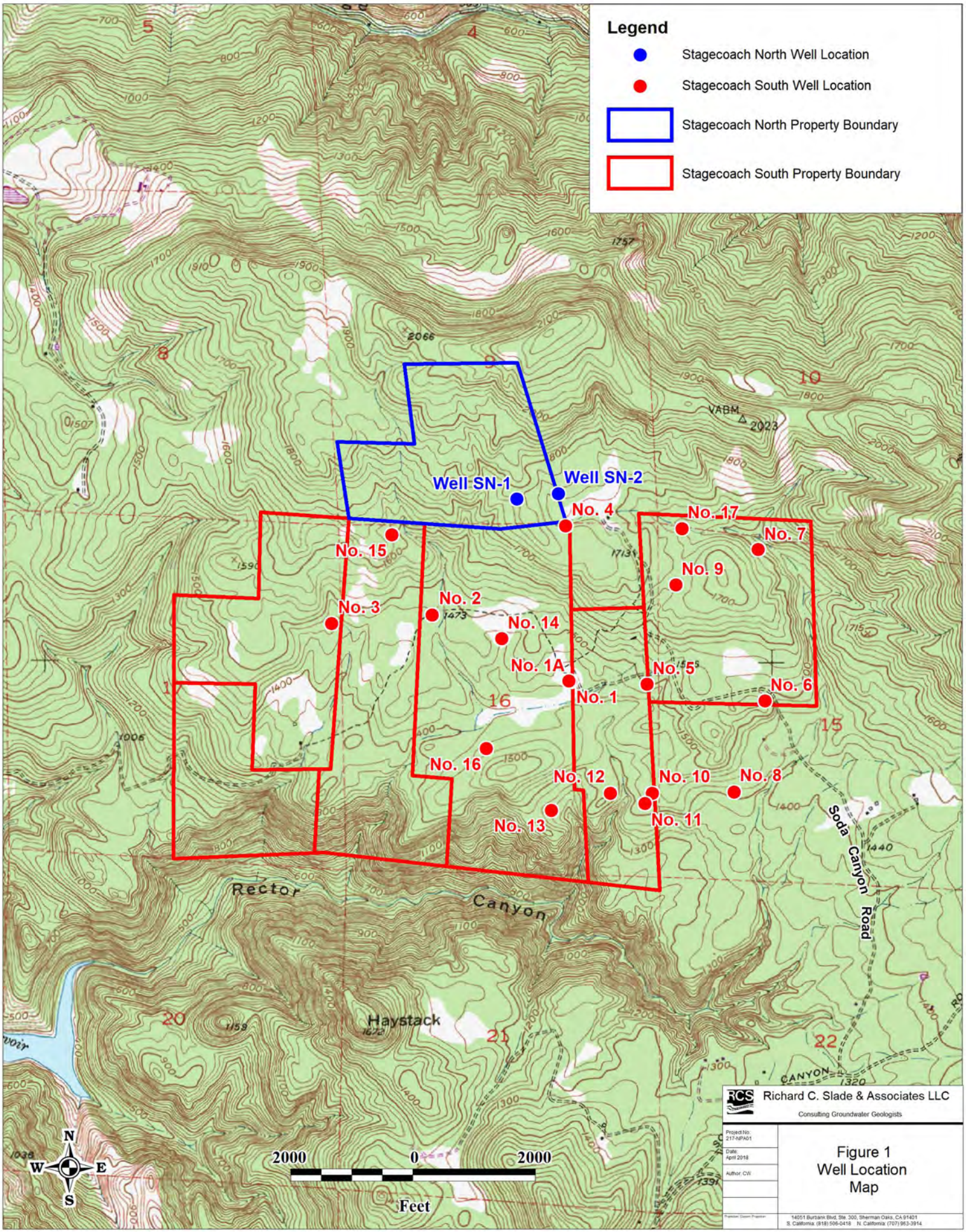
Table 1, "Volume of Groundwater Extracted by Irrigation Year" shows the volume of groundwater extracted from each of the wells required to be monitored over a certain period of time. These volume calculations were determined by RCS using the totalizer data collected by Stagecoach staff. It should be noted that it was necessary for RCS to make certain assumptions regarding "meter turnovers" (when a totalizer meter "resets" to zero) when interpreting these data.

MEMORANDUM

Figures 2A through 5A, "Water Levels vs Water Year Rainfall Total," show the water levels recorded in each well over time, versus the water year rainfall totals (note that a Water Year is October 1 through September 30), for the following two separate rain gages: the onsite Stagecoach Vineyards raingage, and the nearby Atlas Peak raingage, as reported by the California Data Exchange Center (CDEC, http://cdec.water.ca.gov/). Figures 2B through 5B, "Water Levels vs Accumulated Rainfall Departure," show the same water level data that were included in Figures 2A though 5A, but also include the accumulated rainfall departure of both rain gages instead of merely the water year rainfall totals. These accumulative rainfall departure curves are used to help define trends in rainfall over the period of record at the rain gages. In general, whenever the accumulative rainfall departure curve descends over time to the right, the total rainfall in each year during that period was generally at or below the long-term average annual rainfall. Alternatively, whenever the departure curve ascends over time to the right, the total rainfall in each year during that period was generally at or above the long-term average annual rainfall.

On Figures 4A and 4B, RCS observed that the water level data collected in Well 7 between January 2015 and June 2016 had a different signature than that water level data collected after June 2016. After further review, Stagecoach Vineyards reports that the January 2015 to June 2016 data set was erroneous due to possible transducer malfunction.

If you have any questions regarding the attached Figures or Table, please contact our office.



RCS Richard C. Slade & Associates LLC
Consulting Groundwater Geologists

Project No: 217-NPA01
Date: April 2018
Author: CW

Figure 1
Well Location
Map

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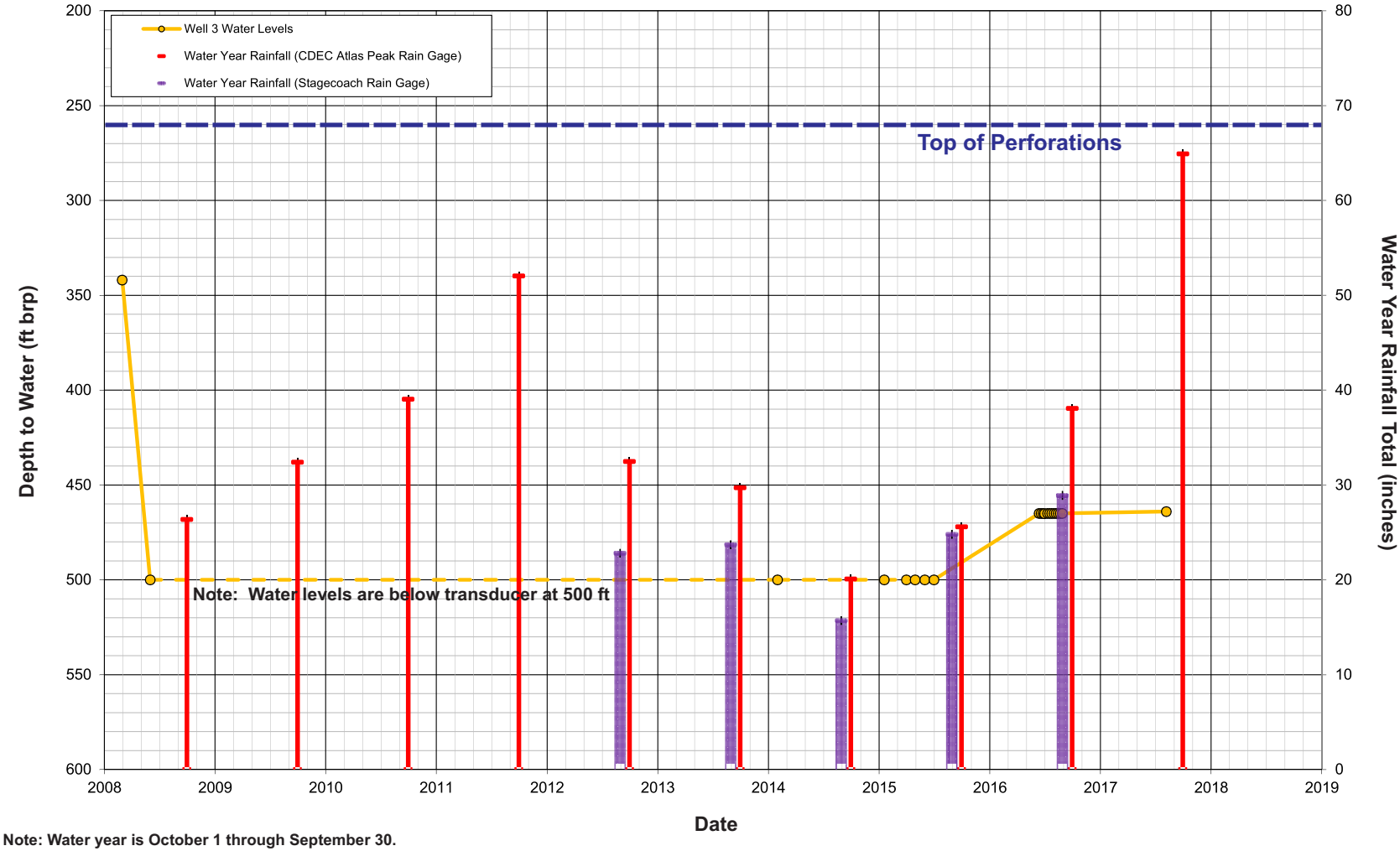
Table 1
Volume of Groundwater Extracted by Irrigation Year
Stagecoach Vineyards

Volume of Groundwater Extracted by Irrigation Year (Acre-Feet, AF)							
Well	**2017**	**2016**	**2015**	**2014**	**2010**	**2009**	**2008**
3	0.0	0.0	7.7	7.2	22.5	14.0	16.0
4	35.1	40.7	47.2	42.5	19.5	89.3	59.4
7	37.4	46.7	55.8	48.5	50.1	59.7	0.0
12	12.4	28.5	34.6	31.4	25.9	48.6	0.0
TOTAL	**84.9**	**115.9**	**145.4**	**129.7**	**118.1**	**211.6**	**75.4**
Totalizer Date Range	12/12/2016 to 12/11/2017	11/15/2015 to 12/12/2016	1/20/2015 to 11/5/2015	5/1/2014 to 1/20/2015	5/1/2010 to 10/4/2010	11/26/2008 to 10/15/2009	11/26/2008 to 10/15/2009
Remarks		Well 3 no longer used		Date range does not represent entire irrigation season	Date range does not represent entire irrigation season		

NOTE: Totalizer readings from Irrigation Years 2011, 2012, and 2013 were not recorded frequently enough to calculate total extractions, and/or contained data that appeared to be erroneous and/or inconsistent with data collected during other years.



Note: Water year is October 1 through September 30.

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FIGURE 2A
WATER LEVELS VS WATER YEAR RAINFALL TOTAL
STAGECOACH VINEYARDS WELL NO. 3

Job No. 217-NPA01 **April 2018**

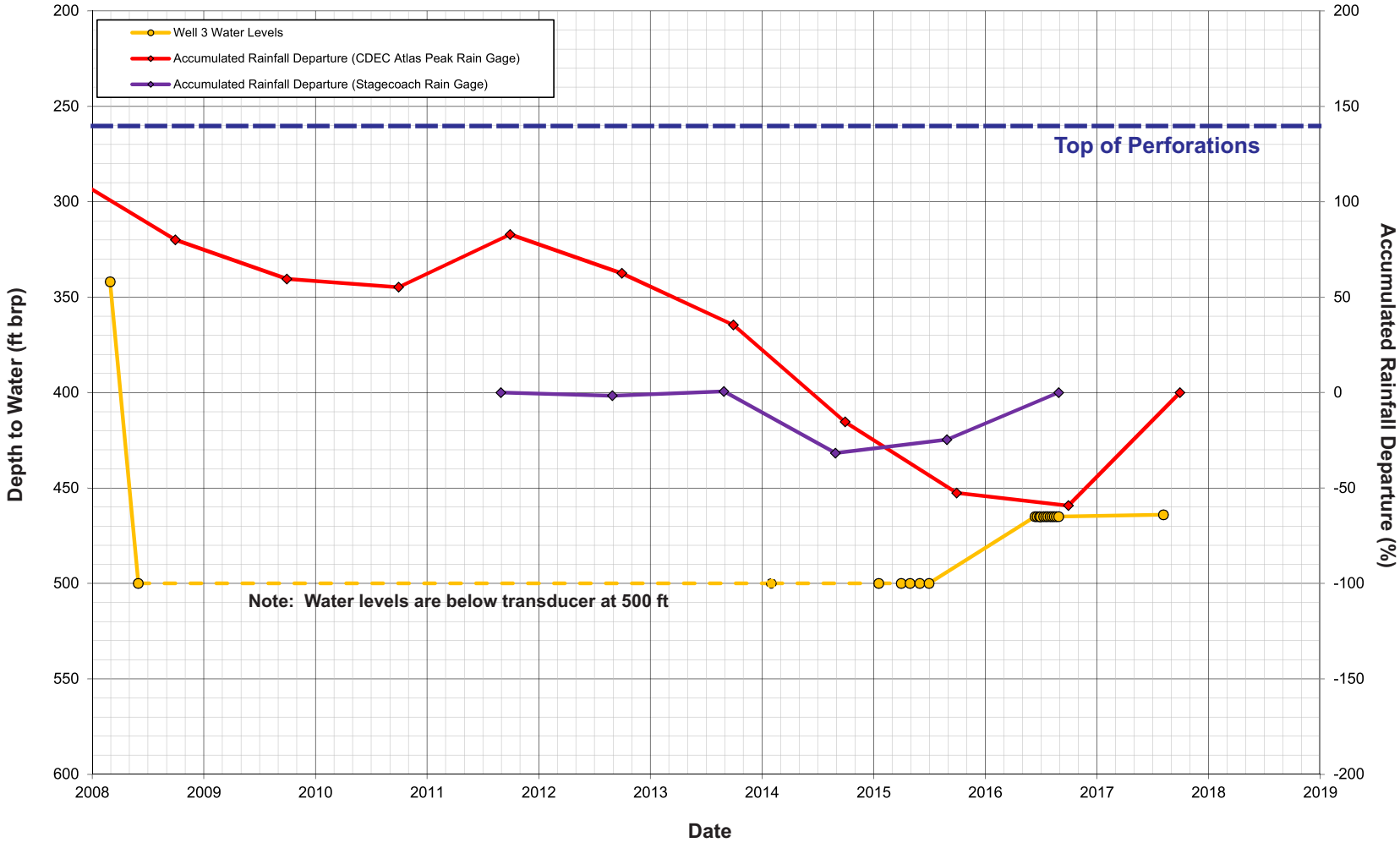

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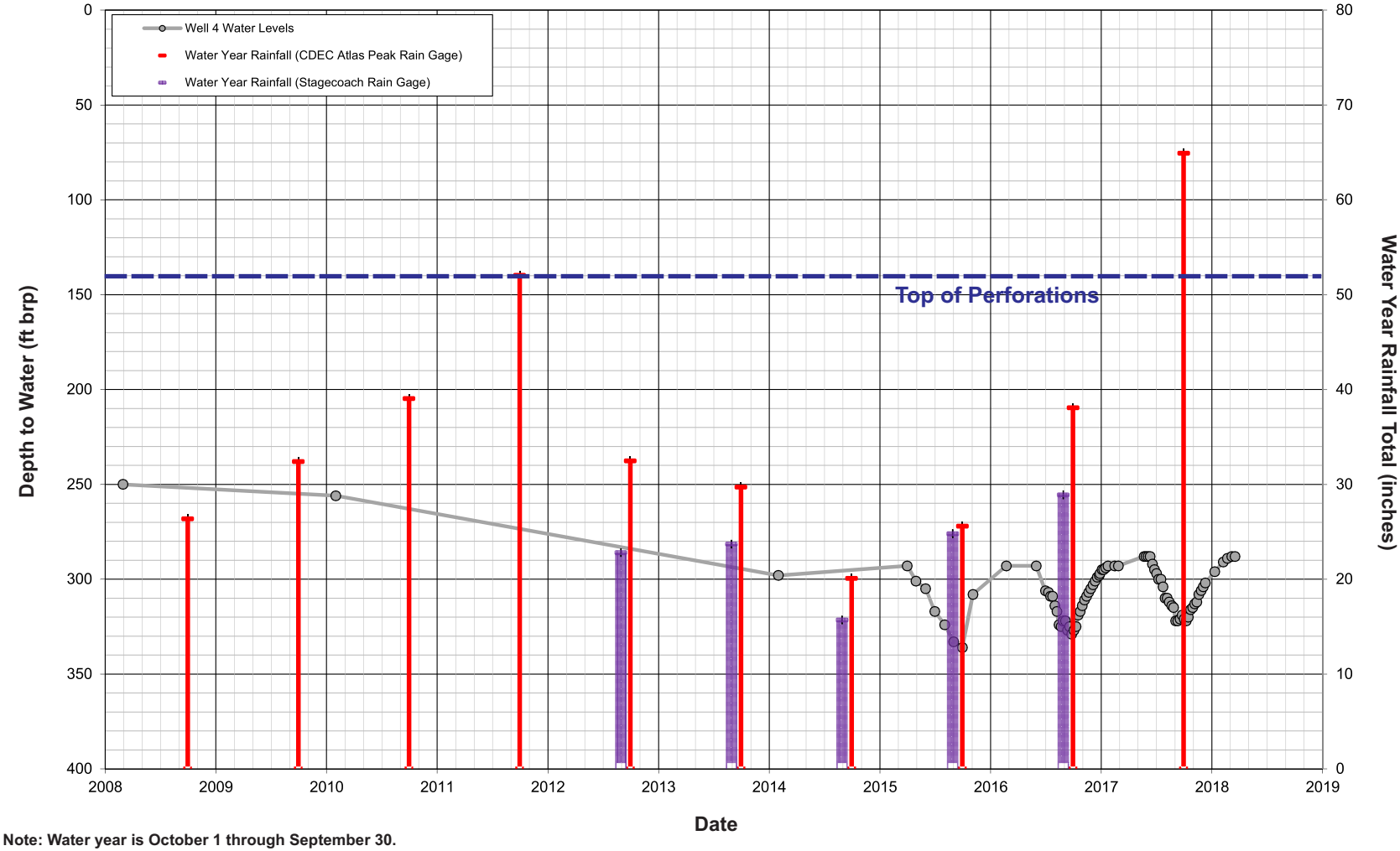
FIGURE 2B
WATER LEVELS VS ACCUMULATED RAINFALL DEPARTURE
STAGECOACH VINEYARDS WELL NO. 3

Job No. 217-NPA01 **April 2018**



Note: Water year is October 1 through September 30.

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FIGURE 3A
WATER LEVELS VS WATER YEAR RAINFALL TOTAL
STAGECOACH VINEYARDS WELL NO. 4

Job No. 217-NPA01 **April 2018**

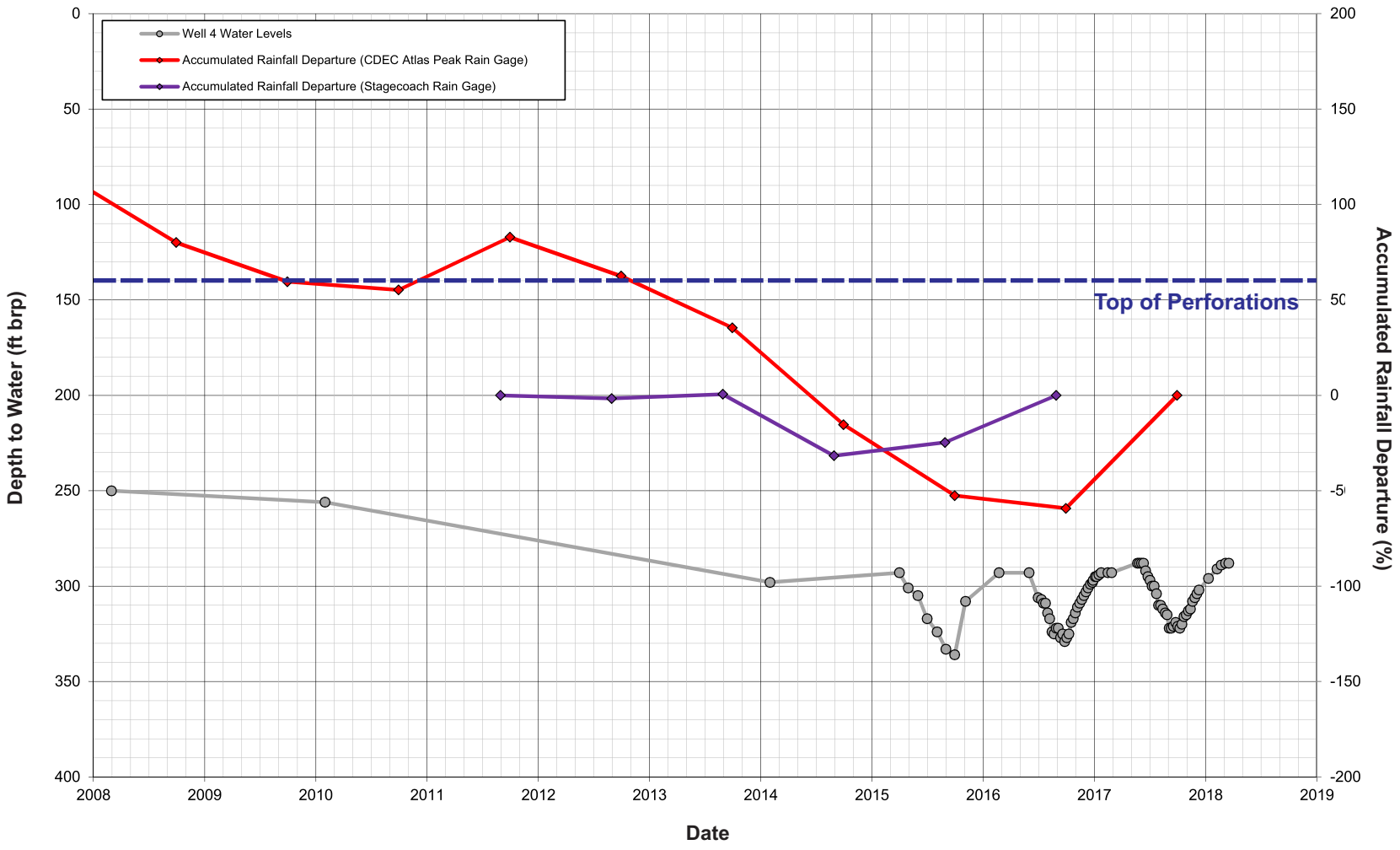

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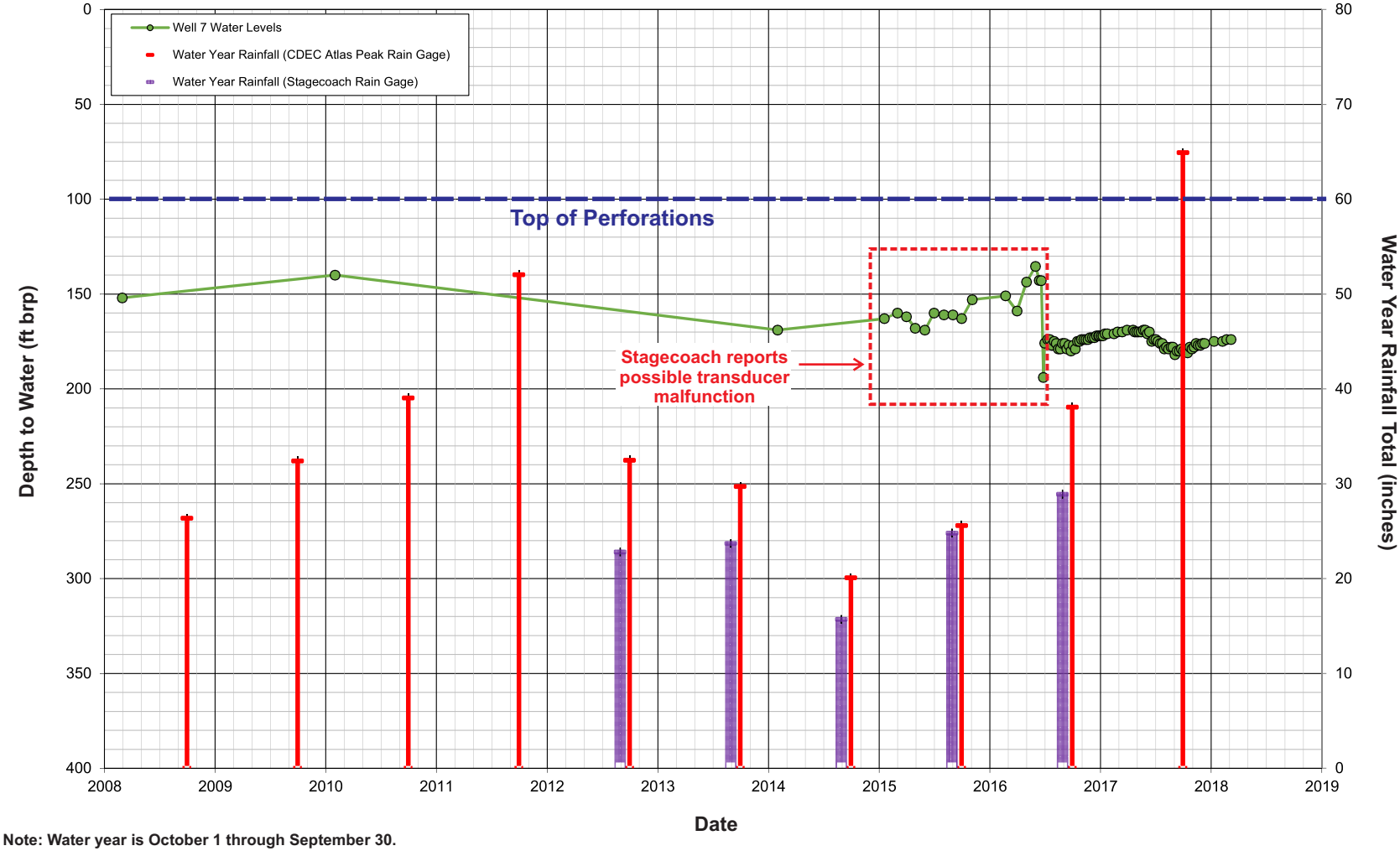
FIGURE 3B
WATER LEVELS VS ACCUMULATED RAINFALL DEPARTURE
STAGECOACH VINEYARDS WELL NO. 4

Job No. 217-NPA01 **April 2018**



Note: Water year is October 1 through September 30.

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FIGURE 4A
WATER LEVELS VS WATER YEAR RAINFALL TOTAL
STAGECOACH VINEYARDS WELL NO. 7

Job No. 217-NPA01 **April 2018**

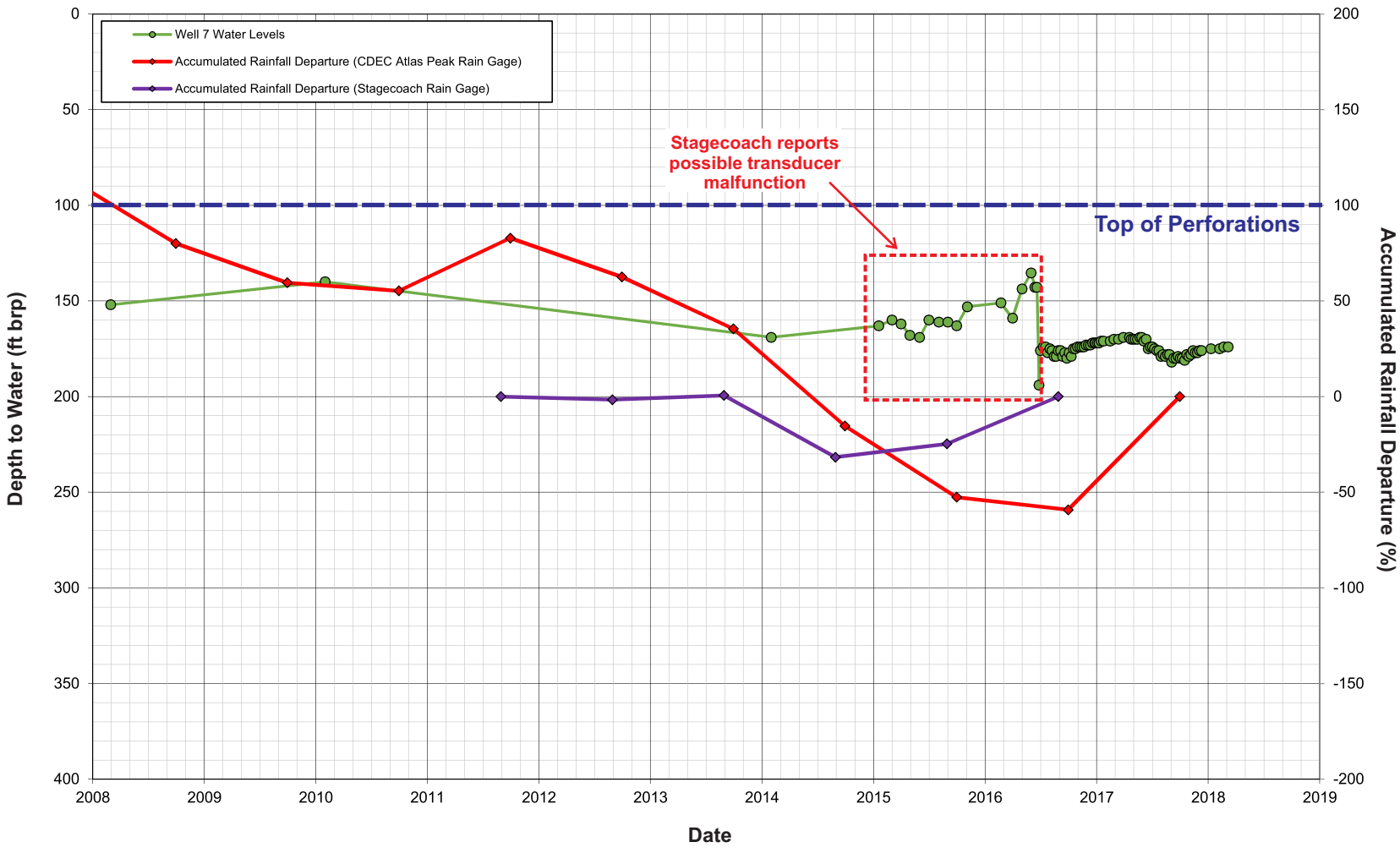

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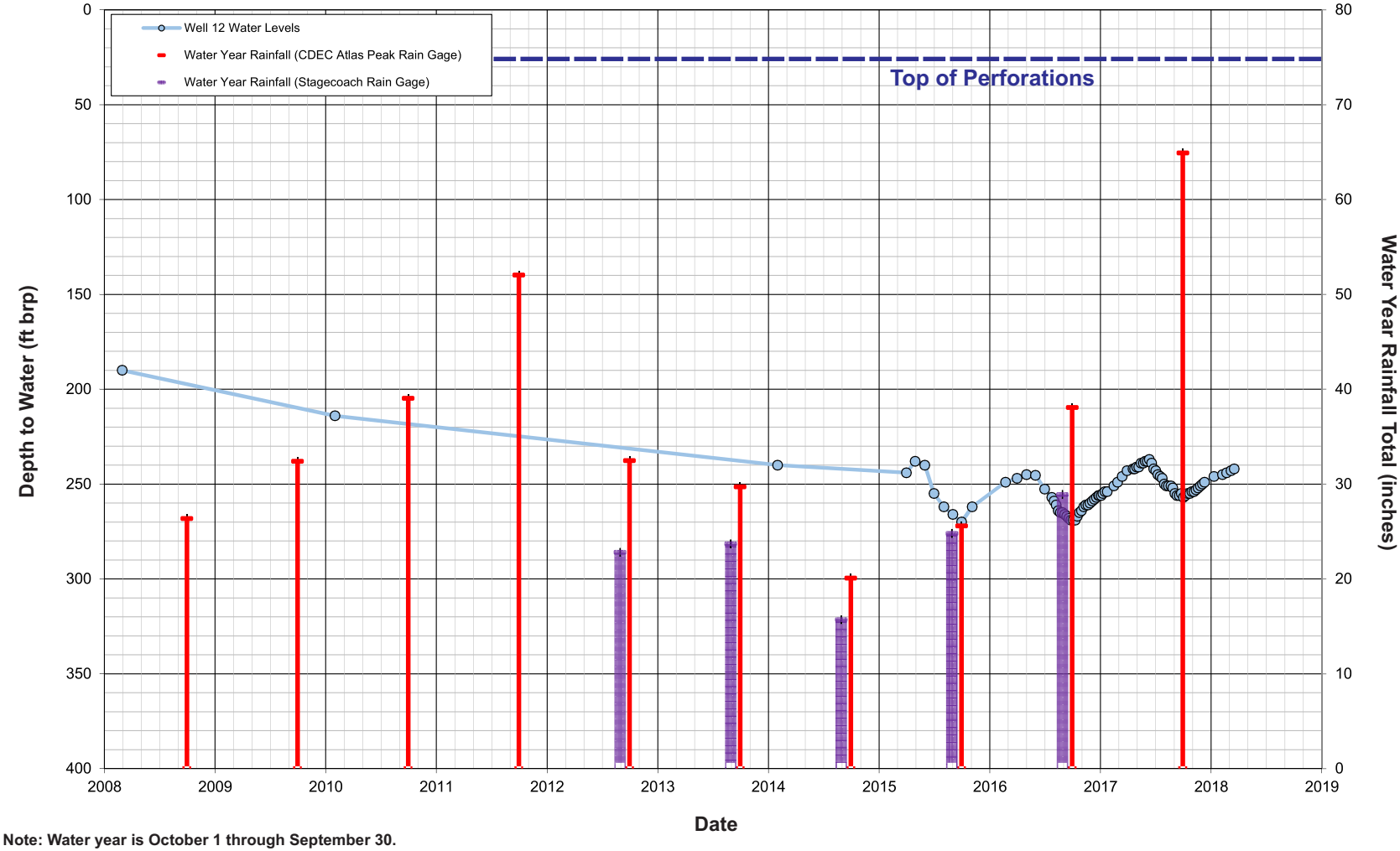
FIGURE 4B
WATER LEVELS VS ACCUMULATED RAINFALL DEPARTURE
STAGECOACH VINEYARDS WELL NO. 7

Job No. 217-NPA01 **April 2018**



Note: Water year is October 1 through September 30.

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FIGURE 5A
WATER LEVELS VS WATER YEAR RAINFALL TOTAL
STAGECOACH VINEYARDS WELL NO. 12

Job No. 217-NPA01 **April 2018**

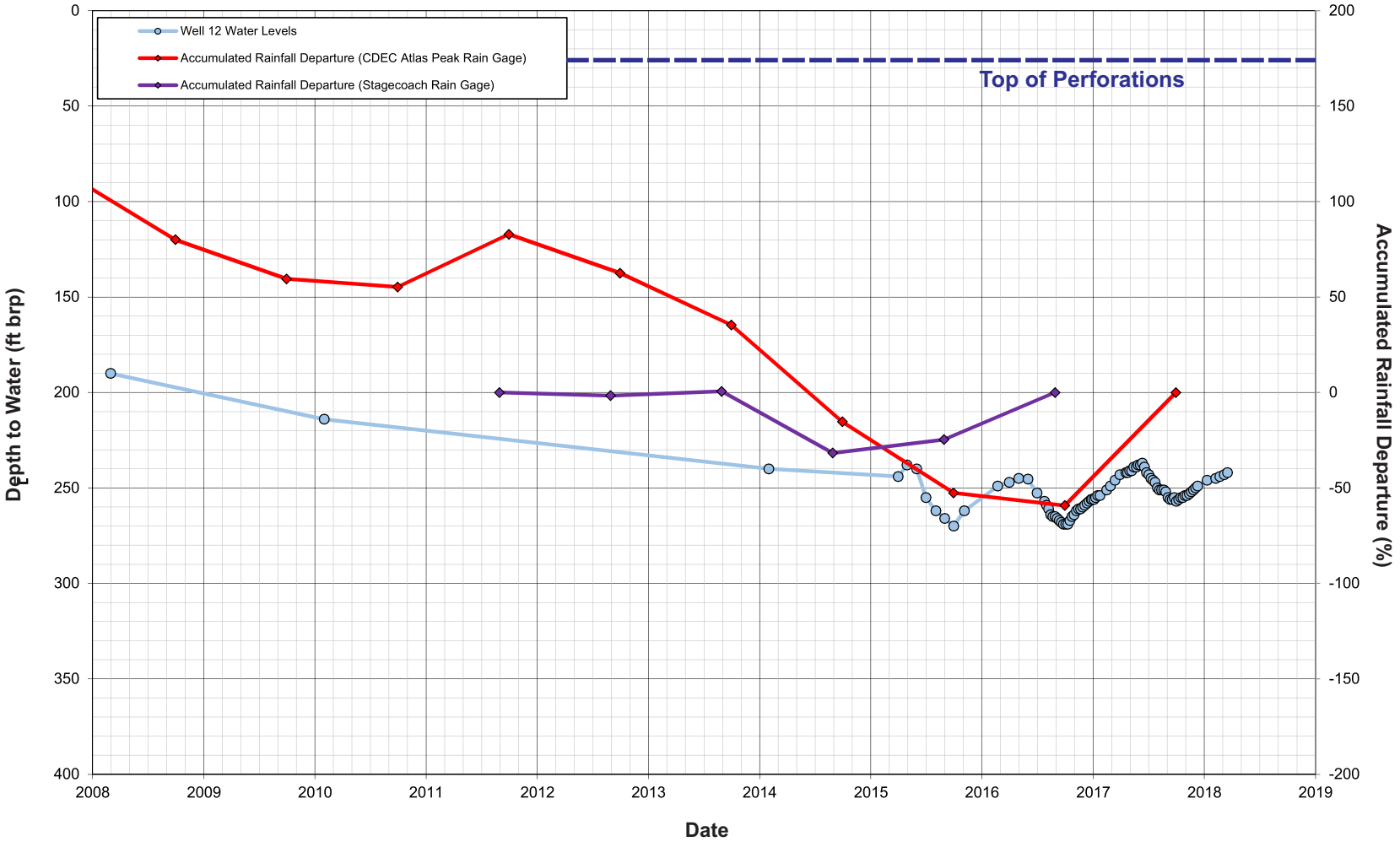

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FIGURE 5B
WATER LEVELS VS ACCUMULATED RAINFALL DEPARTURE
STAGECOACH VINEYARDS WELL NO. 12

Job No. 217-NPA01 **April 2018**

APPENDIX K
GROUNDWATER MONITORING DATA

RICHARD C. SLADE & ASSOCIATES LLC
CONSULTING GROUNDWATER GEOLOGISTS

January 31, 2020

MEMORANDUM

To: Mr. Trini Amador
E&J Gallo
Stagecoach Vineyards
Sent via email (trini.amador@ejgallo.com)

From: Edward Linden, Anthony Hicke, and Richard Slade
Richard C. Slade & Associates LLC

Job No. 217-NPA06

Re: Presentation of Groundwater Monitoring Data
Stagecoach Vineyards
Soda Canyon Area, Napa County, California

Dear Mr. Amador,

Per our recent discussions, provided herein is a summary of groundwater monitoring data for the Stagecoach Vineyards property, prepared in accordance with the Stagecoach Vineyards Environmental Impact Report (EIR) Mitigation Measure 4.6-4. RCS has prepared and submitted two prior monitoring summary memoranda to Stagecoach Vineyards: the first on July 29, 2016, and a second on April 2, 2018. This current Memorandum was prepared by updating the information presented in the two prior memoranda using data collected through November 14, 2019 and includes water levels and groundwater extraction records for specific onsite wells. Data used to prepare the hydrographs and charts presented herein were collected by Stagecoach personnel beginning in 2008, except for the data sourced from the California Data Exchange Center (CDEC).

Figure 1, "Well Location Map", shows the locations of the Stagecoach Vineyard wells. For the current monitoring period, data were provided to RCS for Stagecoach Wells 3, 4, 7, and 12. Recall that Well 7 is being presented as an alternative monitoring point to Well 3 in accordance with the EIR Mitigation Measure 4.6-4. Originally, monitoring was to occur in Stagecoach Wells 3, 4, and 12 (not Well 7). When Well 3 was no longer used for irrigation purposes, Stagecoach staff began monitoring Well 7 as a substitute (this is discussed in the July 29, 2016 RCS Memorandum). Similar to the prior reports, data previously received for Well 3 are included as part of this current Memorandum.

Table 1, "Volume of Groundwater Extracted by Irrigation Year," shows the volume of groundwater extracted from Wells 3, 4, 7, and 12 for each irrigation year (season) from 2008 through 2019. The calculated volumes presented on Table 1 for each well were determined by RCS using wellhead totalizer data collected by Stagecoach staff. It was necessary for RCS to make assumptions regarding "meter turnovers" (when a totalizer meter "resets" to zero) when

MEMORANDUM

interpreting these data. An updated totalizer data set with a revised layout and some adjustments in reported totalizer readings was provided to RCS to review for this monitoring effort. As a result of that review, a calculation discrepancy was discovered between the older and newer datasets. The prior RCS monitoring Memorandum, dated April 2, 2018, reported that Well 12 production was 12.4 acre-feet (AF) for 2017. It appears that volume was actually 21.11 AF, and this latter value has been corrected in this current Memorandum.

As discussed in prior memoranda, reported groundwater production by the onsite wells was likely underestimated for irrigation years 2015 and earlier due to inconsistencies and errors in the available totalizer records compiled by the previous site owner. Totalizer readings have been collected more frequently and regularly by Stagecoach Vineyards' staff over the last few years. Further, RCS review and interpretation of that dataset was performed in a different and more conservative manner than the methodology that was employed for this current analysis. Therefore, the values presented on Table 1 have been recalculated for irrigation years 2014 through 2019 and are different than those reported in previous memoranda. Despite these recalculations, the production totals for pre-2015 irrigation years should still be regarded as rough estimates because of the infrequent data collection by others during that period.

Because a significant number of data points have been collected over time in the Stagecoach wells, not all of the water level data collected are presented on the hydrographs herein. To generate the hydrographs described below, the maximum water level measurement (i.e., the weekly water level "high") for each week of the year is plotted to represent the water level during the entire week. This methodology reduces the number of data points and helps to provide clarity on the hydrographs. More importantly, this methodology helps to illustrate the trend in static water levels in each well, by helping to omit "false" static water level data that may have been collected immediately following periods of extended pumping.

Figures 2A through 5A, "Water Levels vs Water Year Rainfall Totals," contain hydrographs that show the water levels recorded in each well over time and the water year rainfall totals for two rain gages (a Water Year is October 1 through September 30). The two rain gages are "Stagecoach On-Site Average" (an average of the five on-site Stagecoach Vineyards rain gages reported by Stagecoach Staff and calculated by averaging the rainfall recorded at five onsite rain gages, as available) and the nearby CDEC Atlas Peak rain gage (CDEC, http://cdec.water.ca.gov/). Records for Stagecoach onsite rainfall for Water years 2011 through 2016 were reported as the rainfall totals from August of the preceding year to August of that water year.

Figures 2B through 4B, "Water Levels vs Cumulative Departure from Mean Water Year Rainfall," show the same water level data graphs on Figures 2A though 5A, alongside the cumulative departure from mean rainfall curves for each gage. These cumulative departure from mean rainfall curves can be used to help define trends in rainfall over the periods of record at these gages. In general, when the slope of a cumulative departure from mean rainfall curve is negative, the total rainfall in each water year during that period was at or below the long-term mean water year rainfall. Alternatively, when the slope of the departure curve is positive, the total rainfall in each water year during that period tended to be at or above the long-term mean water year rainfall. The period of record used for the Atlas Peak gage is water

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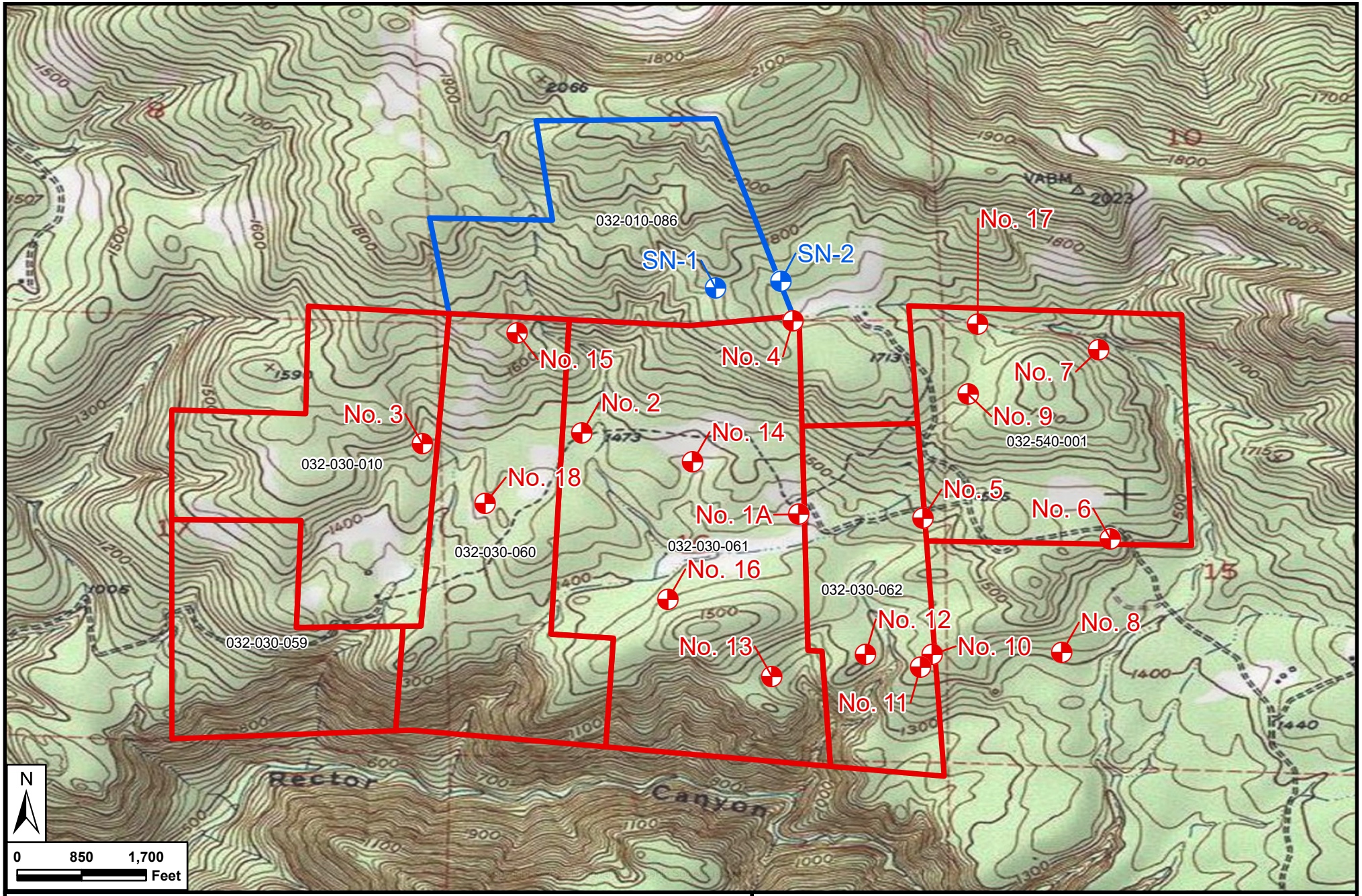
years 1989 to 2019, while the period of record used for the onsite Stagecoach rain gages is water years 2011 to 2019. Mean water year rainfall from 1989 to 2019 at Atlas Peak was 40.72 inches, whereas mean water year rainfall for the "Stagecoach On-Site Average" rain gages from 2011 to 2019 was 31.94 inches.

Note, on Figures 4A and 4B, the water level data collected in Well 7 between January 2015 and June 2016 appears to have a different signature (or pattern) than the water level data collected after June 2016. After further review, Stagecoach Vineyards reports that the January 2015 to June 2016 dataset was erroneous due to possible transducer malfunction.

If you have any questions regarding the attached Figures or Table, please contact our office.



LEGEND

Production Wells

- North Vineyard Well
- South Vineyard Well

Stagecoach Vineyard Parcels

- North Vineyard with Parcel Number
- South Vineyard with Parcel Numbers

RCS

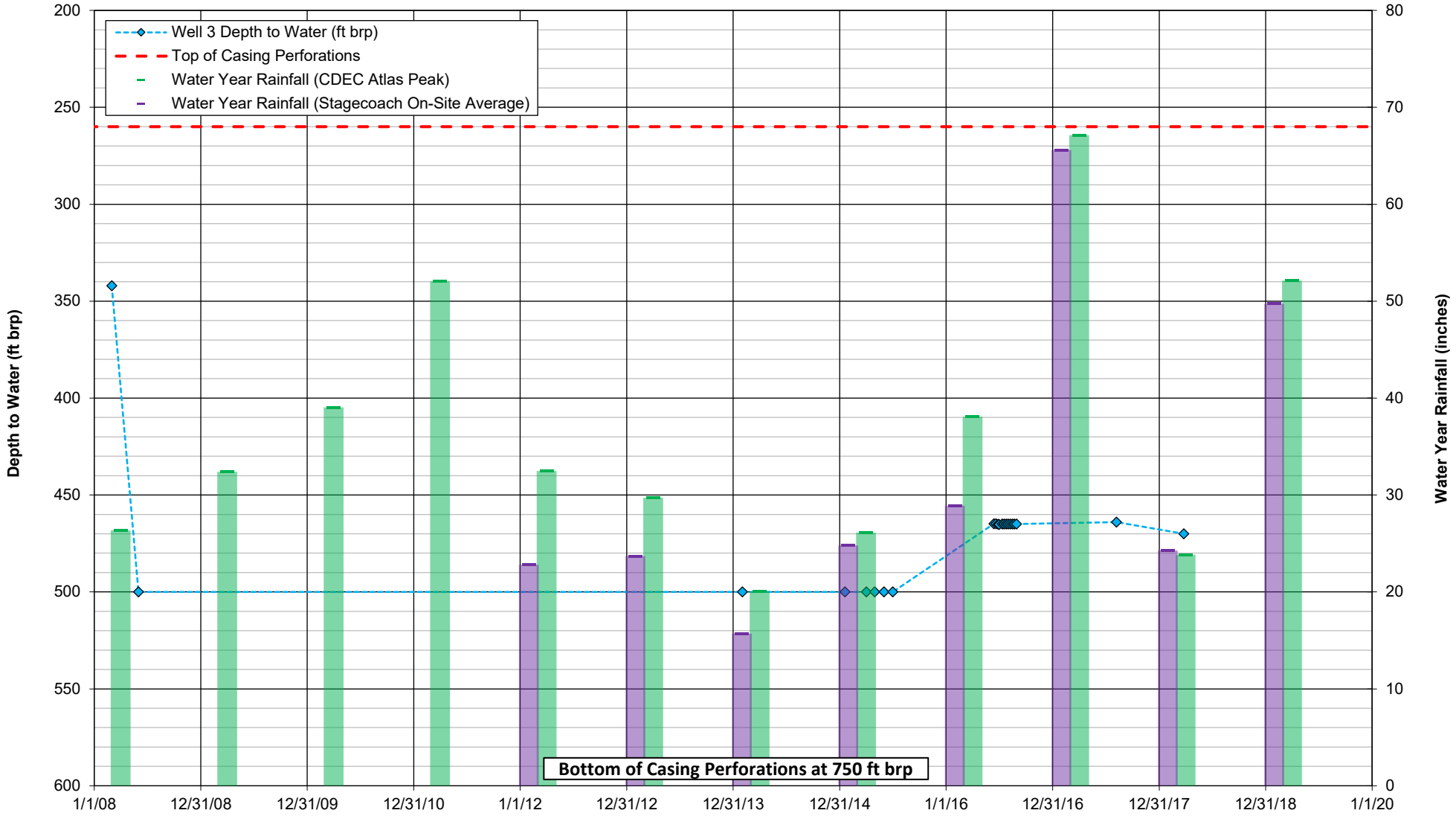
FIGURE 1:
WELL LOCATION MAP

RCS Job No. 217-NPA06

January 2020

Figure 2A

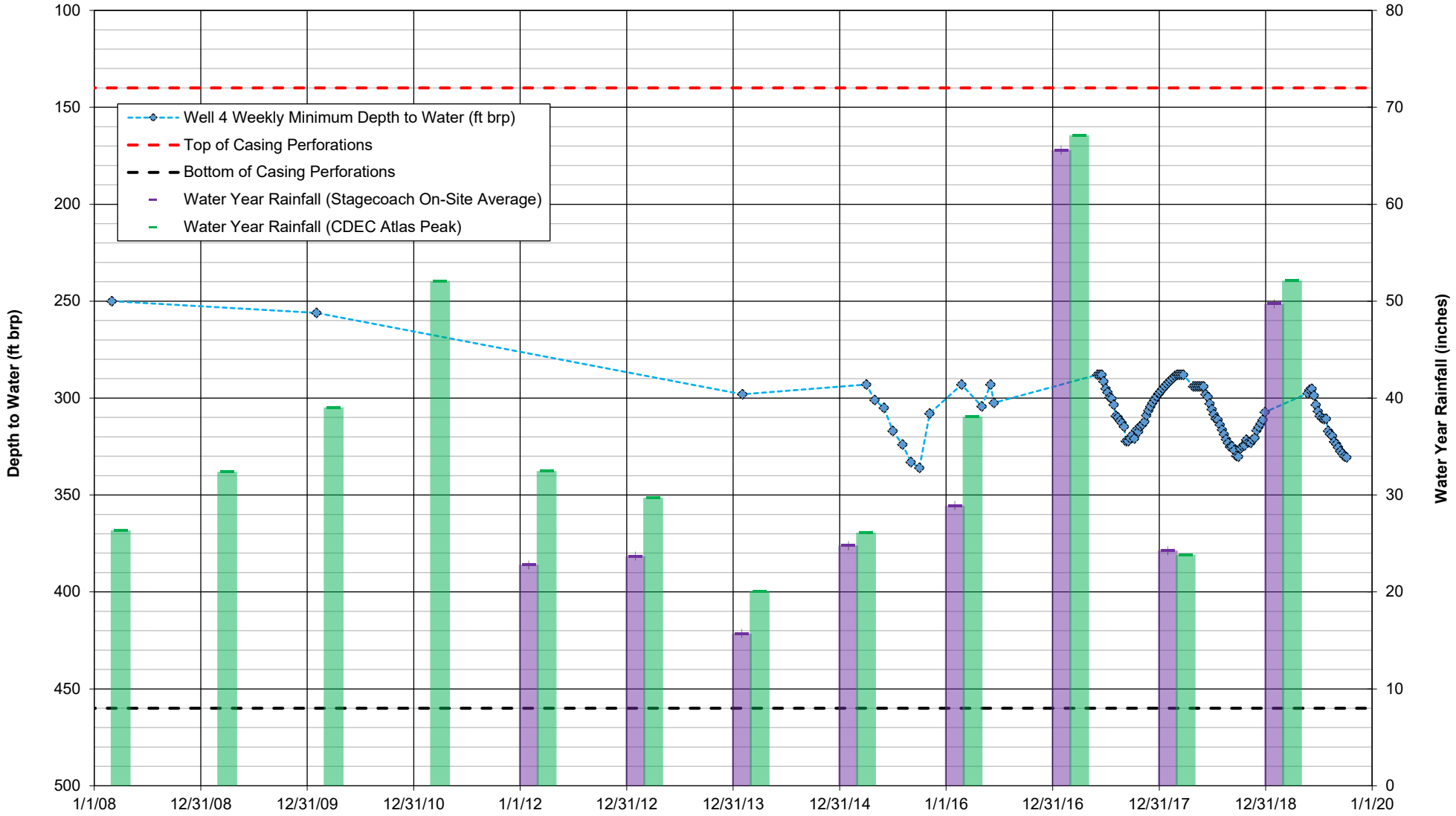
Well 3
Water Levels vs Water Year Rainfall Totals



Stagecoach Vineyards
RCS Job No. 217-NPA06
January 2020

Figure 3A

Well 4
Water Levels vs Water Year Rainfall Totals



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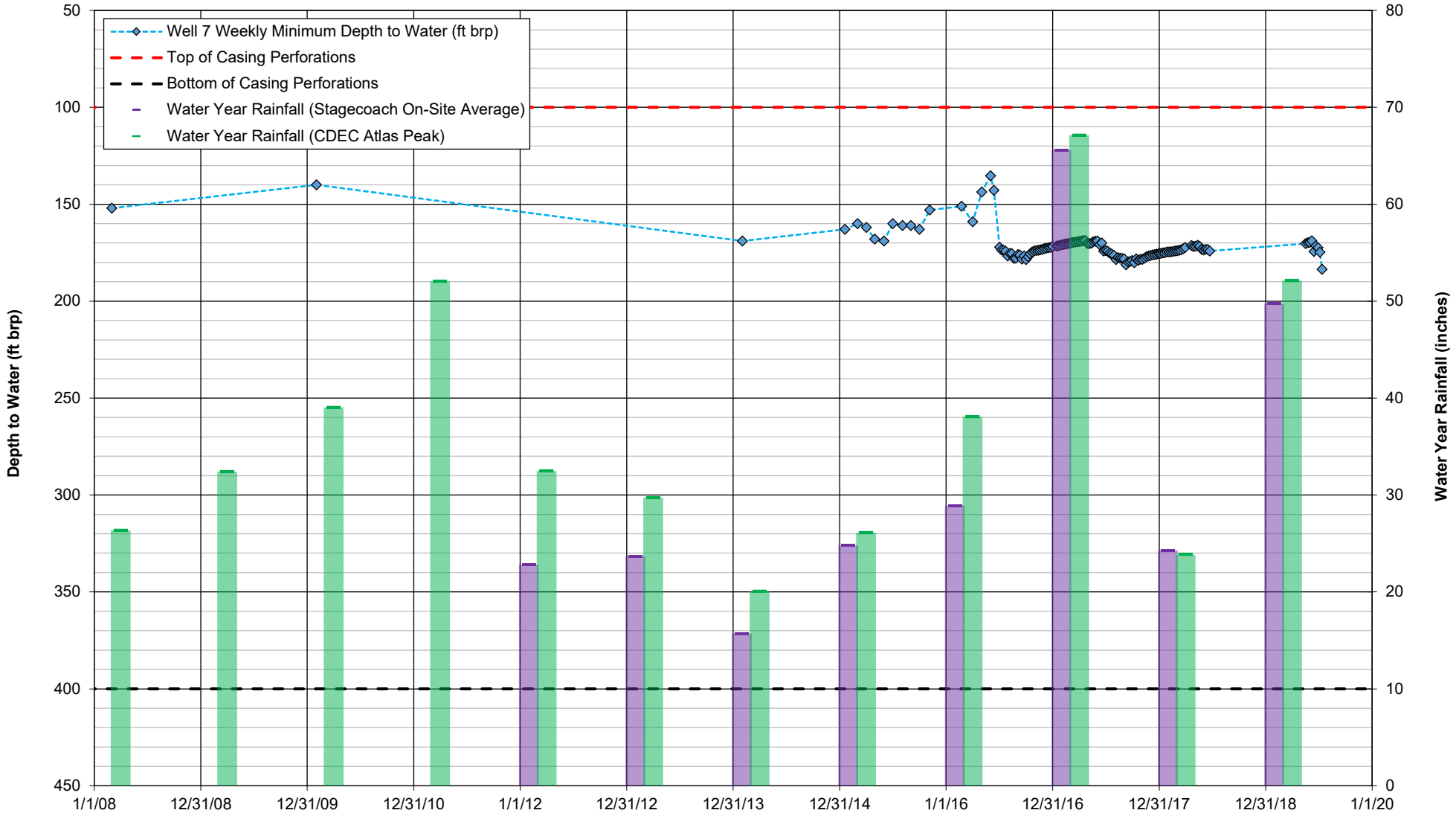
January 2020

Figure 4A

Well 7
Water Levels vs Water Year Rainfall Totals



Stagecoach Vineyards
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Figure 5A

Well 12
Water Levels vs Water Year Rainfall Totals

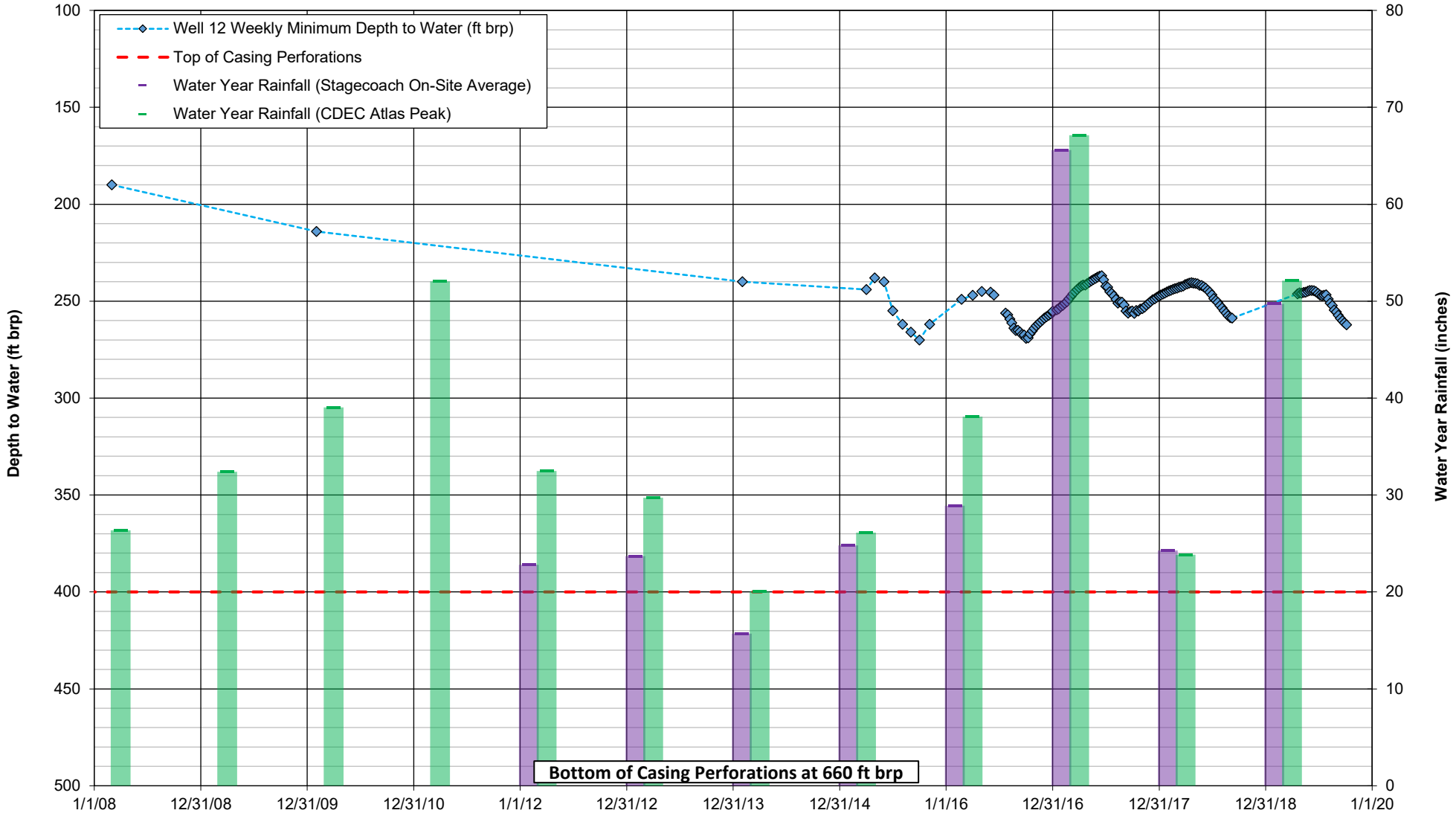

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Figure 2B

Well 3
Water Levels vs Cumulative Departure from Mean Water Year Rainfall

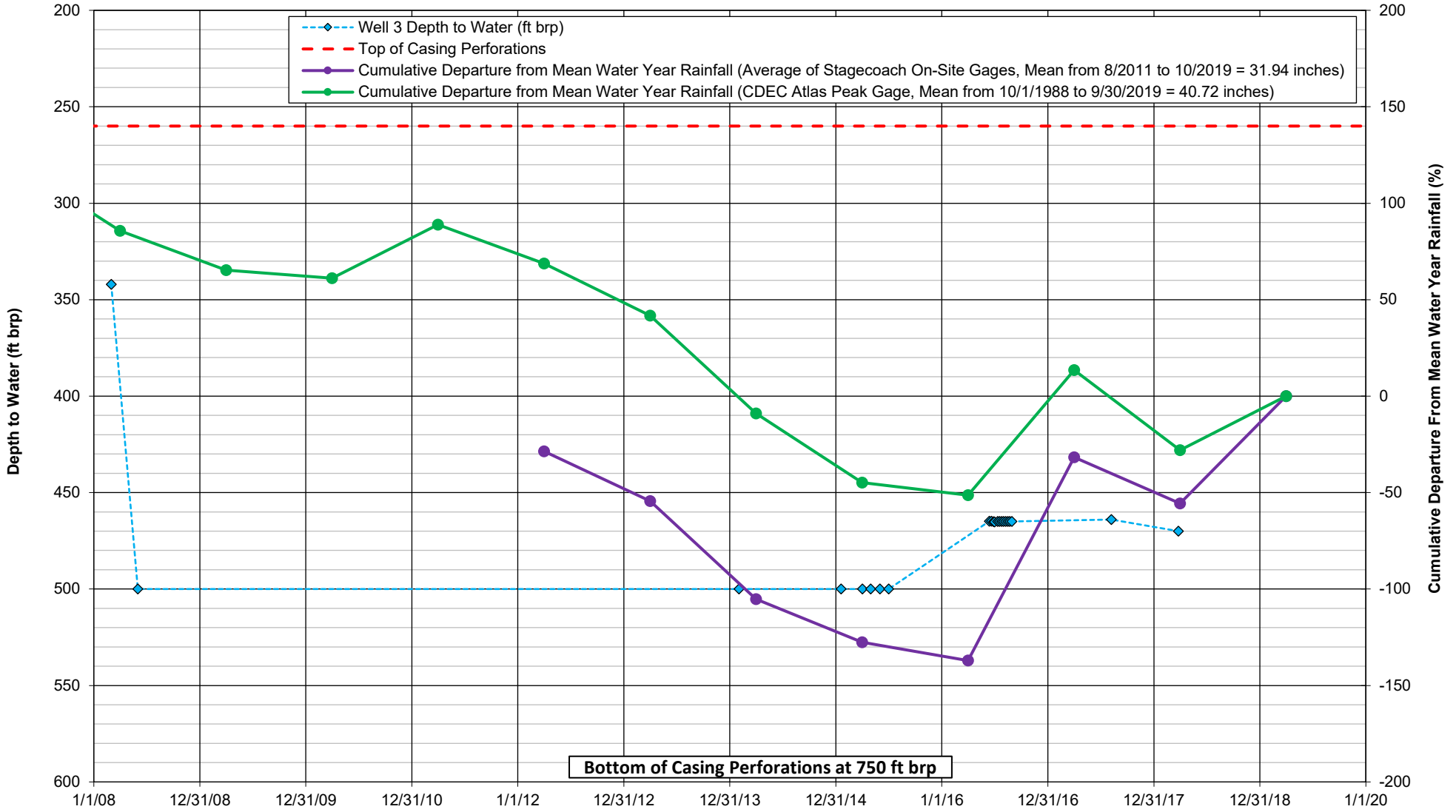

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Figure 3B

Well 4
Water Levels vs Cumulative Departure from Mean Water Year Rainfall

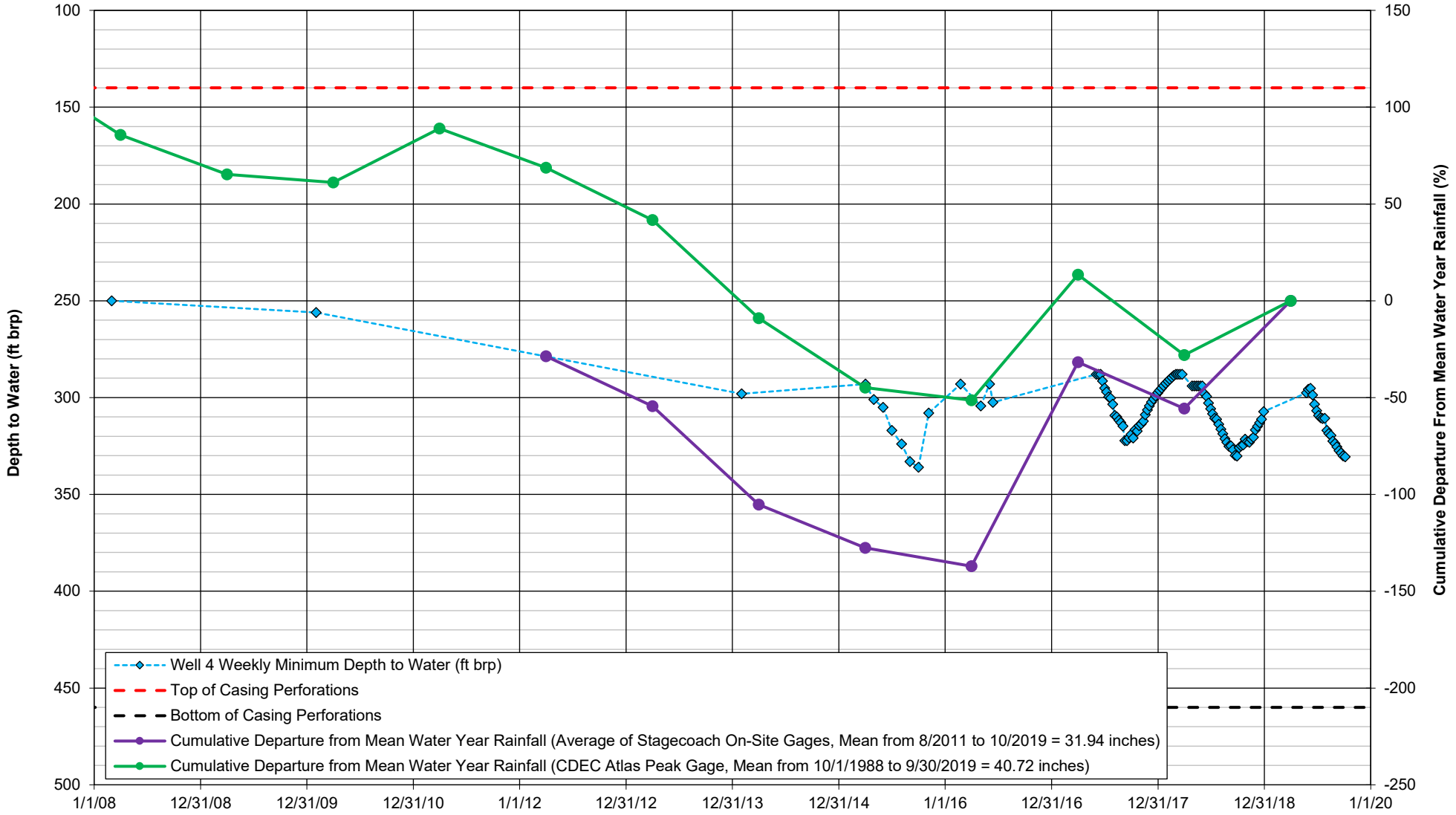

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Figure 4B

Well 7
Water Levels vs Cumulative Departure from Mean Water Year Rainfall

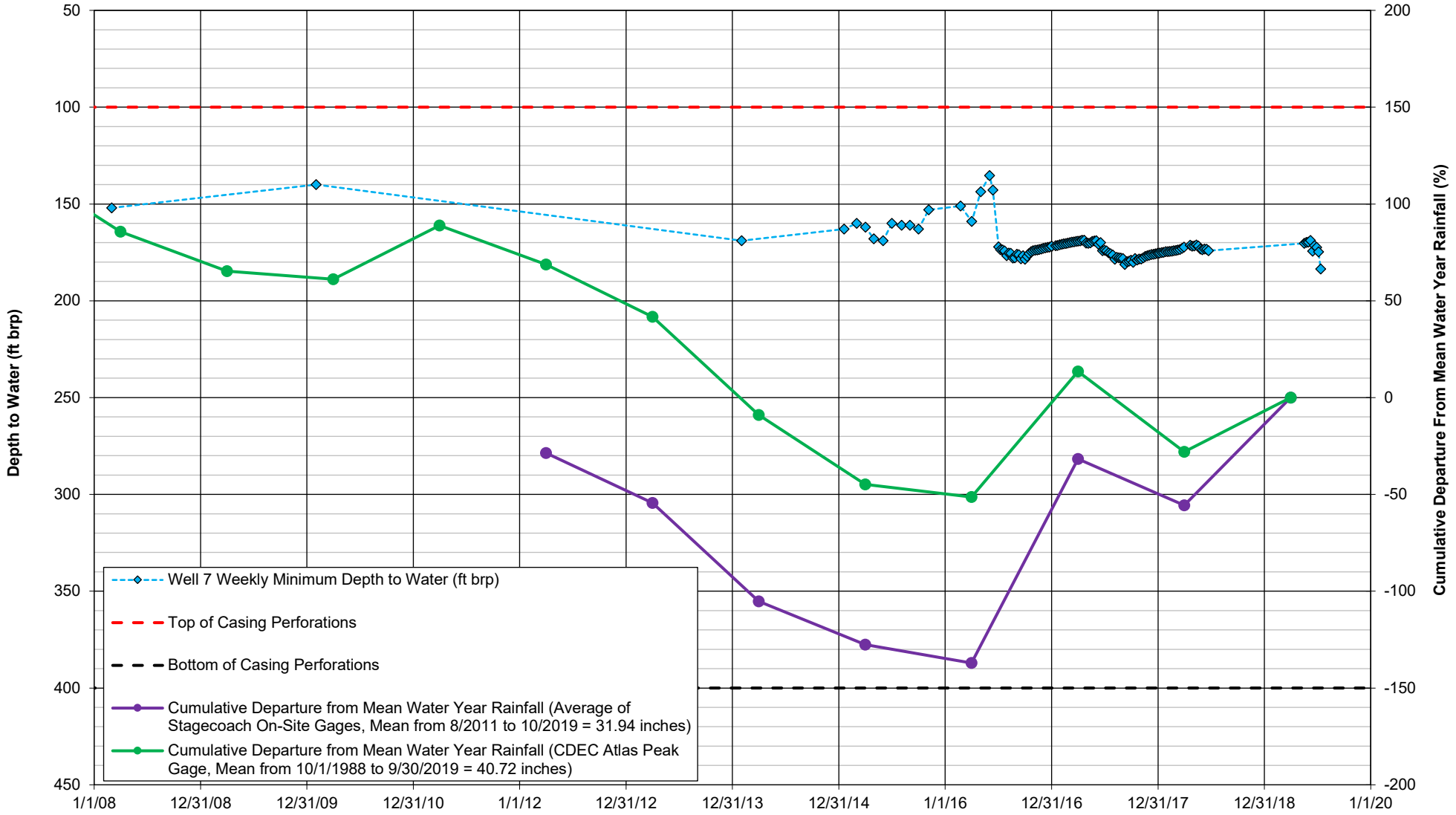

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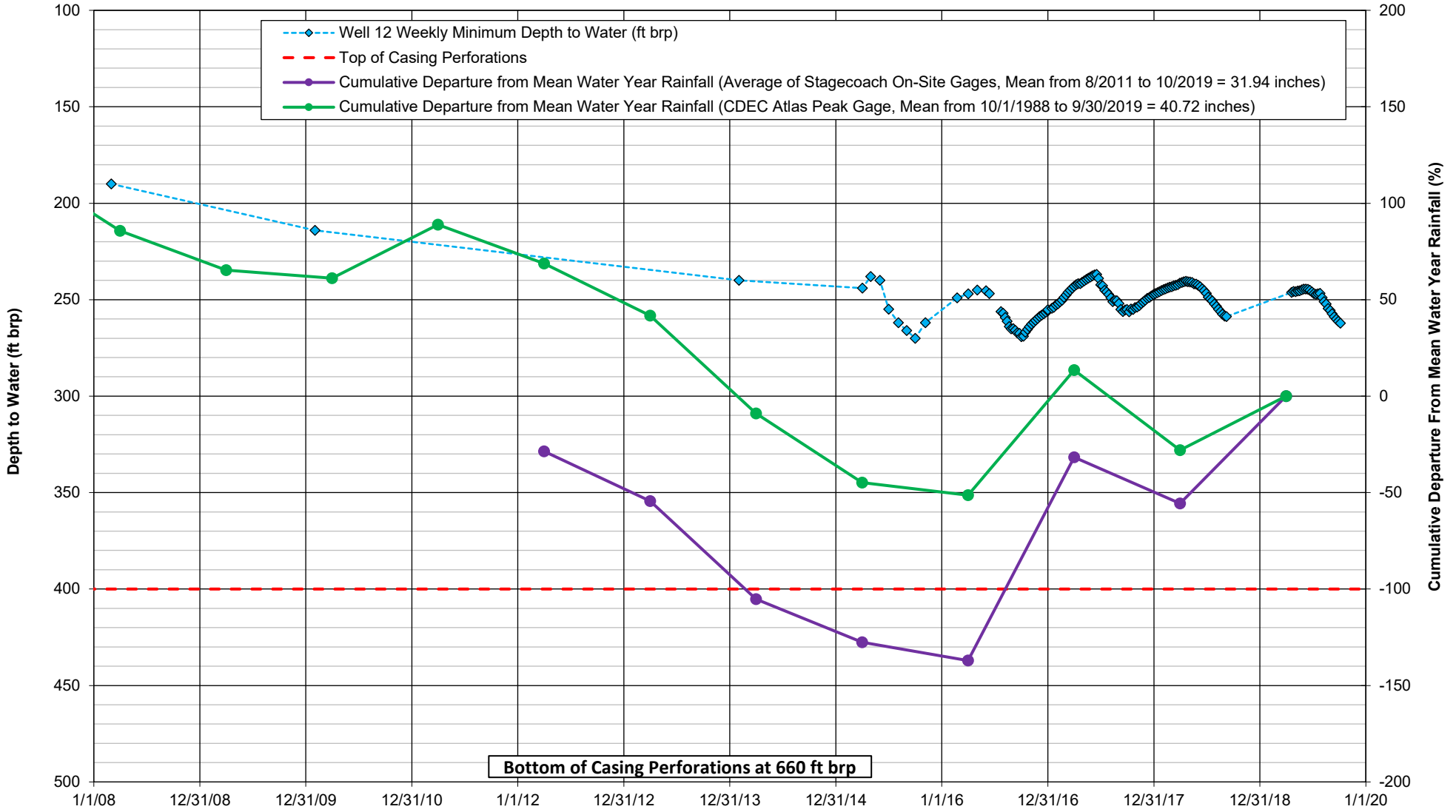
Figure 5B

Well 12
Water Levels vs Cumulative Departure from Mean Water Year Rainfall



Stagecoach Vineyards
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Table 1

Volume of Groundwater Extracted by Irrigation Year (Acre-Feet, AF)									
Well	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2010**	**2009**	**2008**
Well 3	0	0	0	0	12.98	4.87	22.51	13.96	16.00
Well 4	30.64	32.45	35.07	40.71	71.14	36.79	19.54	89.28	59.40
Well 7	31.15	36.99	37.36	46.68	83.79	48.08	50.11	59.71	0
Well 12	18.34	26.10	21.11	28.54	54.79	28.97	25.91	48.63	0
TOTAL	**80.12**	**95.53**	**93.55**	**115.93**	**222.70**	**118.72**	**118.07**	**211.57**	**75.40**
Totalizer Date Range	11/26/2018 to 11/14/2019	12/11/2017 to 11/26/2018	12/12/2016 to 12/11/2017	11/05/2015 to 12/12/2016	07/01/2014 to 11/05/2015	09/01/2013 to 07/01/2014	5/1/2010 to 10/4/2010	11/26/2008 to 10/15/2009	11/26/2008 to 10/15/2009
Remarks				Well 3 no longer used.	May include production from 2014 season.	May include production from 2013 season and may omit production from end of 2014 season.	Date range does not represent entire irrigation season.		

Note: Totalizer readings from Irrigation Years 2011, 2012, and 2013 were not recorded frequently enough to calculate total extractions, and/or contained data that appeared to be erroneous and/or inconsistent with data collected during other years.