Conceptual
Water Quality Management Plan

For:

Tentative Tract 20721

APN: 1201-371-14-0000 AND 1201-371-16-0000

East Highland – Alta Vista

Prepared for:

East Highland Land, LLC.

C/O Jake Sowder

Diversified Pacific

10621 Civic Center

Rancho Cucamonga, CA 91730

Prepared by:

Rob R. Otte, PE

For Review
12/18/2024 11:41:12 AM

Kimley-Horn and Associates

3801 University Ave, Suite 300

Riverside, CA 92501

951-534-5630

Submittal Date: December 17, 2024

Revision Date: _____

Approval Date:_____________________

Project Owner's Certification

This Water Quality Management Plan (WQMP) has been prepared for East Highland Land, LLC. by Kimley-Horn and Associates, Inc. The WQMP is intended to comply with the requirements of the City of Highland and the NPDES Areawide Stormwater Program requiring the preparation of a WQMP. The undersigned, while it owns the subject property, is responsible for the implementation of the provisions of this plan and will ensure that this plan is amended as appropriate to reflect up-to-date conditions on the site consistent with San Bernardino County's Municipal Storm Water Management Program and the intent of the NPDES Permit for San Bernardino County and the incorporated cities of San Bernardino County within the Santa Ana Region. Once the undersigned transfers its interest in the property, its successors in interest and the city/county shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

"I certify under a penalty of law that the provisions (implementation, operation, maintenance, and funding) of the WQMP have been accepted and that the plan will be transferred to future successors."

Project Data			
Permit/Application Number(s):	WQP 24-004 (554.31)	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TENTATIVE TRACT 20721	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 1201-371-14-0000 and 1201-371-16-0000

Owner's Signature			
Owner Name: East Highland Land, LLC.			
Title	C/O Jake Sowder, Project Manager		
Company	Diversified Pacific		
Address	10621 Civic Center Rancho Cucamonga, CA 91730		
Email	JSowder@divpac.com		
Telephone #	909-373-2637		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	WQP 24-004 (554.31)	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TENTATIVE TRACT 20721	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN: 1201-371-14-0000 and 1201-371-16-0000

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan were prepared under my oversight and meet the requirements of Regional Water Quality Control Board Order No. R8-2010-0036."

Engineer: Rob R. Otte		PE Stamp Below
Title	Project Manager	
Company	Kimley-Horn and Associates	
Address	3801 University Ave, Suite 300, Riverside, CA 92501	
Email	Rob.Otte@kimley-horn.com	
Telephone #	951-534-5630	
Signature		
Date		

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Forms

Section 1 Discretionary Permit(s)

<table>
<tr><th colspan="6">Form 1-1 Project Information</th></tr>
<tr><td colspan="2">Project Name</td><td colspan="4">East Highland – Alta Vista</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">East Highland Land, LLC.</td></tr>
<tr><td>Mailing Address:</td><td>10621 Civic Center Drive Rancho Cucamonga, CA 91730</td><td>E-mail Address:</td><td>JSowder@divpac.com</td><td>Telephone:</td><td>909-373-2637</td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td colspan="2">WQP 24-004 (554.31)</td><td>Tract/Parcel Map Number(s):</td><td>TENTATIVE TRACT 20721</td></tr>
<tr><td colspan="2">Additional Information/ Comments:</td><td colspan="4">C/O Jake Sowder, Diversified Pacific</td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">Kimley-Horn and Associates has been retained to prepare a Preliminary WQMP for the proposed East Highland – Alta Vista development in the City of Highland, San Bernardino County.
The existing vacant parcels will be developed into 113 single-family residential lots. The proposed development will include single-family housing with associated residential landscaping, concrete hardscape and asphalt paving community streets. The associated improvements include, but are not limited to onsite and offsite grading, domestic water service, sanitary sewer service, storm drain infrastructure, street improvements, concrete and asphalt pavement, landscaping and irrigation. The proposed development is approximately 12-acres. The proposed single-family residential lots will be homeowner maintained. The private streets, open space, common area landscape, park amenities, and storm drain infrastructure onsite will be maintained by the future homeowner's association. Public streets and public storm drain systems will be maintained by the City of Highland. The APN's for the project site are 1201-371-14-0000 and 1201-371-16-0000.

The post-development condition for the project site consists of two (2) DAs which are comprised of eleven (12) sub-areas. The DA's were divided based on the proposed site grading, of which intends to maintain the existing natural flow pattern to the maximum extent possible. Separate storm drain systems are proposed for each DA to capture and convey stormwater to the proposed storm drain facilities.

In some instances, the proposed improvements may not be included in the DA-1 and DA-2 due to site constraints. These constraints could include factors such as extreme elevation differences with existing conditions and protecting offsite flows mixing with onsite flows. As a result, DA-1 and DA-2 areas from the existing WQMP exhibit will not match the proposed WQMP Exhibit. The percentage of impervious area is currently assumed to be 60% for DA-1 and 42% for DA-2, these were calculated using the parking area, road and sidewalk, green space and landscaping, and the maximum allowed impervious area on a residential lot.</td></tr>
</table>

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	N/A

Section 2 Project Description

2.1 Project Information

This section of the WQMP should provide the information listed below. The information provided for Conceptual/ Preliminary WQMP should give sufficient detail to identify the major proposed site design and LID BMPs and other anticipated water quality features that impact site planning. Final Project WQMP must specifically identify all BMP incorporated into the final site design and provide other detailed information as described herein.

The purpose of this information is to help determine the applicable development category, pollutants of concern, watershed description, and long term maintenance responsibilities for the project, and any applicable water quality credits. This information will be used in conjunction with the information in Section 3, Site Description, to establish the performance criteria and to select the LID BMP or other BMP for the project or other alternative programs that the project will participate in, which are described in Section 4.

Form 2.1-1 Description of Proposed Project

1 Development Category (Select all that apply):

☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site	☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539	☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more
☐ Hillside developments of 5,000 ft² or more which are located on areas with known erosive soil conditions or where the natural slope is 25 percent or more	☐ Developments of 2,500 ft² of impervious surface or more adjacent to (within 200 ft) or discharging directly into environmentally sensitive areas or waterbodies listed on the CWA Section 303(d) list of impaired waters.	☐ Parking lots of 5,000 ft² or more exposed to storm water	☐ Retail gasoline outlets that are either 5,000 ft² or more, or have a projected average daily traffic of 100 or more vehicles per day

☐ Non-Priority / Non-Category Project *May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements*.

2 Project Area (ft2):	521,849	3 Number of Dwelling Units:	113	4 SIC Code:	1521

5 Is Project going to be phased? Yes ☐ No ☒ *If yes, ensure that the WQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.*

6 Does Project include roads? Yes ☐ No ☒ *If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for WQMP)*

2.2 Property Ownership/Management

Describe the ownership/management of all portions of the project and site. State whether any infrastructure will transfer to public agencies (City, County, Caltrans, etc.) after project completion. State if a homeowners or property owners association will be formed and be responsible for the long-term maintenance of project stormwater facilities. Describe any lot-level stormwater features that will be the responsibility of individual property owners.

Form 2.2-1 Property Ownership/Management
Describe property ownership/management responsible for long-term maintenance of WQMP stormwater facilities:
The maintenance of the proposed development is the responsibility of the owner until the property is sold to a new owner and they then assume responsibility of the BMP maintenance and management. There is no homeowners or property owner's association yet formed for this proposed development. All onsite/private BMPs are the responsibility of the owner to maintain until transferred to homeowners or property owner's association once formed. Public Storm drain infrastructure will be transferred to the City after acceptance of those improvements. East Highland Land, LLC. C/O Jake Sowder Diversified Pacific 10621 Civic Center Rancho Cucamonga, CA 91730

2.3 Potential Stormwater Pollutants

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-3 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Resulting from wild bird, pet waste, and garbage. Pollutant of concern for Santa Ana River Reach 3 and 4.
Nutrients - Phosphorous	E ☒	N ☐	Resulting from fertilizers, food waste, and garbage.
Nutrients - Nitrogen	E ☒	N ☐	Resulting from fertilizer and waste
Noxious Aquatic Plants	E ☒	N ☐	Resulting from the infiltration basin. Water will be temporarily stagnant until it infiltrates into the soil, resulting in the promotion of the growth of aquatic plants.
Sediment	E ☒	N ☐	Resulting from the driveways, rooftops, sidewalks, paved areas, and landscape.
Metals	E ☒	N ☐	Resulting from cars, trucks, and parking areas. Pollutant of concern for Santa Ana River Reach 3.
Oil and Grease	E ☒	N ☐	Resulting from leaking vehicles and parking areas.
Trash/Debris	E ☒	N ☐	Resulting from poorly managed trash containers and parking areas.
Pesticides / Herbicides	E ☒	N ☐	Resulting from proposed landscaping areas.
Organic Compounds	E ☒	N ☐	Resulting from proposed landscaping areas.
Other: Petroleum/Hydrocarbons	E ☒	N ☐	Resulting from vehicles.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

2.4 Water Quality Credits

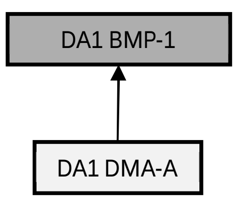
A water quality credit program is applicable for certain types of development projects if it is not feasible to meet the requirements for on-site LID. Proponents for eligible projects, as described below, can apply for water quality credits that would reduce project obligations for selecting and sizing other treatment BMP or participating in other alternative compliance programs. Refer to Section 6.2 in the TGD for WQMP to determine if water quality credits are applicable for the project.

Form 2.4-1 Water Quality Credits			
1 Project Types that Qualify for Water Quality Credits: *Select all that apply*			
☐ Redevelopment projects that reduce the overall impervious footprint of the project site. [Credit = % impervious reduced]	Higher density development projects ☐Vertical density [20%] ☐7 units/ acre [5%]	☐ Mixed use development, (combination of residential, commercial, industrial, office, institutional, or other land uses which incorporate design principles that demonstrate environmental benefits not realized through single use projects) [20%]	☐Brownfield redevelopment (redevelop real property complicated by presence or potential of hazardous contaminants) [25%]
☐ Redevelopment projects in established historic district, historic preservation area, or similar significant core city center areas [10%]	☐ Transit-oriented developments (mixed use residential or commercial area designed to maximize access to public transportation) [20%]	☐ In-fill projects (conversion of empty lots & other underused spaces < 5 acres, substantially surrounded by urban land uses, into more beneficially used spaces, such as residential or commercial areas) [10%]	☐ Live-Work developments (variety of developments designed to support residential and vocational needs) [20%]
2 Total Credit % 0 *(Total all credit percentages up to a maximum allowable credit of 50 percent)*			
Description of Water Quality Credit Eligibility (if applicable)	N/A		

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DMAs) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. *If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet.*

Form 3-1 Site Location and Hydrologic Features			
Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.111319	Longitude -117.151240	Thomas Bros Map page 578
1 San Bernardino County climatic region: ☒ Valley ☐ Mountain			
2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*			



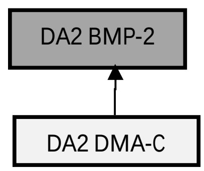
Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DMA-A to BMP-1	Storm water drainage from DMA-A will sheet flow through the site and will be intercepted by the proposed inlets as shown on the WQMP exhibit. All drainage collected from the inlets will be routed to a Contech CDS Hydrodynamic Separator before discharging onto an infiltration basin identified as BMP-1. The infiltration basin has been sized to store the full DCV for DMA-A.

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34.110468	Longitude -117.150683	Thomas Bros Map page 578

1 San Bernardino County climatic region: ☒ Valley ☐ Mountain

2 Does the site have more than one drainage area (DA): Yes☒ No☐ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DMA C to BMP-2	Storm water drainage from DMA-C will sheet flow through the site and will be intercepted by the proposed inlets as shown on the WQMP exhibit. All drainage collected from the inlets will be routed to a Contech CDS Hydrodynamic Separator before discharging onto an infiltration basin identified as BMP-2. The infiltration basin has been sized to store the full DCV for DMA-C.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA-A	N/A	N/A	N/A
1 DMA drainage area (ft²)	435,600			
2 Existing site impervious area (ft²)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	III			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	943			
6 Longest flowpath slope (ft/ft)	0.0207			

7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Annual Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 2

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA-B	N/A	N/A	N/A
1 DMA drainage area (ft^2)	86,249			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use* *http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	III			
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A			
5 Longest flowpath length (ft)	365			
6 Longest flowpath slope (ft/ft)	0.0238			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Annual Grass			
8 Pre-developed pervious area condition: *Based on the extent of wet season vegetated cover good >75%; Fair 50-75%; Poor <50% Attach photos of site to support rating*	Fair			

Form 3-3 Watershed Description for Drainage Area	
Receiving waters *Refer to Watershed Mapping Tool -* *http://permitrack.sbcounty.gov/wap/* *See 'Drainage Facilities" link at this website*	Green spot Road, Existing storm drain at Weaver, City/Plunge Creek, Santa Ana River Reach 1-5, Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River Reach 4 – Indicator Bacteria, Santa Ana River Reach 3 – Copper, Indicator Bacteria, Lead Prado Basin - pH
303(d) listed impairments *Refer to Local Implementation Plan and Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/ and State Water Resources Control Board website –* *http://www.waterboards.ca.gov/santaana/water_issues/programs/tmdl/index.shtml*	Santa Ana River Reach 4 – Indicator Bacteria, Santa Ana River Reach 3 – Copper, Indicator Bacteria, Lead Prado Basin - pH
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	N/A
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	Santa Ana River
Hydrologic Conditions of Concern	☒ Yes *Complete Hydrologic Conditions of Concern (HCOC) Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-10 in submittal* ☐ No
Watershed–based BMP included in a RWQCB approved WAP	☐ Yes *Attach verification of regional BMP evaluation criteria in WAP* • *More Effective than On-site LID* • *Remaining Capacity for Project DCV* • *Upstream of any Water of the US* • *Operational at Project Completion* • *Long-Term Maintenance Plan* ☒ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMP

4.1.1 Pollution Prevention

Non-structural and structural source control BMP are required to be incorporated into all new development and significant redevelopment projects. Form 4.1-1 and 4.1-2 are used to describe specific source control BMPs used in the WQMP or to explain why a certain BMP is not applicable. Table 7-3 of the TGD for WQMP provides a list of applicable source control BMP for projects with specific types of potential pollutant sources or activities. The source control BMP in this table must be implemented for projects with these specific types of potential pollutant sources or activities.

The preparers of this WQMP have reviewed the source control BMP requirements for new development and significant redevelopment projects. The preparers have also reviewed the specific BMP required for project as specified in Forms 4.1-1 and 4.1-2. All applicable non-structural and structural source control BMP shall be implemented in the project.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, if not applicable, state reason
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Education Material included in Attachment F of this document will be provided to Property Owners, Tenants and Occupants when taking possession of property.
N2	Activity Restrictions	☒	☐	Pursuant to the Education Material included in Attachment F of this document, the User of the facility will be notified upon possession of the property of all activities that are restricted and or limited and the education material shall be referenced in all lease documents.
N3	Landscape Management BMPs	☒	☐	Landscape crews contracted shall inspect irrigation system and health of landscaping and shall report all repairs or problems to owner. Routine landscaping maintenance shall be done according to CASQA SC-73 fact sheet. Landscaping debris shall be collected and disposed of properly. No blowing or sweeping of landscaping debris into drainage inlets.
N4	BMP Maintenance	☒	☐	HOA will be responsible for maintain all BMPs per the appropriate O&M and as outlined in the Educational Material included win Attachment F of this document.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No Hazardous Wastes as defined by Title 22 CCR produced at this site.
N6	Local Water Quality Ordinances	☒	☐	HOA shall ensure residential activities at the site comply with the City's Stormwater Ordinance through the implementation of BMP's included in this report.
N7	Spill Contingency Plan	☐	☒	No Hazardous Waste.
N8	Underground Storage Tank Compliance	☐	☒	No Underground Storage Tanks.
N9	Hazardous Materials Disclosure Compliance	☐	☒	No Hazardous Materials.

Form 4.1-1 Non-Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, if not applicable, state reason
N10	Uniform Fire Code Implementation	☐	☒	No hazardous waste applicable to project site.
N11	Litter/Debris Control Program	☒	☐	A program shall be implemented to pick up litter, sweep and clean the trash enclosure on a weekly basis. HOA shall ensure tenants contract with a refuse company to have dumpsters emptied on a weekly basis, at a minimum.
N12	Employee Training	☒	☐	HOA shall establish an educational program for site employees and contractors to inform and train personnel engaged in maintenance activities.
N13	Housekeeping of Loading Docks	☐	☒	No loading docks are proposed.
N14	Catch Basin Inspection Program	☒	☐	A program shall be implemented to inspect catch basins. Inspection should occur at a minimum two times per year and prior to the storm season.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking lots shall be swept weekly by a contractor provided by the HOA.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No non-structural measures for public agency projects.
N17	Comply with all other applicable NPDES permits	☒	☐	Proposed site will comply with all NPDES permits.

Form 4.1-2 Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Storm drain stenciling to be provided near proposed catch basins and infiltration basins.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No Outdoor Storage.
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Covered Trash Enclosure Proposed. Inspection and maintenance outlined in Form 5-1.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	Proposed site follows irrigation requirements described in CASQA New Development BMP SD-12. See Attachment F.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	Proposed site has finished grade of landscape area at a minimum of 1-2 inches below top of curb, sidewalk, and pavement.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Proposed slopes will be landscaped to provide energy dissipation.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	No covered dock areas.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash areas.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☒	☐	Sidewalks and parking.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One: Included	Check One: Not Applicable	Describe BMP Implementation OR, If not applicable, state reason
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No equipment wash areas.
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No Fueling Areas.
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside.
S14	Wash water control for food preparation areas	☐	☒	No food preparation.
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash racks.

4.1.2 Preventative LID Site Design Practices

Site design practices associated with new LID requirements in the MS4 Permit should be considered in the earliest phases of a project. Preventative site design practices can result in smaller DCV for LID BMP and hydromodification control BMP by reducing runoff generation. Describe site design and drainage plan including:

- A narrative of site design practices utilized or rationale for not using practices
- A narrative of how site plan incorporates preventive site design practices
- Include an attached Site Plan layout which shows how preventative site design practices are included in WQMP

Refer to Section 5.2 of the TGD for WQMP for more details.

Form 4.1-3 Preventative LID Site Design Practices Checklist
Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☒ No ☐ Explanation: Landscape areas will be maximized on site to the maximum extent possible in parking islands and where possible along sidewalks.
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation: Two infiltration basins are proposed to maximize onsite infiltration potential. Limit grading activities to protect infiltration capacity at BMP-1 and BMP-2 locations.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Natural drainage patterns will be maintained to the maximum extent possible. Runoff from site will discharge to a proposed public storm drain eventually into an existing storm drain structure similarly to existing conditions.
Disconnect impervious areas: Yes ☐ No ☒ Explanation: All impervious areas will be directed to the infiltration basins proposed on-site.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: There are no sensitive areas onsite. Existing vegetation will be replaced with drought tolerant landscaping.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Drought tolerant landscaping is proposed throughout project area.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Unnecessary compaction will be prevented within the limits of BMP-1 and BMP-2.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: To maintain existing flow patterns, vegetated swales were not feasible.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Proposed landscape areas will be staked off during construction to minimize compaction.

4.2 Project Performance Criteria

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in the MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection of any downstream waterbody segments with a HCOC. *If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.*

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), the San Bernardino County Stormwater Program requires use of the P_6 method (MS4 Permit Section XI.D.6a.ii) – Form 4.2-1
- For HCOC pre- and post-development hydrologic calculation, the San Bernardino County Stormwater Program requires the use of the Rational Method (San Bernardino County Hydrology Manual Section D). Forms 4.2-2 through Form 4.2-5 calculate hydrologic variables including runoff volume, time of concentration, and peak runoff from the project site pre- and post-development using the Hydrology Manual Rational Method approach. For projects greater than 640 acres (1.0 mi^2), the Rational Method and these forms should not be used. For such projects, the Unit Hydrograph Method (San Bernardino County Hydrology Manual Section E) shall be applied for hydrologic calculations for HCOC performance criteria.

Refer to Section 4 in the TGD for WQMP for detailed guidance and instructions.

<table>
<tr><th colspan="4">Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)</th></tr>
<tr><td>1 Project area DA 1 (ft^2): 412,513</td><td colspan="2">2 Imperviousness after applying preventative site design practices (Imp%): 60%</td><td>3 Runoff Coefficient (Rc): _0.409
$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$</td></tr>
<tr><td colspan="4">4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.519 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</td></tr>
<tr><td colspan="4">5 Compute P_6, Mean 6-hr Precipitation (inches): 0.768
P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)</td></tr>
<tr><td colspan="3">6 Drawdown Rate
Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</td><td>24-hrs ☐
48-hrs ☒</td></tr>
<tr><td colspan="4">7 Compute design capture volume, DCV (ft^3): 21,206
DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</td></tr>
</table>

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)

1 Project area DA 1 (ft^2): 80,586	2 Imperviousness after applying preventative site design practices (Imp%): 42%	3 Runoff Coefficient (Rc): _0.291 *R_c = 0.858(Imp%)^3-0.78(Imp%)^2+0.774(Imp%)+0.04*
4 Determine 1-hour rainfall depth for a 2-year return period $P_{2yr-1hr}$ (in): 0.519 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.768 *P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (Valley = 1.4807; Mountain = 1.909; Desert = 1.2371)*		
6 Drawdown Rate *Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.*		24-hrs ☐ 48-hrs ☒
7 Compute design capture volume, DCV (ft^3): 2,949 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-2 Summary of HCOC Assessment (DA 1)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: http://permitrack.sbcounty.gov/wap/

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 2,836 *Form 4.2-3 Item 12*	2 28.5 *Form 4.2-4 Item 13*	3 1.82 *Form 4.2-5 Item 10*
Post-developed	4 7,435 *Form 4.2-3 Item 13*	5 10.21 *Form 4.2-4 Item 14*	6 7.05 *Form 4.2-5 Item 14*
Difference	7 *4,599* *Item 4 – Item 1*	8 *18.29* *Item 2 – Item 5*	9 *5.23* *Item 6 – Item 3*
Difference (as % of pre-developed)	10 *162.17%* *Item 7 / Item 1*	11 *64.18%* *Item 8 / Item 2*	12 *287.36%* *Item 9 / Item 3*

Form 4.2-2 Summary of HCOC Assessment (DA 2)

Does project have the potential to cause or contribute to an HCOC in a downstream channel: Yes ☒ No ☐

Go to: *http://permitrack.sbcounty.gov/wap/*

If "Yes", then complete HCOC assessment of site hydrology for 2yr storm event using Forms 4.2-3 through 4.2-5 and insert results below

(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual)

If "No," then proceed to Section 4.3 Project Conformance Analysis

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	1 562 *Form 4.2-3 Item 12*	2 11.61 *Form 4.2-4 Item 13*	3 0.76 *Form 4.2-5 Item 10*
Post-developed	4 870 *Form 4.2-3 Item 13*	5 10.06 *Form 4.2-4 Item 14*	6 1.17 *Form 4.2-5 Item 14*
Difference	7 *308* *Item 4 – Item 1*	8 *1.55* *Item 2 – Item 5*	9 *0.41* *Item 6 – Item 3*
Difference (as % of pre-developed)	10 *54.80%* *Item 7 / Item 1*	11 *13.35%* *Item 8 / Item 2*	12 *53.95%* *Item 9 / Item 3*

Forms 4.2-3 through 4.2-5 are replaced by computer software analysis based on the San Bernardino County Hydrology Manual in Appendix

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1)								
Weighted Curve Number Determination for: Pre-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1a Land Cover type								
2a Hydrologic Soil Group (HSG)								
3a DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								
Weighted Curve Number Determination for: Post-developed DA	DMA A	DMA B	DMA C	DMA D	DMA E	DMA F	DMA G	DMA H
1b Land Cover type								
2b Hydrologic Soil Group (HSG)								
3b DMA Area, ft^2 *sum of areas of DMA should equal area of DA*								
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*								

5 Pre-Developed area-weighted CN:	7 Pre-developed soil storage capacity, S (in): *S = (1000 / Item 5) - 10*	9 Initial abstraction, I_a (in): *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN:	8 Post-developed soil storage capacity, S (in): *S = (1000 / Item 6) - 10*	10 Initial abstraction, I_a (in): *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 9)^2 / ((Item 11 – Item 9 + Item 7)*

13 Post-developed Volume (ft^3):
*V_{pre} =(1 / 12) * (Item sum of Item 3) * [(Item 11 – Item 10)^2 / ((Item 11 – Item 10 + Item 8)*

14 Volume Reduction needed to meet HCOC Requirement, (ft^3):
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Form 4.2-4 HCOC Assessment for Time of Concentration (DA 1)

Compute time of concentration for pre and post developed conditions for each DA *(For projects using the Hydrology Manual complete the form below)*

Variables	Pre-developed DA1 *Use additional forms if there are more than 4 DMA*				Post-developed DA1 *Use additional forms if there are more than 4 DMA*			
	DMA A	DMA B	DMA C	DMA D	DMA A	DMA B	DMA C	DMA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*								
2 Change in elevation (ft)								
3 Slope (ft/ft), S_o = *Item 2 / Item 1*								
4 Land cover								
5 Initial DMA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*								
6 Length of conveyance from DMA outlet to project site outlet (ft) *May be zero if DMA outlet is at project site outlet*								
7 Cross-sectional area of channel (ft^2)								
8 Wetted perimeter of channel (ft)								
9 Manning's roughness of channel (n)								
10 Channel flow velocity (ft/sec) $V_{fps} = (1.49 / Item\ 9) * (Item\ 7/Item\ 8)^{0.67} * (Item\ 3)^{0.5}$								
11 Travel time to outlet (min) $T_t = Item\ 6 / (Item\ 10 * 60)$								
12 Total time of concentration (min) $T_c = Item\ 5 + Item\ 11$								
13 Pre-developed time of concentration (min): *Minimum of Item 12 pre-developed DMA*								
14 Post-developed time of concentration (min): *Minimum of Item 12 post-developed DMA*								
15 Additional time of concentration needed to meet HCOC requirement (min): $T_{C\text{-}HCOC} = (Item\ 13 * 0.95) – Item\ 14$								

Form 4.2-5 HCOC Assessment for Peak Runoff (DA 1)

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (*Use additional forms if more than 3 DMA*)			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DMA*)		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration *I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.6 LOG Form 4.2-4 Item 5 /60)*							
2 Drainage Area of each DMA (Acres) *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
3 Ratio of pervious area to total area *For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
4 Pervious area infiltration rate (in/hr) *Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP*							
5 Maximum loss rate (in/hr) *F_m = Item 3 * Item 4* *Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)*							
6 Peak Flow from DMA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DMA to site discharge point *Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DMA A	*n/a*			*n/a*		
	DMA B		*n/a*			*n/a*	
	DMA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DMA A: *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	9 Pre-developed Q_p at T_c for DMA B: *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	10 Pre-developed Q_p at T_c for DMA C: *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*
10 Peak runoff from pre-developed condition confluence analysis (cfs): *Maximum of Item 8, 9, and 10 (including additional forms as needed)*		
11 Post-developed Q_p at T_c for DMA A: *Same as Item 8 for post-developed values*	12 Post-developed Q_p at T_c for DMA B: *Same as Item 9 for post-developed values*	13 Post-developed Q_p at T_c for DMA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): *Q_{p-HCOC} = (Item 14 * 0.95) – Item 10*		

4.3 Project Conformance Analysis

Complete the following forms for each project site DA to document that the proposed LID BMPs conform to the project DCV developed to meet performance criteria specified in the MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the MS4 Permit (see Section 5.3.1 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design and Hydrologic Source Controls (Form 4.3-2)
- Retention and Infiltration (Form 4.3-3)
- Harvested and Use (Form 4.3-4) or
- Biotreatment (Form 4.3-5).

At the end of each form, additional fields facilitate the determination of the extent of mitigation provided by the specific BMP category, allowing for use of the next category of BMP in the hierarchy, if necessary.

The first step in the analysis, using Section 5.3.2.1 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Forms 4.3-2 and 4.3-4 to determine the feasibility of applicable HSC and harvest and use BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

If no site constraints exist that would limit the type of BMP to be implemented in a DA, evaluate the use of combinations of LID BMPs, including all applicable HSC BMPs to maximize on-site retention of the DCV. If no combination of BMP can mitigate the entire DCV, implement the single BMP type, or combination of BMP types, that maximizes on-site retention of the DCV within the minimum effective area.

If the combination of LID HSC, retention and infiltration, and harvest and use BMPs are unable to mitigate the entire DCV, then biotreatment BMPs may be implemented by the project proponent. If biotreatment BMPs are used, then they must be sized to provide sufficient capacity for effective treatment of the remainder of the volume-based performance criteria that cannot be achieved with LID BMPs (TGD for WQMP Section 5.4.4.2). Under no circumstances shall any portion of the DCV be released from the site without effective mitigation and/or treatment.

Form 4.3-1 Infiltration BMP Feasibility (DA 1 and DA 2)

Feasibility Criterion – Complete evaluation for each DA on the Project Site
1 Would infiltration BMP pose significant risk for groundwater related concerns? Yes ☐ No ☒ *Refer to Section 5.3.2.1 of the TGD for WQMP*
If Yes, Provide basis: (attach)
2 Would installation of infiltration BMP significantly increase the risk of geotechnical hazards? Yes ☐ No ☒ (Yes, if the answer to any of the following questions is yes, as established by a geotechnical expert): • The location is less than 50 feet away from slopes steeper than 15 percent • The location is less than eight feet from building foundations or an alternative setback. • A study certified by a geotechnical professional or an available watershed study determines that stormwater infiltration would result in significantly increased risks of geotechnical hazards.
If Yes, Provide basis: (attach)
3 Would infiltration of runoff on a Project site violate downstream water rights? Yes ☐ No ☒
If Yes, Provide basis: (attach)
4 Is proposed infiltration facility located on hydrologic soil group (HSG) D soils or does the site geotechnical investigation indicate presence of soil characteristics, which support categorization as D soils? Yes ☐ No ☒
If Yes, Provide basis: (attach)
5 Is the design infiltration rate, after accounting for safety factor of 2.0, below proposed facility less than 0.3 in/hr (accounting for soil amendments)? Yes ☐ No ☒
If Yes, Provide basis: (attach)
6 Would on-site infiltration or reduction of runoff over pre-developed conditions be partially or fully inconsistent with watershed management strategies as defined in the WAP, or impair beneficial uses? Yes ☐ No ☒ *See Section 3.5 of the TGD for WQMP and WAP*
If Yes, Provide basis: (attach)
7 Any answer from Item 1 through Item 3 is "Yes": Yes ☐ No ☒ *If yes, infiltration of any volume is not feasible onsite. Proceed to Form 4.3-4, Harvest and Use BMP. If no, then proceed to Item 8 below.* 8 Any answer from Item 4 through Item 6 is "Yes": Yes ☐ No ☒ *If yes, infiltration is permissible but is not required to be considered. Proceed to Form 4.3-2, Hydrologic Source Control BMP.* *If no, then proceed to Item 9, below.* 9 All answers to Item 1 through Item 6 are "No": *Infiltration of the full DCV is potentially feasible, LID infiltration BMP must be designed to infiltrate the full DCV to the MEP.* *Proceed to Form 4.3-2, Hydrologic Source Control BMP.*

4.3.1 Site Design Hydrologic Source Control BMP

Section XI.E. of the Permit emphasizes the use of LID preventative measures; and the use of LID HSC BMPs reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable HSC shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of HSC, if a project cannot feasibly meet BMP sizing requirements or cannot fully address HCOCs, feasibility of all applicable HSC must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design HSC BMP. Refer to Section 5.4.1 in the TGD for more detailed guidance.

Form 4.3-2 Site Design Hydrologic Source Control BMPs (DA 1)			
1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)			
3 Ratio of pervious area receiving runoff to impervious area			
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*			
5 Sum of retention volume achieved from impervious area dispersion (ft^3):	*$V_{retention}$ =Sum of Item 4 for all BMPs*		
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)			
8 Ponding depth (ft)			
9 Surface area of amended soil/gravel (ft^2)			
10 Average depth of amended soil/gravel (ft)			
11 Average porosity of amended soil/gravel			
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*			
13 Runoff volume retention from on-lot infiltration (ft^3):	*$V_{retention}$ =Sum of Item 12 for all BMPs*		

Form 4.3-2 cont. Site Design Hydrologic Source Control BMPs (DA 1)			
14 Implementation of evapotranspiration BMP (green, brown, or blue roofs): Yes ☐ No ☒ *If yes, complete Items 15-20. If no, proceed to Item 21*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
15 Rooftop area planned for ET BMP (ft^2)			
16 Average wet season ET demand (in/day) *Use local values, typical ~ 0.1*			
17 Daily ET demand (ft^3/day) *Item 15 * (Item 16 / 12)*			
18 Drawdown time (hrs) *Copy Item 6 in Form 4.2-1*			
19 Retention Volume (ft^3) $V_{retention}$ *= Item 17 * (Item 18 / 24)*			
20 Runoff volume retention from evapotranspiration BMPs (ft^3): $V_{retention}$ *=Sum of Item 19 for all BMPs*			
21 Implementation of Street Trees: Yes ☐ No ☒ *If yes, complete Items 22-25. If no, proceed to Item 26*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
22 Number of Street Trees			
23 Average canopy cover over impervious area (ft^2)			
24 Runoff volume retention from street trees (ft^3) $V_{retention}$ *= Item 22 * Item 23 * (0.05/12) assume runoff retention of 0.05 inches*			
25 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ *= Sum of Item 24 for all BMPs*			
26 Implementation of residential rain barrel/cisterns: Yes ☐ No ☒ *If yes, complete Items 27-29; If no, proceed to Item 30*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
27 Number of rain barrels/cisterns			
28 Runoff volume retention from rain barrels/cisterns (ft^3) $V_{retention}$ *= Item 27 * 3*			
29 Runoff volume retention from residential rain barrels/Cisterns (ft3): $V_{retention}$ *=Sum of Item 28 for all BMPs*			
30 Total Retention Volume from Site Design Hydrologic Source Control BMPs: *Sum of Items 5, 13, 20, 25 and 29*			

4.3.2 Infiltration BMPs

Use Form 4.3-3 to compute on-site retention of runoff from proposed retention and infiltration BMPs. Volume retention estimates are sensitive to the percolation rate used, which determines the amount of runoff that can be infiltrated within the specified drawdown time. The infiltration safety factor reduces field measured percolation to account for potential inaccuracy associated with field measurements, declining BMP performance over time, and compaction during construction. Appendix D of the TGD for WQMP provides guidance on estimating an appropriate safety factor to use in Form 4.3-3.

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5.1 of the TGD for WQMP)

If implementation of infiltrations BMPs is feasible as determined using Form 4.3-1, then LID infiltration BMPs shall be implemented to the MEP (section 4.1 of the TGD for WQMP).

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 1)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 21,206 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*

BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 1 BMP-1 Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	20.13		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.75		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.4		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	2		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	9,444		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
12 Gravel porosity	N/A		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	24,555		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		

16 Total Retention Volume from LID Infiltration BMPs: 24,555 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 116% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐
If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA 2)

1 Remaining LID DCV not met by site design HSC BMP (ft^3): 2,949 *V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item 30*			
BMP Type *Use columns to the right to compute runoff volume retention from proposed infiltration BMP (select BMP from Table 5-4 in TGD for WQMP) - Use additional forms for more BMPs*	DA 2 BMP-2 Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix D of the TGD for WQMP for minimum requirements for assessment methods*	29.48		
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.75		
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.4		
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48		
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.6		
8 Infiltrating surface area, SA_{BMP} (ft^2) *the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP*	1,512		
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A		
10 Amended soil porosity	N/A		
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	N/A		
12 Gravel porosity	N/A		
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3		
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	3,327		
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	N/A		
16 Total Retention Volume from LID Infiltration BMPs: 3,327 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 113% *Retention% = Item 16 / Form 4.2-1 Item 7*			
18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐ *If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.*			

4.3.3 Harvest and Use BMP

Harvest and use BMP may be considered if the full LID DCV cannot be met by maximizing infiltration BMPs. Use Form 4.3-4 to compute on-site retention of runoff from proposed harvest and use BMPs.

Volume retention estimates for harvest and use BMPs are sensitive to the on-site demand for captured stormwater. Since irrigation water demand is low in the wet season, when most rainfall events occur in San Bernardino County, the volume of water that can be used within a specified drawdown period is relatively low. The bottom portion of Form 4.3-4 facilitates the necessary computations to show infeasibility if a minimum incremental benefit of 40 percent of the LID DCV would not be achievable with MEP implementation of on-site harvest and use of stormwater (Section 5.5.4 of the TGD for WQMP).

Form 4.3-4 Harvest and Use BMPs (DA 1)			
1 Remaining LID DCV not met by site design HSC or infiltration BMP (ft^3): V_{unmet} = *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16*			
BMP Type(s) *Compute runoff volume retention from proposed harvest and use BMP (Select BMPs from Table 5-4 of the TGD for WQMP) - Use additional forms for more BMPs*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Describe cistern or runoff detention facility			
3 Storage volume for proposed detention type (ft^3) *Volume of cistern*			
4 Landscaped area planned for use of harvested stormwater (ft^2)			
5 Average wet season daily irrigation demand (in/day) Use local values, typical ~ 0.1 in/day			
6 Daily water demand (ft^3/day) *Item 4 * (Item 5 / 12)*			
7 Drawdown time (hrs) *Copy Item 6 from Form 4.2-1*			
8 Retention Volume (ft^3) $V_{retention}$ = *Minimum of (Item 3) or (Item 6 * (Item 7 / 24))*			
9 Total Retention Volume (ft^3) from Harvest and Use BMP *Sum of Item 8 for all harvest and use BMP included in plan*			
10 Is the full DCV retained with a combination of LID HSC, retention and infiltration, and harvest & use BMPs? Yes ☐ No ☐ *If yes, demonstrate conformance using Form 4.3-10. If no, then re-evaluate combinations of all LID BMP and optimize their implementation such that the maximum portion of the DCV is retained on-site (using a single BMP type or combination of BMP types). If the full DCV cannot be mitigated after this optimization process, proceed to Section 4.3.4.*			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration, and harvest and use BMPs. A key consideration when using biotreatment BMP is the effectiveness of the proposed BMP in addressing the pollutants of concern for the project (see Table 5-5 of the TGD for WQMP).

Use Form 4.3-5 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV w. Biotreatment computations are included as follows:

- Use Form 4.3-6 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-7 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-8 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)		
1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): *Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-6 and 4.3-7 to compute treated volume* ☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	Flow-based biotreatment *Use Form 4.3-8 to compute treated volume* ☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft³): *Form 4.3-6 Item 15 + Form 4.3-7 Item 13*	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): *Item 1 – Item 3*	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

Form 4.3-6 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains			
Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*			
2 Amended soil infiltration rate *Typical ~ 5.0*			
3 Amended soil infiltration safety factor *Typical ~ 2.0*			
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*			
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*			
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*			
8 Amended soil surface area (ft^2)			
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Amended soil porosity, *n*			
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
12 Gravel porosity, *n*			
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*			
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*			
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: *Sum of Item 14 for all volume-based BMPs included in this form*			

Form 4.3-7 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (e.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*				
2 Bottom width (ft)				
3 Bottom length (ft)				
4 Bottom area (ft^2) *A_{bottom} = Item 2 * Item 3*				
5 Side slope (ft/ft)				
6 Depth of storage (ft)				
7 Water surface area (ft^2) $A_{surface}$ *=(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*				
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*				
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*				
10 Outflow rate (cfs) *Q_{BMP} = (Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*				
11 Duration of design storm event (hrs)				
12 Biotreated Volume (ft^3) *$V_{biotreated}$ = (Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*				
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-8 Flow Based Biotreatment (DA 1)			
Biotreatment BMP Type *Vegetated swale, vegetated filter strip, or other comparable proprietary BMP*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5*			
2 Flow depth for water quality treatment (ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
3 Bed slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
4 Manning's roughness coefficient			
5 Bottom width (ft) *b_w = (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2$^{\wedge 1.67}$ * Item 3$^{\wedge 0.5}$)*			
6 Side Slope (ft/ft) *BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
7 Cross sectional area (ft^2) *A = (Item 5 * Item 2) + (Item 6 * Item 2$^{\wedge 2}$)*			
8 Water quality flow velocity (ft/sec) *V = Form 4.3-5 Item 6 / Item 7*			
9 Hydraulic residence time (min) *Pollutant specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details*			
10 Length of flow based BMP (ft) *L = Item 8 * Item 9 * 60*			
11 Water surface area at water quality flow depth (ft^2) *SA_{top} = (Item 5 + (2 * Item 2 * Item 6)) * Item 10*			

4.3.5 Conformance Summary

Complete Form 4.3-9 to demonstrate how on-site LID DCV is met with proposed site design hydrologic source control, infiltration, harvest and use, and/or biotreatment BMP. The bottom line of the form is used to describe the basis for infeasibility determination for on-site LID BMP to achieve full LID DCV, and provides methods for computing remaining volume to be addressed in an alternative compliance plan. If the project has more than one outlet, then complete additional versions of this form for each outlet.

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)
1 Total LID DCV for the Project DA-1 (ft^3): 21,206 *Copy Item 7 in Form 4.2-1*
2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*
3 On-site retention with LID infiltration BMP (ft^3): 24,555 *Copy Item 16 in Form 4.3-3*
4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*
5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*
6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*
7 LID BMP performance criteria are achieved if answer to any of the following is "Yes": • Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐ *If yes, sum of Items 2, 3, and 4 is greater than Item 1* • Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐ *If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized* ▪ On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐ *If yes, Form 4.3-1 Items 7 and 8 were both checked yes*
8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance: • Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐ *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance,* V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%* • An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐ *Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed*

Form 4.3-9 Conformance Summary and Alternative Compliance Volume Estimate (DA 2)

1 Total LID DCV for the Project DA-1 (ft^3): 2,949 *Copy Item 7 in Form 4.2-1*

2 On-site retention with site design hydrologic source control LID BMP (ft^3): 0 *Copy Item 30 in Form 4.3-2*

3 On-site retention with LID infiltration BMP (ft^3): 3,327 *Copy Item 16 in Form 4.3-3*

4 On-site retention with LID harvest and use BMP (ft^3): 0 *Copy Item 9 in Form 4.3-4*

5 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 *Copy Item 3 in Form 4.3-5*

6 Flow capacity provided by flow based biotreatment BMP (cfs): 0 *Copy Item 6 in Form 4.3-5*

7 LID BMP performance criteria are achieved if answer to any of the following is "Yes":

- Full retention of LID DCV with site design HSC, infiltration, or harvest and use BMP: Yes ☒ No ☐
  If yes, sum of Items 2, 3, and 4 is greater than Item 1
- Combination of on-site retention BMPs for a portion of the LID DCV and volume-based biotreatment BMP that address all pollutants of concern for the remaining LID DCV: Yes ☐ No ☐
  If yes, a) sum of Items 2, 3, 4, and 5 is greater than Item 1, and Items 2, 3 and 4 are maximized; or b) Item 6 is greater than Form 4.3--5 Item 6 and Items 2, 3 and 4 are maximized
- On-site retention and infiltration is determined to be infeasible and biotreatment BMP provide biotreatment for all pollutants of concern for full LID DCV: Yes ☐ No ☐
  If yes, Form 4.3-1 Items 7 and 8 were both checked yes

8 If the LID DCV is not achieved by any of these means, then the project may be allowed to develop an alternative compliance plan. Check box that describes the scenario which caused the need for alternative compliance:

- Combination of HSC, retention and infiltration, harvest and use, and biotreatment BMPs provide less than full LID DCV capture: ☐
  *Checked yes for Form 4.3-5 Item 7, Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} = (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*
- An approved Watershed Action Plan (WAP) demonstrates that water quality and hydrologic impacts of urbanization are more effective when managed in at an off-site facility: ☐
  Attach appropriate WAP section, including technical documentation, showing effectiveness comparisons for the project site and regional watershed

4.3.6 Hydromodification Control BMP

Use Form 4.3-10 to compute the remaining runoff volume retention, after LID BMP are implemented, needed to address HCOC, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential HCOC. Describe hydromodification control BMP that address HCOC, which may include off-site BMP and/or in-stream controls. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-10 Hydromodification Control BMPs (DA 1)	
1 Volume reduction needed for HCOC performance criteria (ft^3): 4,227 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 24,555 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): N/A *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*
5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*	
6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒ *If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒ *BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)* • Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐ • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	
7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒ *If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:* • Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒ *BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)* • Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐	

Form 4.3-10 Hydromodification Control BMPs (DA 2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 265 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	2 On-site retention with site design hydrologic source control, infiltration, and harvest and use LID BMP (ft^3): 3,327 *Sum of Form 4.3-9 Items 2, 3, and 4 Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving HCOC volume reduction*
3 Remaining volume for HCOC volume capture (ft^3): 0 *Item 1 – Item 2*	4 Volume capture provided by incorporating additional on-site or off-site retention BMPs (ft^3): N/A *Existing downstream BMP may be used to demonstrate additional volume capture (if so, attach to this WQMP a hydrologic analysis showing how the additional volume would be retained during a 2-yr storm event for the regional watershed)*

5 If Item 4 is less than Item 3, incorporate in-stream controls on downstream waterbody segment to prevent impacts due to hydromodification ☐ *Attach in-stream control BMP selection and evaluation to this WQMP*

6 Is Form 4.2-2 Item 11 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site or off-site retention BMP ☒
  BMP upstream of a waterbody segment with a potential HCOC may be used to demonstrate increased time of concentration through hydrograph attenuation (if so, show that the hydraulic residence time provided in BMP for a 2-year storm event is equal or greater than the addition time of concentration requirement in Form 4.2-4 Item 15)
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

7 Form 4.2-2 Item 12 less than or equal to 5%: Yes ☐ No ☒

If yes, HCOC performance criteria is achieved. If no, select one or more mitigation options below:

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site or off-site retention BMPs ☒
  BMPs upstream of a waterbody segment with a potential HCOC may be used to demonstrate additional peak runoff reduction through hydrograph attenuation (if so, attach to this WQMP, a hydrograph analysis showing how the peak runoff would be reduced during a 2-yr storm event)
- Incorporate appropriate in-stream controls for downstream waterbody segment to prevent impacts due to hydromodification, in a plan approved and signed by a licensed engineer in the State of California ☐

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, harvest and use, or biotreat the DCV via on-site LID practices. A project proponent must develop an alternative compliance plan to address the remainder of the LID DCV. Depending on project type some projects may qualify for water quality credits that can be applied to reduce the DCV that must be treated prior to development of an alternative compliance plan (see Form 2.4-1, Water Quality Credits). Form 4.3-9 Item 8 includes instructions on how to apply water quality credits when computing the DCV that must be met through alternative compliance. Alternative compliance plans may include one or more of the following elements:

- On-site structural treatment control BMP - All treatment control BMP should be located as close to possible to the pollutant sources and should not be located within receiving waters;
- Off-site structural treatment control BMP - Pollutant removal should occur prior to discharge of runoff to receiving waters;
- Urban runoff fund or In-lieu program, if available

Depending upon the proposed alternative compliance plan, approval by the executive officer may or may not be required (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMP included as part of the project WQMP are required to be maintained through regular scheduled inspection and maintenance (refer to Section 8, Post Construction BMP Requirements, in the TGD for WQMP). Fully complete Form 5-1 summarizing all BMP included in the WQMP. Attach additional forms as needed. The WQMP shall also include a detailed Operation and Maintenance Plan for all BMP and may require a Maintenance Agreement (consult the jurisdiction's LIP). If a Maintenance Agreement is required, it must also be attached to the WQMP.

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
N-1: Education of Property Owners, Tenants, and Occupants on Stormwater BMPs	HOA	This BMP will begin at construction completion. Practical informational materials are provided in this document in Section 6. These include BMPs that eliminate or reduce pollution during the property improvements. Reference educational material can be found at http://sbcountystormwater.org/government/outreach-materials	As needed
N3: Landscape Management BMPs	HOA	Gardening and lawn care practices to prevent landscape waste to exit project site per SC-73	Weekly
N4: Infiltration Basins	HOA	See manufacturer information in O&M information. See Appendix D	See manufacturer information in O&M information. See Appendix D
N11: Litter/Debris Control Program	HOA	This BMP will begin within 30 days of project completing and will occur on a weekly basis (or more frequently if dictated by volume of trash). A landscape maintenance company will be retained to provide litter control services. They are to ensure that overall site is free of trash. Trash is to be landfilled.	Weekly
N12: Employee Training	HOA	This BMP will begin within 30 days of construction completion and refresher course will occur annually thereafter. The HOA shall ensure that all employees are familiar with the contents of this plan and attachments.	Annually
N14: Catch Basin	HOA	This BMP will begin within 30 days of project completing.	Prior to the rainy season and two

Inspection Program		Inspections will be done by a landscape maintenance company or other staff prior to the rainy season and two times per months thereafter for the duration of the rainy season. The inspector is required to clean the drop inlet as needed or when filled to 25% capacity. Cleaning can be by pump or shop vac or by hand. Debris and trash shall be landfilled.	times per month thereafter for the duration of the rainy season
N15: Vacuum Sweeping of Private Streets and Parking Lots	HOA	This BMP will begin within 1 year of project completion and sweeping will occur annually thereafter, prior to the rainy season. The owners will contract with a sweeping company to complete this BMP as needed. All wastes shall be landfilled. The access road shall be swept. There will be no road cleaning with water.	Quarterly (Minimum), Weekly during rainy season (Oct-May)

Section 6 CWQMP Attachments

6.1. Site Plan and Drainage Plan

Include a site plan and drainage plan sheet set containing the following minimum information:

- Project location
- Site boundary
- Land uses and land covers, as applicable
- Suitability/feasibility constraints
- Structural Source Control BMP locations
- Site Design Hydrologic Source Control BMP locations
- LID BMP details
- Drainage delineations and flow information
- Drainage connections

6.2 Electronic Data Submittal

Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their local Local Implementation Plan), this section will describe the contents (e.g., layering, nomenclature, geo-referencing, etc.) of these documents so that they may be interpreted efficiently and accurately.

6.3 Post Construction

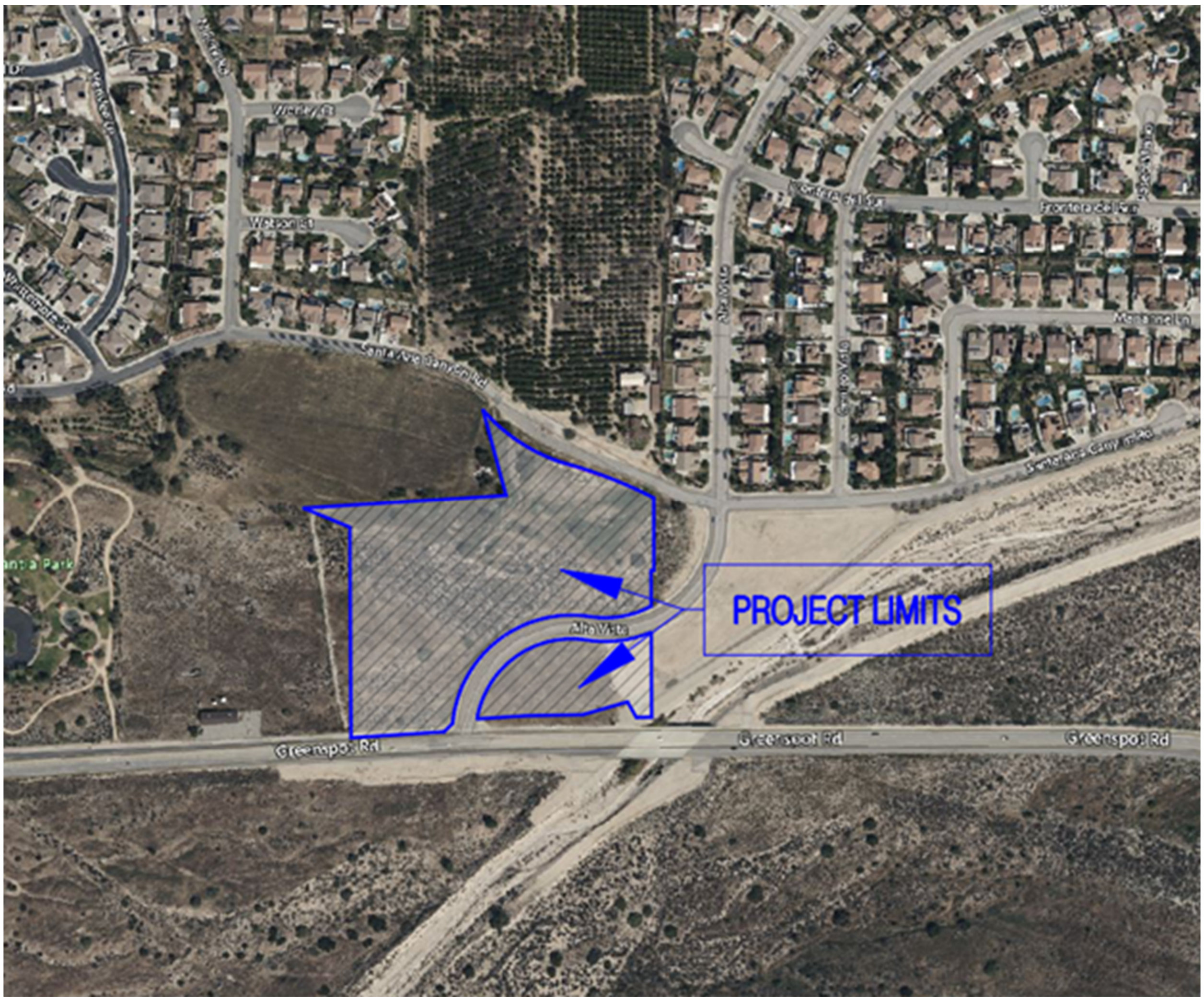
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

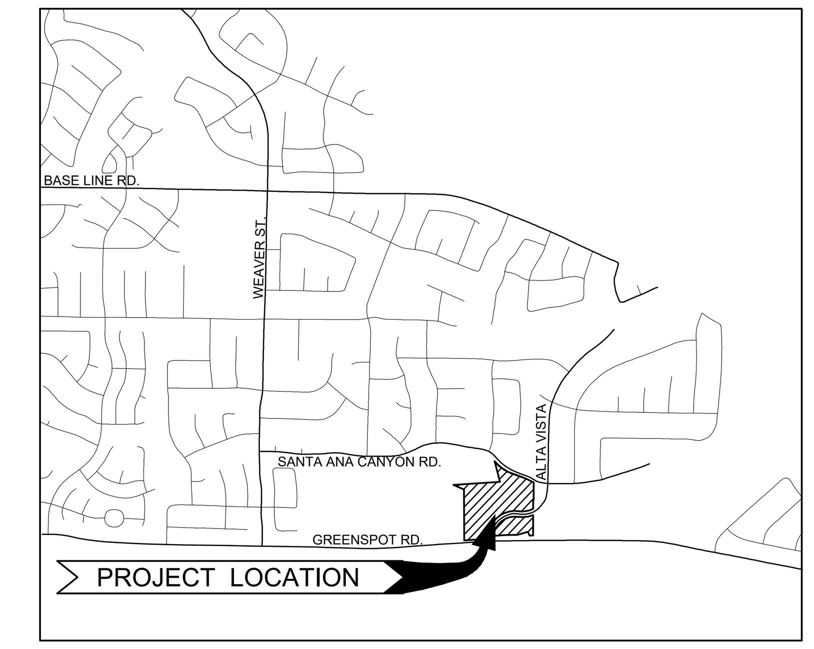
6.4 Other Supporting Documentation

- BMP Educational Materials
- Activity Restriction – C, C&R's & Lease Agreements

Vicinity Map

East Highland – Alta Vista





VICINITY MAP
NOT TO SCALE

LEGEND

- 1400 — PROPOSED CONTOUR
- -1400- — EXISTING CONTOUR
- DMA BOUNDARY
- DMA SUB BOUNDARY
- PROPOSED STORM DRAIN
- FLOW PATH
- NODE 100 1450.0 FS — NODE ID AND ELEVATION
- X / XX — DA NAME / DA AREA (IN ACRES)
- RIGHT OF WAY

DRAINAGE AREA SUMMARY			
DRAINAGE AREA	AREA (AC)	2-YR FLOW (CFS)	100-YR FLOW (CFS)
DA-1: DMA-A	10.000	0.178	20.234
DA-2: DMA-B	1.980	0.726	5.690
TOTAL	11.980	0.904	25.924

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100
SCALE: 1"=50'
(WHEN PRINTED AT 24"X36")

CITY OF HIGHLAND

EXISTING CONCEPTUAL WQMP EXHBIT

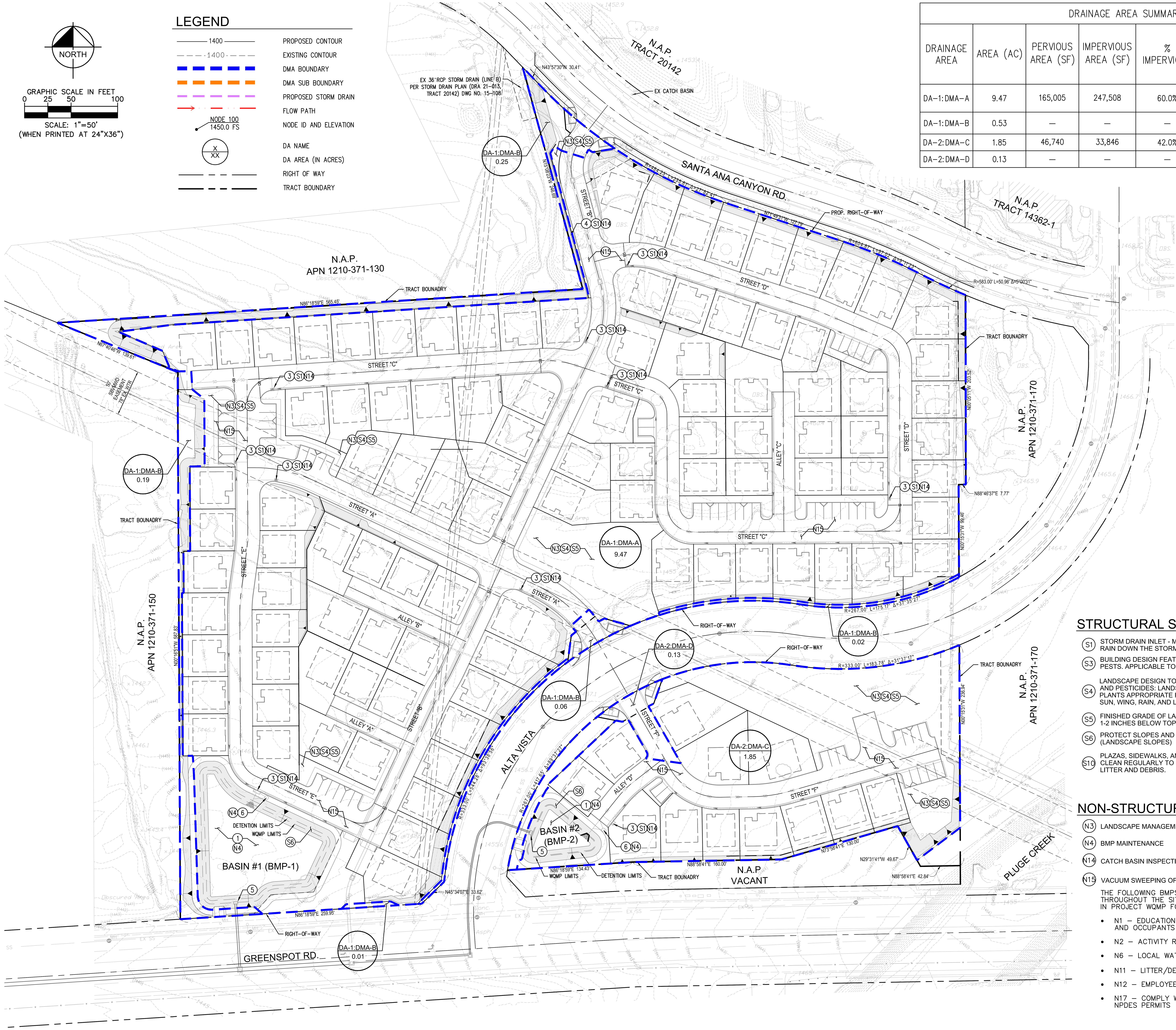
EAST HIGHLAND RANCH - ALTA VISTA
TENTATIVE TRACT MAP NO. 20721

SCALE:	1"=50'
DATE:	12/2024
DESIGNED:	JDA
CHECKED:	RRO
PLN CK REF:	
F.B.	

Kimley»Horn
3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501
PHONE: (951) 543-9868 WWW.KIMLEY-HORN.COM

PROJ. # 195266009
SHEET 1 OF 1 SHEETS
DWG. NO.

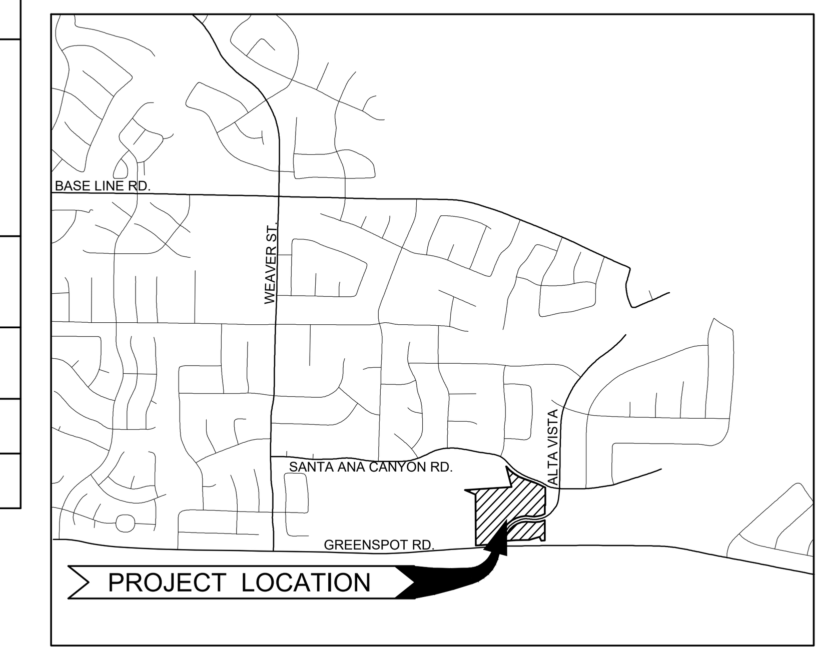
K:\RIV_LDEV\195256009 - EAST HIGHLAND-ALTA VISTA\REPORTS\PRELIM_WQMP\EXHIBITS\EX_WQMP.DWG 12/17/2024 7:38:54 PM



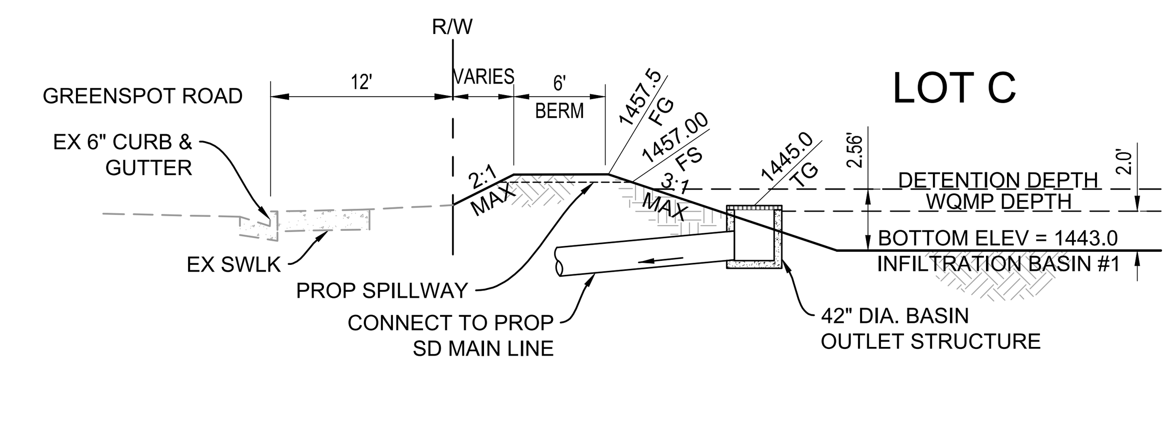
LEGEND

1400	PROPOSED CONTOUR
1400	EXISTING CONTOUR
	DMA BOUNDARY
	DMA SUB BOUNDARY
	PROPOSED STORM DRAIN
	FLOW PATH
NODE 100 1450.0 FS	NODE ID AND ELEVATION
X XX	DA NAME DA AREA (IN ACRES)
	RIGHT OF WAY
	TRACT BOUNDARY

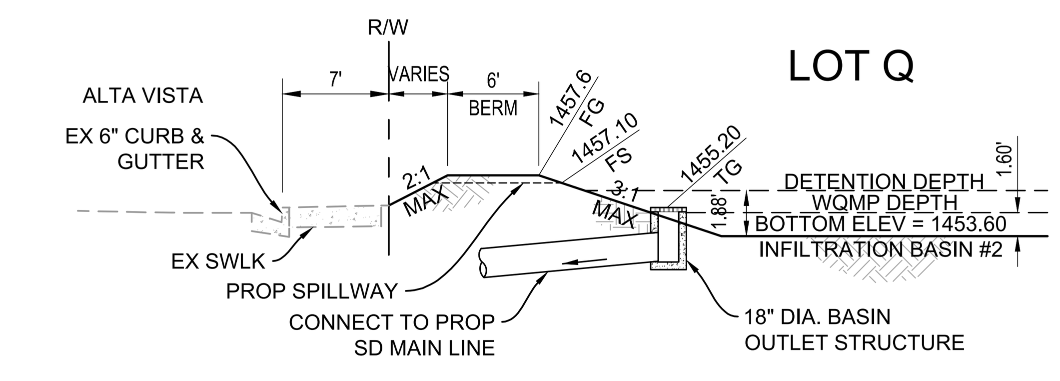
DRAINAGE AREA SUMMARY						
DRAINAGE AREA	AREA (AC)	PERVIOUS AREA (SF)	IMPERVIOUS AREA (SF)	% IMPERVIOUS	WATER QUALITY VOLUME (CF)	VOLUME PROVIDED (CF)
DA-1:DMA-A	9.47	165,005	247,508	60.0%	21,206	24,555
DA-1:DMA-B	0.53	—	—	—	SELF-TREATING	
DA-2:DMA-C	1.85	46,740	33,846	42.0%	2,949	3,327
DA-2:DMA-D	0.13	—	—	—	SELF-TREATING	



VICINITY MAP
NOT TO SCALE



BASIN #1 DETAIL
N.T.S.



BASIN #2 DETAIL
N.T.S.

STRUCTURAL SOURCE CONTROL BMP NOTES

- S1 STORM DRAIN INLET - MARK ALL INLETS WITH WORDS "ONLY RAIN DOWN THE STORM DRAIN" OR SIMILAR.
- S3 BUILDING DESIGN FEATURES TO DISCOURAGE ENTRY OF PESTS. APPLICABLE TO ALL PROPOSED BUILDINGS.
- S4 LANDSCAPE DESIGN TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES: LANDSCAPE PALATE TO CONSIST OF PLANTS APPROPRIATE FOR SITE SOILS, SLOPES, CLIMATE, SUN, WING, RAIN, AND LAND USE.
- S5 FINISHED GRADE OF LANDSCAPED AREAS AT A MINIMUM OF 1-2 INCHES BELOW TOP OF CURB, SIDEWALK, OR PAVEMENT.
- S6 PROTECT SLOPES AND PROVIDE ENERGY DISSIPATION (LANDSCAPE SLOPES)
- S10 PLAZAS, SIDEWALKS, AND PARKING LOTS TO BE SWEPT CLEAN REGULARLY TO PREVENT THE ACCUMULATION OF LITTER AND DEBRIS.

DRAINAGE NOTES

1. PROPOSED INFILTRATION BASIN.
2. PROPOSED OVERFLOW STRUCTURE.
3. PROPOSED GRATE INLET.
4. PROPOSED AREA DRAIN.
5. PROPOSED OVERFLOW RISER.
6. PROPOSED CONTECH CDS HYDRODYNAMIC SEPARATOR.

NON-STRUCTURAL SOURCE CONTROL BMP NOTES

- N3 LANDSCAPE MANAGEMENT BMPS
- N4 BMP MAINTENANCE
- N14 CATCH BASIN INSPECTION PROGRAM
- N15 VACUUM SWEEPING OF PRIVATE STREETS AND PARKING LOTS

THE FOLLOWING BMPS MAY BE APPLICABLE THROUGHOUT THE SITE AS NEEDED PER FORM 4.1-1 IN PROJECT WQMP FOR DETAILS.

- N1 – EDUCATION OF PROPERTY OWNERS, TENANTS, AND OCCUPANTS ON STORMWATER BMPS
- N2 – ACTIVITY RESTRICTIONS
- N6 – LOCAL WATER QUALITY ORDINANCES
- N11 – LITTER/DEBRIS CONTROL PROGRAM
- N12 – EMPLOYEE TRAINING
- N17 – COMPLY WITH ALL OTHER APPLICABLE NPDES PERMITS

CITY OF HIGHLAND

PROPOSED CONCEPTUAL WQMP EXHIBIT

EAST HIGHLAND RANCH - ALTA VISTA
TENTATIVE TRACT MAP NO. 20721

SCALE:	1"=50'	PROJ. #	195266009
DATE:	12/2024	SHEET	1
DESIGNED:	JDA	OF	1 SHEETS
CHECKED:	RRO	DWG. NO.	
PLN CK REF:			
F.B.			

Kimley»Horn
3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501
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K:\RIV_LDEV\195266009 - EAST HIGHLAND-ALTA VISTA\REPORTS\PRELIM_WQMP\EXHIBITS\PROP_WQMP.DWG 12/17/2024 7:34:57 PM

Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) $p = w \times v$
A	Suitability Assessment	Soil assessment methods	0.25	1	0.25
		Predominant soil texture	0.25	2	0.5
		Site soil variability	0.25	2	0.5
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	2	0.5
		Level of pretreatment/ expected sediment loads	0.25	2	0.5
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	2	0.5
		Design Safety Factor, $S_B = \Sigma p$			2.25
Combined Safety Factor, $S_{TOT} = S_A \times S_B$				3.75	
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)				BMP-1 20.13	BMP-2 29.48
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$				5.368	7.861

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Preliminary Geotechnical Evaluation Report, East Highland Ranch, Approximately 12.5-Acre of Vacant Land North of Greenspot Road and Bisected by Alta Vista, City of Highland, San Bernardino County, California prepared by Petra Geosciences, Inc. on August 12, 2024 J.N. 24-156, a total of 4 tests were conducted, two per infiltration basin. It was concluded that the conservative infiltration rate is approximately 20.13 in/hr for Basin 1 and 29.48 in/hr for Basin 2. As demonstrated in the test results, the infiltration rate improves with depth.

Note: The minimum combined adjustment factor shall not be less than 2.0 and the maximum combined adjustment factor shall not exceed 9.0.

12/17/2024

PROJECT NAME: East Highland Ranch - ALTA VISTA
DRAW-DOWN TIME CHECK: WHITE WATER WATERSHED METHOD

DRAW-DOWN TIME for Basin #1 DA-1:DMA-A & DMA-B DCV

INFILTRATION BMP	Total Storage Volume (V)	Design Infiltration Rate *	Total Basin Footprint (Area) **	Total Percolation	Draw-Down Time
BMP-1	(ft^3)	(in/hr)	(sf)	(CFS)	(hr)
BASIN A	21,206	2.4	9,444	0.525	11.23

GOOD < 48 Hours

DRAW-DOWN TIME for Basin #2 DA-2:DMA-C DCV

INFILTRATION BMP	Total Storage Volume (V)	Design Infiltration Rate *	Total Basin Footprint (Area) **	Total Percolation	Draw-Down Time
BMP-2	(ft^3)	(in/hr)	(sf)	(CFS)	(hr)
BASIN B	2,949	2.4	1,512	0.084	9.75

GOOD < 48 Hours

NOAA Atlas 14, Volume 6, Version 2
Location name: Highland, California, USA*
Latitude: 34.1113°, Longitude: -117.1511°
Elevation: 1457 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	**2**	**5**	**10**	**25**	**50**	**100**	**200**	**500**	**1000**
5-min	**0.111** (0.092-0.135)	**0.144** (0.119-0.175)	**0.190** (0.157-0.232)	**0.230** (0.189-0.282)	**0.287** (0.228-0.365)	**0.334** (0.260-0.435)	**0.385** (0.292-0.513)	**0.440** (0.324-0.604)	**0.521** (0.368-0.745)	**0.588** (0.401-0.872)
10-min	**0.159** (0.132-0.193)	**0.206** (0.171-0.251)	**0.272** (0.225-0.332)	**0.329** (0.270-0.405)	**0.411** (0.327-0.524)	**0.479** (0.372-0.623)	**0.552** (0.418-0.736)	**0.631** (0.465-0.866)	**0.747** (0.527-1.07)	**0.843** (0.574-1.25)
15-min	**0.192** (0.160-0.233)	**0.249** (0.207-0.303)	**0.329** (0.273-0.402)	**0.398** (0.327-0.489)	**0.497** (0.395-0.633)	**0.579** (0.450-0.753)	**0.667** (0.506-0.889)	**0.763** (0.562-1.05)	**0.903** (0.637-1.29)	**1.02** (0.695-1.51)
30-min	**0.284** (0.236-0.344)	**0.368** (0.306-0.448)	**0.486** (0.402-0.592)	**0.587** (0.482-0.722)	**0.734** (0.583-0.934)	**0.855** (0.664-1.11)	**0.984** (0.746-1.31)	**1.13** (0.829-1.54)	**1.33** (0.940-1.91)	**1.50** (1.02-2.23)
60-min	**0.400** (0.332-0.486)	**0.519** (0.431-0.631)	**0.684** (0.567-0.835)	**0.827** (0.680-1.02)	**1.04** (0.821-1.32)	**1.20** (0.936-1.57)	**1.39** (1.05-1.85)	**1.59** (1.17-2.18)	**1.88** (1.32-2.69)	**2.12** (1.44-3.14)
2-hr	**0.571** (0.475-0.694)	**0.732** (0.608-0.890)	**0.950** (0.787-1.16)	**1.13** (0.931-1.40)	**1.39** (1.11-1.77)	**1.60** (1.24-2.08)	**1.82** (1.38-2.43)	**2.05** (1.51-2.82)	**2.38** (1.68-3.41)	**2.64** (1.80-3.92)
3-hr	**0.702** (0.584-0.853)	**0.894** (0.742-1.09)	**1.15** (0.954-1.41)	**1.37** (1.12-1.68)	**1.67** (1.32-2.12)	**1.91** (1.48-2.48)	**2.16** (1.63-2.87)	**2.42** (1.78-3.32)	**2.78** (1.96-3.98)	**3.07** (2.09-4.55)
6-hr	**0.981** (0.816-1.19)	**1.24** (1.03-1.51)	**1.59** (1.32-1.94)	**1.88** (1.55-2.32)	**2.28** (1.81-2.90)	**2.59** (2.01-3.36)	**2.90** (2.20-3.87)	**3.23** (2.38-4.44)	**3.69** (2.60-5.28)	**4.04** (2.76-6.00)
12-hr	**1.32** (1.10-1.61)	**1.69** (1.40-2.06)	**2.17** (1.80-2.65)	**2.56** (2.10-3.15)	**3.09** (2.45-3.94)	**3.50** (2.72-4.55)	**3.92** (2.97-5.22)	**4.35** (3.20-5.97)	**4.93** (3.48-7.06)	**5.39** (3.67-7.99)
24-hr	**1.79** (1.59-2.06)	**2.31** (2.04-2.67)	**2.99** (2.64-3.46)	**3.55** (3.10-4.14)	**4.30** (3.64-5.18)	**4.88** (4.05-6.00)	**5.46** (4.43-6.88)	**6.07** (4.78-7.86)	**6.88** (5.21-9.28)	**7.52** (5.50-10.5)
2-day	**2.18** (1.93-2.51)	**2.86** (2.53-3.30)	**3.77** (3.32-4.36)	**4.51** (3.95-5.26)	**5.53** (4.69-6.66)	**6.33** (5.25-7.78)	**7.14** (5.79-9.00)	**7.99** (6.30-10.3)	**9.16** (6.93-12.3)	**10.1** (7.37-14.0)
3-day	**2.35** (2.08-2.70)	**3.12** (2.76-3.60)	**4.15** (3.66-4.80)	**5.01** (4.38-5.84)	**6.20** (5.25-7.47)	**7.14** (5.92-8.78)	**8.11** (6.57-10.2)	**9.13** (7.20-11.8)	**10.6** (7.98-14.2)	**11.7** (8.54-16.3)
4-day	**2.53** (2.24-2.91)	**3.38** (2.99-3.90)	**4.53** (4.00-5.24)	**5.49** (4.80-6.40)	**6.83** (5.78-8.22)	**7.88** (6.54-9.69)	**8.98** (7.28-11.3)	**10.1** (7.99-13.1)	**11.7** (8.89-15.8)	**13.0** (9.54-18.2)
7-day	**2.92** (2.58-3.36)	**3.93** (3.48-4.54)	**5.29** (4.67-6.12)	**6.42** (5.62-7.49)	**8.00** (6.78-9.64)	**9.24** (7.67-11.4)	**10.5** (8.54-13.3)	**11.9** (9.37-15.4)	**13.8** (10.4-18.6)	**15.3** (11.2-21.3)
10-day	**3.18** (2.81-3.66)	**4.30** (3.80-4.96)	**5.80** (5.12-6.71)	**7.05** (6.17-8.22)	**8.79** (7.44-10.6)	**10.2** (8.43-12.5)	**11.6** (9.38-14.6)	**13.1** (10.3-16.9)	**15.1** (11.5-20.4)	**16.8** (12.3-23.4)
20-day	**3.93** (3.48-4.53)	**5.36** (4.74-6.19)	**7.28** (6.43-8.43)	**8.88** (7.78-10.4)	**11.1** (9.41-13.4)	**12.9** (10.7-15.8)	**14.7** (11.9-18.5)	**16.6** (13.1-21.5)	**19.2** (14.5-25.9)	**21.3** (15.6-29.7)
30-day	**4.66** (4.12-5.37)	**6.36** (5.63-7.34)	**8.65** (7.63-10.0)	**10.6** (9.23-12.3)	**13.2** (11.2-15.9)	**15.3** (12.7-18.8)	**17.5** (14.1-22.0)	**19.7** (15.6-25.6)	**22.9** (17.3-30.9)	**25.4** (18.6-35.5)
45-day	**5.60** (4.96-6.45)	**7.61** (6.73-8.78)	**10.3** (9.09-11.9)	**12.6** (11.0-14.6)	**15.7** (13.3-18.9)	**18.2** (15.1-22.4)	**20.8** (16.8-26.1)	**23.5** (18.5-30.4)	**27.3** (20.6-36.7)	**30.3** (22.1-42.2)
60-day	**6.58** (5.82-7.58)	**8.86** (7.84-10.2)	**11.9** (10.5-13.8)	**14.5** (12.7-16.9)	**18.1** (15.3-21.8)	**20.9** (17.3-25.7)	**23.8** (19.3-30.0)	**26.9** (21.2-34.9)	**31.3** (23.7-42.2)	**34.7** (25.4-48.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.
Please refer to NOAA Atlas 14 document for more information.

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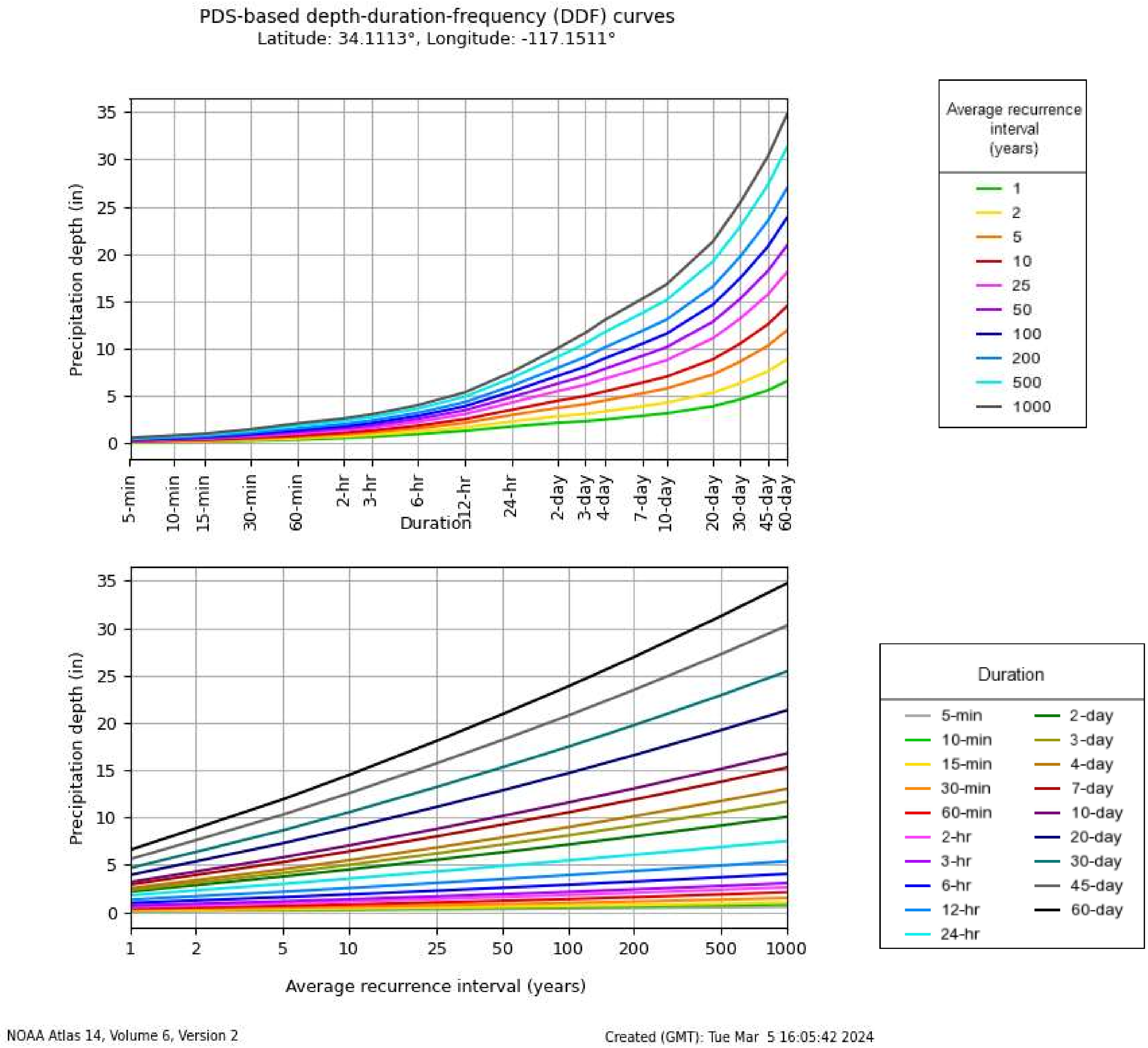
PF graphical



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Maps & aerials

Small scale terrain

Large scale terrain

Large scale map

Large scale aerial

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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

```
                San Bernardino County Rational Hydrology Program

                   (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study       Date: 12/13/24
------------------------------------------------------------------------
EXISTING CONDITIONS EAST HIGHLAND RANCH
EXISTING 100-YR DESIGN STORM
RATIONAL METHOD
KIMLEY-HORN
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.390 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Initial subarea data:
Initial area flow distance =   193.000(Ft.)
Top (of initial area) elevation =  1462.500(Ft.)
Bottom (of initial area) elevation =  1458.800(Ft.)
Difference in elevation =     3.700(Ft.)
Slope =    0.01917  s(%)=       1.92
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.779 min.
Rainfall intensity =      3.516(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.764
Subarea runoff =      1.611(CFS)
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.532(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.368(Ft.), Average velocity =   1.960(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2             20.00              0.00
        3             61.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      8.093(CFS)
  '     '        flow top width =     22.443(Ft.)
  '     '    velocity=    1.960(Ft/s)
  '     '        area =      4.129(Sq.Ft)
  '     '        Froude number =     0.805

Upstream point elevation =  1458.800(Ft.)
Downstream point elevation =  1446.300(Ft.)
Flow length =   613.000(Ft.)
Travel time  =    5.21 min.
Time of concentration =   17.99 min.
Depth of flow =   0.368(Ft.)
Average velocity =   1.960(Ft/s)
Total irregular channel flow =     8.093(CFS)
Irregular channel normal depth above invert elev. =   0.368(Ft.)
Average velocity of channel(s) =   1.960(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Rainfall intensity =      2.863(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
```

```
rational method)(Q=KCIA) is C = 0.733
Subarea runoff =     12.885(CFS) for    6.310(Ac.)
Total runoff =     14.496(CFS)
Effective area this stream =        6.91(Ac.)
Total Study Area (Main Stream No. 1) =        6.91(Ac.)
Area averaged Fm value =    0.532(In/Hr)
Depth of flow =   0.458(Ft.), Average velocity =   2.268(Ft/s)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.478(Ft.), Average velocity =   2.538(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1             0.00              1.00
        2            30.00              0.00
        3            60.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =     17.412(CFS)
  '     '        flow top width =     28.694(Ft.)
  '     '    velocity=    2.538(Ft/s)
  '     '        area =      6.861(Sq.Ft)
  '     '        Froude number =     0.915

Upstream point elevation =  1446.300(Ft.)
Downstream point elevation =  1443.000(Ft.)
Flow length =   137.000(Ft.)
Travel time  =    0.90 min.
Time of concentration =   18.89 min.
Depth of flow =   0.478(Ft.)
Average velocity =   2.538(Ft/s)
Total irregular channel flow =    17.412(CFS)
Irregular channel normal depth above invert elev. =   0.478(Ft.)
Average velocity of channel(s) =   2.538(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
```

```
Rainfall intensity =      2.781(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.728
Subarea runoff =      5.738(CFS) for    3.090(Ac.)
Total runoff =     20.234(CFS)
Effective area this stream =       10.00(Ac.)
Total Study Area (Main Stream No. 1) =       10.00(Ac.)
Area averaged Fm value =    0.532(In/Hr)
Depth of flow =   0.506(Ft.), Average velocity =   2.635(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Initial subarea data:
Initial area flow distance =   170.000(Ft.)
Top (of initial area) elevation =  1466.100(Ft.)
Bottom (of initial area) elevation =  1462.000(Ft.)
Difference in elevation =     4.100(Ft.)
Slope =    0.02412  s(%)=       2.41
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.602 min.
Rainfall intensity =      3.726(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.771
Subarea runoff =      2.615(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.532(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.013(Ft.), Average velocity =   4.890(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
```

```
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2             37.00              0.00
        3            101.00              0.00
        4            129.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      4.153(CFS)
  '     '        flow top width =     64.857(Ft.)
  '     '    velocity=    4.891(Ft/s)
  '     '        area =      0.849(Sq.Ft)
  '     '        Froude number =     7.532

Upstream point elevation =  1462.000(Ft.)
Downstream point elevation =  1457.400(Ft.)
Flow length =     1.070(Ft.)
Travel time  =    0.00 min.
Time of concentration =   11.61 min.
Depth of flow =   0.013(Ft.)
Average velocity =   4.890(Ft/s)
Total irregular channel flow =     4.153(CFS)
Irregular channel normal depth above invert elev. =   0.013(Ft.)
Average velocity of channel(s) =   4.890(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 3 = 70.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.532(In/Hr)
Rainfall intensity =      3.725(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.771
Subarea runoff =      3.074(CFS) for    1.070(Ac.)
Total runoff =       5.689(CFS)
Effective area this stream =         1.98(Ac.)
Total Study Area (Main Stream No. 1) =       11.98(Ac.)
Area averaged Fm value =    0.532(In/Hr)
Depth of flow =   0.016(Ft.), Average velocity =   5.540(Ft/s)
End of computations, Total Study Area =           11.98 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  50.0
```

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study        Date: 12/17/24
------------------------------------------------------------------------
PROPOSED CONDITIONS EAST HIGHLAND RANCH
PROPOSED 100 YEAR DESIGN STORM
RATIONAL METHOD
KIMLEY-HORN
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
Computed rainfall intensity:
Storm year =   100.00   1 hour rainfall =     1.390 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 3



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   208.000(Ft.)
Top (of initial area) elevation =  1463.300(Ft.)
Bottom (of initial area) elevation =  1455.000(Ft.)
Difference in elevation =     8.300(Ft.)
Slope =    0.03990  s(%)=       3.99
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.024 min.
Rainfall intensity =      5.520(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.849
Subarea runoff =      0.703(CFS)
Total initial stream area =        0.150(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.600(Ft.)
Downstream point/station elevation =  1449.300(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.703(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.703(CFS)
Normal flow depth in pipe =    4.51(In.)
Flow top width inside pipe =    5.18(In.)
Critical Depth =    5.07(In.)
Pipe flow velocity =      4.44(Ft/s)
Travel time through pipe =    0.06 min.
Time of concentration (TC) =     6.08 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.150(Ac.)
Runoff from this stream =      0.703(CFS)
Time of concentration =    6.08 min.
Rainfall intensity =     5.488(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   365.000(Ft.)
Top (of initial area) elevation =  1461.700(Ft.)
Bottom (of initial area) elevation =  1458.900(Ft.)
Difference in elevation =     2.800(Ft.)
Slope =    0.00767  s(%)=       0.77
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.491 min.
Rainfall intensity =      3.957(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.829
Subarea runoff =      4.361(CFS)
Total initial stream area =        1.330(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1453.400(Ft.)
Downstream point/station elevation =  1449.300(Ft.)
Pipe length  =   127.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.361(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.361(CFS)
Normal flow depth in pipe =    7.27(In.)
Flow top width inside pipe =   11.73(In.)
Critical Depth =   10.52(In.)
Pipe flow velocity =      8.77(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =    10.73 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.330(Ac.)
Runoff from this stream =      4.361(CFS)
Time of concentration =   10.73 min.
Rainfall intensity =     3.904(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      0.70     0.150      6.08    0.314      5.488
2      4.36     1.330     10.73    0.314      3.904
Qmax(1) =
           1.000 *    1.000 *     0.703) +
           1.441 *    0.567 *     4.361) + =       4.266
Qmax(2) =
           0.694 *    1.000 *     0.703) +
           1.000 *    1.000 *     4.361) + =       4.849

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.703       4.361
Maximum flow rates at confluence using above data:
        4.266        4.849
Area of streams before confluence:
        0.150        1.330
Effective area values after confluence:
        0.904        1.480
Results of confluence:
Total flow rate =      4.849(CFS)
Time of concentration =    10.732 min.
Effective stream area after confluence =      1.480(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =       1.48(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.300(Ft.)
Downstream point/station elevation =  1449.100(Ft.)
Pipe length  =    26.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.849(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.849(CFS)
Normal flow depth in pipe =   10.69(In.)
Flow top width inside pipe =   13.58(In.)
Critical Depth =   10.71(In.)
Pipe flow velocity =      5.19(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    10.82 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      121.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.480(Ac.)
Runoff from this stream =      4.849(CFS)
Time of concentration =   10.82 min.
Rainfall intensity =     3.886(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   595.000(Ft.)
Top (of initial area) elevation =  1461.700(Ft.)
Bottom (of initial area) elevation =  1455.300(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01076  s(%)=       1.08
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.922 min.
Rainfall intensity =      3.665(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.823
Subarea runoff =      6.545(CFS)
Total initial stream area =        2.170(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      121.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
```

```
Upstream point/station elevation =  1449.800(Ft.)
Downstream point/station elevation =  1449.100(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     6.545(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     6.545(CFS)
Normal flow depth in pipe =    9.40(In.)
Flow top width inside pipe =   14.51(In.)
Critical Depth =   12.36(In.)
Pipe flow velocity =      8.10(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    11.99 min.



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      121.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.170(Ac.)
Runoff from this stream =      6.545(CFS)
Time of concentration =   11.99 min.
Rainfall intensity =     3.652(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      4.85     1.480     10.82    0.314      3.886
2      6.54     2.170     11.99    0.314      3.652
Qmax(1) =
           1.000 *    1.000 *     4.849) +
           1.070 *    0.902 *     6.545) + =      11.164
Qmax(2) =
           0.935 *    1.000 *     4.849) +
           1.000 *    1.000 *     6.545) + =      11.076

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.849       6.545
Maximum flow rates at confluence using above data:
       11.164       11.076
Area of streams before confluence:
        1.480        2.170
Effective area values after confluence:
        3.437        3.650
```

```
Results of confluence:
Total flow rate =     11.164(CFS)
Time of concentration =    10.816 min.
Effective stream area after confluence =      3.437(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =       3.65(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.100(Ft.)
Downstream point/station elevation =  1445.800(Ft.)
Pipe length  =   343.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    11.164(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    11.164(CFS)
Normal flow depth in pipe =   13.17(In.)
Flow top width inside pipe =   20.31(In.)
Critical Depth =   14.95(In.)
Pipe flow velocity =      7.03(Ft/s)
Travel time through pipe =    0.81 min.
Time of concentration (TC) =    11.63 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.437(Ac.)
Runoff from this stream =     11.164(CFS)
Time of concentration =   11.63 min.
Rainfall intensity =     3.720(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   432.000(Ft.)
Top (of initial area) elevation =  1455.700(Ft.)
Bottom (of initial area) elevation =  1449.300(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01481  s(%)=       1.48
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.838 min.
Rainfall intensity =      4.113(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.831
Subarea runoff =      4.171(CFS)
Total initial stream area =        1.220(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1446.000(Ft.)
Downstream point/station elevation =  1445.800(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.171(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     4.171(CFS)
Normal flow depth in pipe =    8.95(In.)
Flow top width inside pipe =   10.45(In.)
Critical Depth =   10.34(In.)
Pipe flow velocity =      6.63(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =     9.87 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.220(Ac.)
Runoff from this stream =      4.171(CFS)
Time of concentration =    9.87 min.
Rainfall intensity =     4.105(In/Hr)
```

```
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     11.16     3.437     11.63    0.314      3.720
2      4.17     1.220      9.87    0.314      4.105
Qmax(1) =
           1.000 *    1.000 *    11.164) +
           0.898 *    1.000 *     4.171) + =      14.911
Qmax(2) =
           1.113 *    0.849 *    11.164) +
           1.000 *    1.000 *     4.171) + =      14.716

Total of 2 streams to confluence:
Flow rates before confluence point:
      11.164       4.171
Maximum flow rates at confluence using above data:
       14.911       14.716
Area of streams before confluence:
        3.437       1.220
Effective area values after confluence:
        4.657       4.137
Results of confluence:
Total flow rate =     14.911(CFS)
Time of concentration =    11.629 min.
Effective stream area after confluence =      4.657(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =      4.66(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      123.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.800(Ft.)
Downstream point/station elevation =  1445.200(Ft.)
Pipe length  =   115.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    14.911(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    14.911(CFS)
Normal flow depth in pipe =   18.00(In.)
Flow top width inside pipe =   20.78(In.)
Critical Depth =   16.71(In.)
Pipe flow velocity =      5.90(Ft/s)
```

```
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    11.95 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      123.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.657(Ac.)
Runoff from this stream =     14.911(CFS)
Time of concentration =   11.95 min.
Rainfall intensity =     3.659(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      112.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   164.000(Ft.)
Top (of initial area) elevation =  1449.100(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =     1.200(Ft.)
Slope =    0.00732  s(%)=       0.73
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.690 min.
Rainfall intensity =      4.768(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.841
Subarea runoff =      3.047(CFS)
Total initial stream area =        0.760(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      123.000
```

```
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.400(Ft.)
Downstream point/station elevation =  1445.200(Ft.)
Pipe length  =    13.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.047(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.047(CFS)
Normal flow depth in pipe =    7.32(In.)
Flow top width inside pipe =   11.70(In.)
Critical Depth =    8.97(In.)
Pipe flow velocity =      6.07(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     7.73 min.



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      123.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.760(Ac.)
Runoff from this stream =      3.047(CFS)
Time of concentration =    7.73 min.
Rainfall intensity =     4.755(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     14.91     4.657     11.95    0.314      3.659
2      3.05     0.760      7.73    0.314      4.755
Qmax(1) =
           1.000 *    1.000 *    14.911) +
           0.753 *    1.000 *     3.047) + =      17.206
Qmax(2) =
           1.328 *    0.646 *    14.911) +
           1.000 *    1.000 *     3.047) + =      15.840

Total of 2 streams to confluence:
Flow rates before confluence point:
      14.911       3.047
Maximum flow rates at confluence using above data:
       17.206       15.840
Area of streams before confluence:
        4.657        0.760
```

```
Effective area values after confluence:
        5.417       3.770
Results of confluence:
Total flow rate =     17.206(CFS)
Time of concentration =    11.954 min.
Effective stream area after confluence =      5.417(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =      5.42(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      124.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.200(Ft.)
Downstream point/station elevation =  1445.000(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.206(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    17.206(CFS)
Normal flow depth in pipe =   15.38(In.)
Flow top width inside pipe =   23.03(In.)
Critical Depth =   17.94(In.)
Pipe flow velocity =      8.09(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    11.99 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      124.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.417(Ac.)
Runoff from this stream =     17.206(CFS)
Time of concentration =   11.99 min.
Rainfall intensity =     3.652(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
```

```
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   364.000(Ft.)
Top (of initial area) elevation =  1455.700(Ft.)
Bottom (of initial area) elevation =  1448.500(Ft.)
Difference in elevation =     7.200(Ft.)
Slope =    0.01978  s(%)=       1.98
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.671 min.
Rainfall intensity =      4.437(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.836
Subarea runoff =      2.894(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      124.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.700(Ft.)
Downstream point/station elevation =  1445.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     2.894(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     2.894(CFS)
Normal flow depth in pipe =    6.29(In.)
Flow top width inside pipe =   11.99(In.)
Critical Depth =    8.75(In.)
Pipe flow velocity =      6.95(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =     8.75 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      124.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.780(Ac.)
Runoff from this stream =      2.894(CFS)
```

```
Time of concentration =    8.75 min.
Rainfall intensity =     4.414(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     17.21     5.417     11.99    0.314      3.652
2      2.89     0.780      8.75    0.314      4.414
Qmax(1) =
           1.000 *    1.000 *    17.206) +
           0.814 *    1.000 *     2.894) + =      19.563
Qmax(2) =
           1.228 *    0.729 *    17.206) +
           1.000 *    1.000 *     2.894) + =      18.305

Total of 2 streams to confluence:
Flow rates before confluence point:
      17.206       2.894
Maximum flow rates at confluence using above data:
       19.563       18.305
Area of streams before confluence:
        5.417        0.780
Effective area values after confluence:
        6.197        4.730
Results of confluence:
Total flow rate =     19.563(CFS)
Time of concentration =    11.993 min.
Effective stream area after confluence =      6.197(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =       6.20(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.000(Ft.)
Downstream point/station elevation =  1443.300(Ft.)
Pipe length  =   346.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.563(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    19.563(CFS)
Normal flow depth in pipe =   20.06(In.)
Flow top width inside pipe =   23.60(In.)
```

```
Critical Depth =   18.58(In.)
Pipe flow velocity =      6.18(Ft/s)
Travel time through pipe =    0.93 min.
Time of concentration (TC) =    12.93 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      6.197(Ac.)
Runoff from this stream =     19.563(CFS)
Time of concentration =   12.93 min.
Rainfall intensity =     3.492(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   224.000(Ft.)
Top (of initial area) elevation =  1449.100(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =     1.200(Ft.)
Slope =    0.00536  s(%)=       0.54
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.272 min.
Rainfall intensity =      4.262(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.834
Subarea runoff =      1.848(CFS)
Total initial stream area =        0.520(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.520(Ac.)
Runoff from this stream =      1.848(CFS)
Time of concentration =    9.27 min.
Rainfall intensity =     4.262(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =  1458.200(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =    10.300(Ft.)
Slope =    0.01925  s(%)=       1.93
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.170 min.
Rainfall intensity =      4.032(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.830
Subarea runoff =      6.893(CFS)
Total initial stream area =        2.060(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.060(Ac.)
Runoff from this stream =      6.893(CFS)
```

```
Time of concentration =   10.17 min.
Rainfall intensity =     4.032(In/Hr)
Area averaged loss rate (Fm) =    0.3141(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1     19.56     6.197     12.93    0.314      3.492
2      1.85     0.520      9.27    0.314      4.262
3      6.89     2.060     10.17    0.314      4.032
Qmax(1) =
           1.000 *    1.000 *    19.563) +
           0.805 *    1.000 *     1.848) +
           0.855 *    1.000 *     6.893) + =      26.941
Qmax(2) =
           1.242 *    0.717 *    19.563) +
           1.000 *    1.000 *     1.848) +
           1.062 *    0.912 *     6.893) + =      25.955
Qmax(3) =
           1.170 *    0.787 *    19.563) +
           0.942 *    1.000 *     1.848) +
           1.000 *    1.000 *     6.893) + =      26.641

Total of 3 streams to confluence:
Flow rates before confluence point:
      19.563       1.848       6.893
Maximum flow rates at confluence using above data:
       26.941       25.955       26.641
Area of streams before confluence:
        6.197        0.520        2.060
Effective area values after confluence:
        8.777        6.843        7.455
Results of confluence:
Total flow rate =     26.941(CFS)
Time of concentration =    12.926 min.
Effective stream area after confluence =      8.777(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.314(In/Hr)
Study area total (this main stream) =       8.78(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      125.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1443.300(Ft.)
```

```
Downstream point/station elevation =  1443.200(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.941(CFS)
Nearest computed pipe diameter  =     30.00(In.)
Calculated individual pipe flow  =    26.941(CFS)
Normal flow depth in pipe =   19.88(In.)
Flow top width inside pipe =   28.37(In.)
Critical Depth =   21.23(In.)
Pipe flow velocity =      7.80(Ft/s)
Travel time through pipe =    0.03 min.
Time of concentration (TC) =    12.96 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      125.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     26.432(CFS)
therefore the upstream flow rate of Q =     26.941(CFS) is being used
Time of concentration =    12.96 min.
Rainfall intensity =      3.487(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.819
Subarea runoff =      0.000(CFS) for    0.480(Ac.)
Total runoff =     26.941(CFS)
Effective area this stream =        9.26(Ac.)
Total Study Area (Main Stream No. 1) =         9.47(Ac.)
Area averaged Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Initial subarea data:
Initial area flow distance =   232.000(Ft.)
Top (of initial area) elevation =  1462.800(Ft.)
Bottom (of initial area) elevation =  1460.100(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.01164  s(%)=       1.16
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.052 min.
Rainfall intensity =      4.638(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.839
Subarea runoff =      4.281(CFS)
Total initial stream area =        1.100(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.314(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1460.100(Ft.)
Downstream point elevation =  1458.000(Ft.)
Channel length thru subarea  =   182.000(Ft.)
Channel base width      =   14.750(Ft.)
Slope or 'Z' of left channel bank =   3.270
Slope or 'Z' of right channel bank =  21.470
Estimated mean flow rate at midpoint of channel =      5.238(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.330(Ft.)
Flow(q) thru subarea =      5.238(CFS)
Depth of flow =   0.127(Ft.), Average velocity =   2.527(Ft/s)
Channel flow top width =   17.892(Ft.)
Flow Velocity =    2.53(Ft/s)
Travel time  =    1.20 min.
Time of concentration =    9.25 min.
Critical depth =      0.150(Ft.)
 Adding area flow to channel
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Rainfall intensity =      4.267(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.834
Subarea runoff =      1.839(CFS) for    0.620(Ac.)
Total runoff =      6.120(CFS)
Effective area this stream =        1.72(Ac.)
Total Study Area (Main Stream No. 1) =       11.19(Ac.)
Area averaged Fm value =    0.314(In/Hr)
Depth of flow =   0.139(Ft.), Average velocity =   2.671(Ft/s)
Critical depth =      0.166(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1454.400(Ft.)
Downstream point/station elevation =  1454.000(Ft.)
Pipe length  =    32.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     6.120(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     6.120(CFS)
Normal flow depth in pipe =   12.00(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =   11.99(In.)
Pipe flow velocity =      5.81(Ft/s)
Travel time through pipe =    0.09 min.
Time of concentration (TC) =     9.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Adjusted SCS curve number for AMC 3 = 52.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.314(In/Hr)
Time of concentration =     9.34 min.
Rainfall intensity =      4.242(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.833
Subarea runoff =      0.421(CFS) for    0.130(Ac.)
Total runoff =      6.540(CFS)
Effective area this stream =        1.85(Ac.)
```

```
Total Study Area (Main Stream No. 1) =       11.32(Ac.)
Area averaged Fm value =    0.314(In/Hr)
End of computations, Total Study Area =           11.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.400
Area averaged SCS curve number =  32.0
```

```
                San Bernardino County Rational Hydrology Program

                    (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study       Date: 12/13/24
------------------------------------------------------------------------
EXISTING CONDITIONS EAST HIGHLAND RANCH
EXISTING 2 YR DESIGN STORM
RATIONAL METHOD
KIMLEY-HORN
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.519 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 1



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
Initial subarea data:
Initial area flow distance =   193.000(Ft.)
Top (of initial area) elevation =  1462.500(Ft.)
Bottom (of initial area) elevation =  1458.800(Ft.)
Difference in elevation =     3.700(Ft.)
Slope =    0.01917  s(%)=       1.92
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.779 min.
Rainfall intensity =      1.313(In/Hr) for a     2.0 year storm
```

```
Effective runoff coefficient used for area (Q=KCIA) is C = 0.226
Subarea runoff =      0.178(CFS)
Total initial stream area =        0.600(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.983(In/Hr)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.093(Ft.), Average velocity =   0.784(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2             20.00              0.00
        3             61.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.207(CFS)
  '     '        flow top width =      5.677(Ft.)
  '     '    velocity=    0.784(Ft/s)
  '     '        area =      0.264(Sq.Ft)
  '     '        Froude number =     0.641

Upstream point elevation =  1458.800(Ft.)
Downstream point elevation =  1446.300(Ft.)
Flow length =   613.000(Ft.)
Travel time  =   13.03 min.
Time of concentration =   25.81 min.
Depth of flow =   0.093(Ft.)
Average velocity =   0.784(Ft/s)
Total irregular channel flow =     0.207(CFS)
Irregular channel normal depth above invert elev. =   0.093(Ft.)
Average velocity of channel(s) =   0.784(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      0.000(CFS)
```

```
therefore the upstream flow rate of Q =      0.178(CFS) is being used
Rainfall intensity =      0.861(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.000
Subarea runoff =      0.000(CFS) for    6.310(Ac.)
Total runoff =      0.178(CFS)
Effective area this stream =        6.91(Ac.)
Total Study Area (Main Stream No. 1) =        6.91(Ac.)
Area averaged Fm value =    0.983(In/Hr)
Depth of flow =   0.088(Ft.), Average velocity =   0.755(Ft/s)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      103.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.092(Ft.), Average velocity =   0.849(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1              0.00              1.00
        2             30.00              0.00
        3             60.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.218(CFS)
  '     '        flow top width =      5.548(Ft.)
  '     '    velocity=    0.849(Ft/s)
  '     '        area =      0.257(Sq.Ft)
  '     '        Froude number =     0.695

Upstream point elevation =  1446.300(Ft.)
Downstream point elevation =  1443.000(Ft.)
Flow length =   137.000(Ft.)
Travel time  =    2.69 min.
Time of concentration =   28.50 min.
Depth of flow =   0.092(Ft.)
Average velocity =   0.849(Ft/s)
Total irregular channel flow =     0.218(CFS)
Irregular channel normal depth above invert elev. =   0.092(Ft.)
Average velocity of channel(s) =   0.849(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
```

```
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      0.000(CFS)
therefore the upstream flow rate of Q =      0.178(CFS) is being used
Rainfall intensity =      0.811(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.000
Subarea runoff =      0.000(CFS) for    3.090(Ac.)
Total runoff =      0.178(CFS)
Effective area this stream =       10.00(Ac.)
Total Study Area (Main Stream No. 1) =       10.00(Ac.)
Area averaged Fm value =    0.983(In/Hr)
Depth of flow =   0.086(Ft.), Average velocity =   0.807(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
Initial subarea data:
Initial area flow distance =   170.000(Ft.)
Top (of initial area) elevation =  1466.100(Ft.)
Bottom (of initial area) elevation =  1462.000(Ft.)
Difference in elevation =     4.100(Ft.)
Slope =    0.02412  s(%)=       2.41
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.602 min.
Rainfall intensity =      1.391(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.264
Subarea runoff =      0.334(CFS)
Total initial stream area =        0.910(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.983(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      201.000 to Point/Station      202.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
```

```
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.004(Ft.), Average velocity =   2.154(Ft/s)
        ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
        1             0.00              1.00
        2            37.00              0.00
        3           101.00              0.00
        4           129.00              1.00
Manning's 'N' friction factor =   0.035
-----------------------------------------------------------------
Sub-Channel flow  =      0.531(CFS)
  '     '         flow top width =     64.250(Ft.)
  '     '     velocity=    2.156(Ft/s)
  '     '         area =      0.246(Sq.Ft)
  '     '         Froude number =     6.137

Upstream point elevation =  1462.000(Ft.)
Downstream point elevation =  1457.400(Ft.)
Flow length =     1.070(Ft.)
Travel time  =    0.01 min.
Time of concentration =   11.61 min.
Depth of flow =    0.004(Ft.)
Average velocity =   2.154(Ft/s)
Total irregular channel flow =     0.530(CFS)
Irregular channel normal depth above invert elev. =   0.004(Ft.)
Average velocity of channel(s) =   2.154(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 50.00
Adjusted SCS curve number for AMC 1 = 31.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.983(In/Hr)
Rainfall intensity =      1.390(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.264
Subarea runoff =      0.392(CFS) for    1.070(Ac.)
Total runoff =      0.726(CFS)
Effective area this stream =         1.98(Ac.)
Total Study Area (Main Stream No. 1) =       11.98(Ac.)
Area averaged Fm value =    0.983(In/Hr)
Depth of flow =   0.005(Ft.), Average velocity =   2.442(Ft/s)
End of computations, Total Study Area =           11.98 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
```

Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 50.0

```
                 San Bernardino County Rational Hydrology Program

                     (Hydrology Manual Date - August 1986)

 CIVILCADD/CIVILDESIGN  Engineering Software, (c) 1989-2018 Version 9.0
        Rational Hydrology Study       Date: 12/17/24
------------------------------------------------------------------------
PROPOSED CONDITIONS EAST HIGHLAND RANCH
PROPOSED 2 YEAR DESIGN STORM
RATIONAL METHOD
KIMLEY-HORN
------------------------------------------------------------------------


Program License Serial Number 6443

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------
Rational hydrology study storm event year is     2.0
Computed rainfall intensity:
Storm year =     2.00   1 hour rainfall =     0.510 (In.)
Slope used for rainfall intensity curve b =  0.6000
Soil antecedent moisture condition (AMC) = 2



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      105.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   208.000(Ft.)
Top (of initial area) elevation =  1463.300(Ft.)
Bottom (of initial area) elevation =  1455.000(Ft.)
Difference in elevation =     8.300(Ft.)
Slope =    0.03990  s(%)=       3.99
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.024 min.
Rainfall intensity =      2.025(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.726
```

```
Subarea runoff =      0.221(CFS)
Total initial stream area =        0.150(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      105.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.600(Ft.)
Downstream point/station elevation =  1449.300(Ft.)
Pipe length  =    16.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.221(CFS)
Nearest computed pipe diameter  =      6.00(In.)
Calculated individual pipe flow  =     0.221(CFS)
Normal flow depth in pipe =    2.20(In.)
Flow top width inside pipe =    5.78(In.)
Critical Depth =    2.83(In.)
Pipe flow velocity =      3.38(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =     6.10 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      0.150(Ac.)
Runoff from this stream =      0.221(CFS)
Time of concentration =    6.10 min.
Rainfall intensity =     2.010(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      102.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   365.000(Ft.)
Top (of initial area) elevation =  1461.700(Ft.)
Bottom (of initial area) elevation =  1458.900(Ft.)
Difference in elevation =     2.800(Ft.)
Slope =    0.00767  s(%)=       0.77
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.491 min.
Rainfall intensity =      1.452(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.658
Subarea runoff =      1.270(CFS)
Total initial stream area =        1.330(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      102.000 to Point/Station      120.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =  1453.400(Ft.)
Downstream point/station elevation =  1449.300(Ft.)
Pipe length  =   127.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.270(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.270(CFS)
Normal flow depth in pipe =    4.11(In.)
Flow top width inside pipe =    8.97(In.)
Critical Depth =    6.22(In.)
Pipe flow velocity =      6.46(Ft/s)
Travel time through pipe =    0.33 min.
Time of concentration (TC) =    10.82 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      120.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.330(Ac.)
Runoff from this stream =      1.270(CFS)
Time of concentration =   10.82 min.
Rainfall intensity =     1.425(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      0.22     0.150      6.10    0.391      2.010
2      1.27     1.330     10.82    0.391      1.425
Qmax(1) =
           1.000 *    1.000 *     0.221) +
           1.565 *    0.564 *     1.270) + =       1.342
Qmax(2) =
           0.639 *    1.000 *     0.221) +
           1.000 *    1.000 *     1.270) + =       1.411

Total of 2 streams to confluence:
Flow rates before confluence point:
       0.221       1.270
Maximum flow rates at confluence using above data:
        1.342       1.411
Area of streams before confluence:
        0.150       1.330
Effective area values after confluence:
        0.900       1.480
Results of confluence:
Total flow rate =      1.411(CFS)
Time of concentration =    10.818 min.
Effective stream area after confluence =      1.480(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =      1.48(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      120.000 to Point/Station      121.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.300(Ft.)
Downstream point/station elevation =  1449.100(Ft.)
Pipe length  =    26.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.411(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.411(CFS)
Normal flow depth in pipe =    7.16(In.)
Flow top width inside pipe =    7.26(In.)
Critical Depth =    6.57(In.)
Pipe flow velocity =      3.74(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    10.93 min.
```

```
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      121.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      1.480(Ac.)
Runoff from this stream =      1.411(CFS)
Time of concentration =   10.93 min.
Rainfall intensity =     1.416(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      103.000 to Point/Station      104.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   595.000(Ft.)
Top (of initial area) elevation =  1461.700(Ft.)
Bottom (of initial area) elevation =  1455.300(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01076  s(%)=       1.08
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.922 min.
Rainfall intensity =      1.345(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.638
Subarea runoff =      1.863(CFS)
Total initial stream area =        2.170(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)


+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      104.000 to Point/Station      121.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.800(Ft.)
Downstream point/station elevation =  1449.100(Ft.)
Pipe length  =    35.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     1.863(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.863(CFS)
Normal flow depth in pipe =    6.07(In.)
Flow top width inside pipe =    8.43(In.)
Critical Depth =    7.48(In.)
Pipe flow velocity =      5.88(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =    12.02 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      121.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      2.170(Ac.)
Runoff from this stream =      1.863(CFS)
Time of concentration =   12.02 min.
Rainfall intensity =     1.338(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm        Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      1.41     1.480     10.93    0.391      1.416
2      1.86     2.170     12.02    0.391      1.338
Qmax(1) =
           1.000 *    1.000 *     1.411) +
           1.083 *    0.910 *     1.863) + =       3.245
Qmax(2) =
           0.924 *    1.000 *     1.411) +
           1.000 *    1.000 *     1.863) + =       3.166

Total of 2 streams to confluence:
Flow rates before confluence point:
       1.411       1.863
Maximum flow rates at confluence using above data:
        3.245        3.166
Area of streams before confluence:
        1.480        2.170
Effective area values after confluence:
        3.454        3.650
Results of confluence:
Total flow rate =      3.245(CFS)
Time of concentration =    10.934 min.
```

```
Effective stream area after confluence =      3.454(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =      3.65(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      121.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1449.100(Ft.)
Downstream point/station elevation =  1445.800(Ft.)
Pipe length  =   343.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.245(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.245(CFS)
Normal flow depth in pipe =    9.14(In.)
Flow top width inside pipe =   10.22(In.)
Critical Depth =    9.25(In.)
Pipe flow velocity =      5.05(Ft/s)
Travel time through pipe =    1.13 min.
Time of concentration (TC) =    12.07 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      3.454(Ac.)
Runoff from this stream =      3.245(CFS)
Time of concentration =   12.07 min.
Rainfall intensity =     1.335(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      106.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   432.000(Ft.)
Top (of initial area) elevation =  1455.700(Ft.)
Bottom (of initial area) elevation =  1449.300(Ft.)
Difference in elevation =     6.400(Ft.)
Slope =    0.01481  s(%)=       1.48
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.838 min.
Rainfall intensity =      1.509(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.667
Subarea runoff =      1.227(CFS)
Total initial stream area =        1.220(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      106.000 to Point/Station      122.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1446.000(Ft.)
Downstream point/station elevation =  1445.800(Ft.)
Pipe length  =    12.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     1.227(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     1.227(CFS)
Normal flow depth in pipe =    4.89(In.)
Flow top width inside pipe =    8.97(In.)
Critical Depth =    6.12(In.)
Pipe flow velocity =      5.00(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =     9.88 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      122.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      1.220(Ac.)
Runoff from this stream =      1.227(CFS)
Time of concentration =    9.88 min.
Rainfall intensity =     1.505(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:
```

```
Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      3.25     3.454     12.07    0.391      1.335
2      1.23     1.220      9.88    0.391      1.505
Qmax(1) =
           1.000 *    1.000 *     3.245) +
           0.847 *    1.000 *     1.227) + =       4.285
Qmax(2) =
           1.180 *    0.819 *     3.245) +
           1.000 *    1.000 *     1.227) + =       4.363

Total of 2 streams to confluence:
Flow rates before confluence point:
       3.245       1.227
Maximum flow rates at confluence using above data:
        4.285        4.363
Area of streams before confluence:
        3.454        1.220
Effective area values after confluence:
        4.674        4.048
Results of confluence:
Total flow rate =      4.363(CFS)
Time of concentration =     9.878 min.
Effective stream area after confluence =      4.048(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =       4.67(Ac.)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      122.000 to Point/Station      123.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.800(Ft.)
Downstream point/station elevation =  1445.200(Ft.)
Pipe length  =   115.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     4.363(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     4.363(CFS)
Normal flow depth in pipe =   11.51(In.)
Flow top width inside pipe =   12.68(In.)
Critical Depth =   10.16(In.)
Pipe flow velocity =      4.32(Ft/s)
Travel time through pipe =    0.44 min.
Time of concentration (TC) =    10.32 min.
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      123.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.048(Ac.)
Runoff from this stream =      4.363(CFS)
Time of concentration =   10.32 min.
Rainfall intensity =     1.466(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      112.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   164.000(Ft.)
Top (of initial area) elevation =  1449.100(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =     1.200(Ft.)
Slope =    0.00732  s(%)=       0.73
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    7.690 min.
Rainfall intensity =      1.749(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.699
Subarea runoff =      0.929(CFS)
Total initial stream area =        0.760(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      112.000 to Point/Station      123.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.400(Ft.)
Downstream point/station elevation =  1445.200(Ft.)
Pipe length  =    13.00(Ft.)   Manning's N = 0.013
```

```
No. of pipes = 1  Required pipe flow  =     0.929(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.929(CFS)
Normal flow depth in pipe =    4.25(In.)
Flow top width inside pipe =    8.99(In.)
Critical Depth =    5.29(In.)
Pipe flow velocity =      4.53(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =     7.74 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      123.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.760(Ac.)
Runoff from this stream =      0.929(CFS)
Time of concentration =    7.74 min.
Rainfall intensity =     1.743(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      4.36     4.048     10.32    0.391      1.466
2      0.93     0.760      7.74    0.391      1.743
Qmax(1) =
           1.000 *    1.000 *     4.363) +
           0.795 *    1.000 *     0.929) + =       5.102
Qmax(2) =
           1.257 *    0.750 *     4.363) +
           1.000 *    1.000 *     0.929) + =       5.042

Total of 2 streams to confluence:
Flow rates before confluence point:
       4.363       0.929
Maximum flow rates at confluence using above data:
        5.102        5.042
Area of streams before confluence:
        4.048        0.760
Effective area values after confluence:
        4.808        3.794
Results of confluence:
Total flow rate =      5.102(CFS)
Time of concentration =    10.322 min.
```

```
Effective stream area after confluence =      4.808(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =      4.81(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      123.000 to Point/Station      124.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.200(Ft.)
Downstream point/station elevation =  1445.000(Ft.)
Pipe length  =    19.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.102(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     5.102(CFS)
Normal flow depth in pipe =    9.87(In.)
Flow top width inside pipe =   14.23(In.)
Critical Depth =   10.99(In.)
Pipe flow velocity =      5.96(Ft/s)
Travel time through pipe =    0.05 min.
Time of concentration (TC) =    10.38 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      124.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      4.808(Ac.)
Runoff from this stream =      5.102(CFS)
Time of concentration =   10.38 min.
Rainfall intensity =     1.462(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      108.000 to Point/Station      107.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
```

```
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   364.000(Ft.)
Top (of initial area) elevation =  1455.700(Ft.)
Bottom (of initial area) elevation =  1448.500(Ft.)
Difference in elevation =     7.200(Ft.)
Slope =    0.01978  s(%)=       1.98
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.671 min.
Rainfall intensity =      1.628(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.684
Subarea runoff =      0.868(CFS)
Total initial stream area =        0.780(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      107.000 to Point/Station      124.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.700(Ft.)
Downstream point/station elevation =  1445.000(Ft.)
Pipe length  =    31.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.868(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.868(CFS)
Normal flow depth in pipe =    3.67(In.)
Flow top width inside pipe =    8.85(In.)
Critical Depth =    5.11(In.)
Pipe flow velocity =      5.13(Ft/s)
Travel time through pipe =    0.10 min.
Time of concentration (TC) =     8.77 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      124.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.780(Ac.)
Runoff from this stream =      0.868(CFS)
Time of concentration =    8.77 min.
Rainfall intensity =     1.617(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:
```

```
Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)


1      5.10     4.808     10.38    0.391      1.462
2      0.87     0.780      8.77    0.391      1.617
Qmax(1) =
           1.000 *    1.000 *     5.102) +
           0.874 *    1.000 *     0.868) + =       5.861
Qmax(2) =
           1.145 *    0.845 *     5.102) +
           1.000 *    1.000 *     0.868) + =       5.806

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.102       0.868
Maximum flow rates at confluence using above data:
        5.861        5.806
Area of streams before confluence:
        4.808        0.780
Effective area values after confluence:
        5.588        4.845
Results of confluence:
Total flow rate =      5.861(CFS)
Time of concentration =    10.375 min.
Effective stream area after confluence =      5.588(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =       5.59(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      124.000 to Point/Station      111.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1445.000(Ft.)
Downstream point/station elevation =  1443.300(Ft.)
Pipe length  =   346.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     5.861(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     5.861(CFS)
Normal flow depth in pipe =   12.14(In.)
Flow top width inside pipe =   16.87(In.)
Critical Depth =   11.21(In.)
Pipe flow velocity =      4.63(Ft/s)
Travel time through pipe =    1.25 min.
Time of concentration (TC) =    11.62 min.
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      5.588(Ac.)
Runoff from this stream =      5.861(CFS)
Time of concentration =   11.62 min.
Rainfall intensity =     1.366(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      110.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   224.000(Ft.)
Top (of initial area) elevation =  1449.100(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =     1.200(Ft.)
Slope =    0.00536  s(%)=       0.54
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.272 min.
Rainfall intensity =      1.564(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.675
Subarea runoff =      0.549(CFS)
Total initial stream area =        0.520(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.520(Ac.)
Runoff from this stream =      0.549(CFS)
```

```
Time of concentration =    9.27 min.
Rainfall intensity =     1.564(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      109.000 to Point/Station      111.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   535.000(Ft.)
Top (of initial area) elevation =  1458.200(Ft.)
Bottom (of initial area) elevation =  1447.900(Ft.)
Difference in elevation =    10.300(Ft.)
Slope =    0.01925  s(%)=       1.93
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.170 min.
Rainfall intensity =      1.479(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.662
Subarea runoff =      2.018(CFS)
Total initial stream area =        2.060(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      111.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 3
Stream flow area =      2.060(Ac.)
Runoff from this stream =      2.018(CFS)
Time of concentration =   10.17 min.
Rainfall intensity =     1.479(In/Hr)
Area averaged loss rate (Fm) =    0.3911(In/Hr)
Area averaged Pervious ratio (Ap) = 0.4000
Summary of stream data:

Stream Flow rate    Area    TC      Fm       Rainfall Intensity
 No.    (CFS)   (Ac.)       (min) (In/Hr)     (In/Hr)
```

```
1      5.86     5.588     11.62    0.391      1.366
2      0.55     0.520      9.27    0.391      1.564
3      2.02     2.060     10.17    0.391      1.479
Qmax(1) =
           1.000 *    1.000 *     5.861) +
           0.831 *    1.000 *     0.549) +
           0.895 *    1.000 *     2.018) + =      8.123
Qmax(2) =
           1.203 *    0.798 *     5.861) +
           1.000 *    1.000 *     0.549) +
           1.078 *    0.912 *     2.018) + =      8.158
Qmax(3) =
           1.117 *    0.875 *     5.861) +
           0.928 *    1.000 *     0.549) +
           1.000 *    1.000 *     2.018) + =      8.255

Total of 3 streams to confluence:
Flow rates before confluence point:
       5.861      0.549      2.018
Maximum flow rates at confluence using above data:
        8.123        8.158        8.255
Area of streams before confluence:
        5.588        0.520        2.060
Effective area values after confluence:
        8.168        6.856        7.470
Results of confluence:
Total flow rate =      8.255(CFS)
Time of concentration =    10.170 min.
Effective stream area after confluence =      7.470(Ac.)
Study area average Pervious fraction(Ap) =  0.400
Study area average soil loss rate(Fm) =    0.391(In/Hr)
Study area total (this main stream) =      8.17(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      111.000 to Point/Station      125.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1443.300(Ft.)
Downstream point/station elevation =  1443.200(Ft.)
Pipe length  =    14.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     8.255(CFS)
Nearest computed pipe diameter  =     18.00(In.)
Calculated individual pipe flow  =     8.255(CFS)
Normal flow depth in pipe =   13.73(In.)
Flow top width inside pipe =   15.31(In.)
Critical Depth =   13.35(In.)
```

```
Pipe flow velocity =      5.71(Ft/s)
Travel time through pipe =    0.04 min.
Time of concentration (TC) =    10.21 min.



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      125.000 to Point/Station      125.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      7.760(CFS)
therefore the upstream flow rate of Q =      8.255(CFS) is being used
Time of concentration =    10.21 min.
Rainfall intensity =      1.476(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.661
Subarea runoff =      0.000(CFS) for    0.480(Ac.)
Total runoff =       8.255(CFS)
Effective area this stream =        7.95(Ac.)
Total Study Area (Main Stream No. 1) =          9.47(Ac.)
Area averaged Fm value =    0.391(In/Hr)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Initial subarea data:
Initial area flow distance =   232.000(Ft.)
Top (of initial area) elevation =  1462.800(Ft.)
Bottom (of initial area) elevation =  1460.100(Ft.)
Difference in elevation =     2.700(Ft.)
Slope =    0.01164  s(%)=       1.16
TC = k(0.374)*[(length^3)/(elevation change)]^0.2
```

```
Initial area time of concentration =    8.052 min.
Rainfall intensity =      1.702(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.693
Subarea runoff =      1.298(CFS)
Total initial stream area =        1.100(Ac.)
Pervious area fraction = 0.400
Initial area Fm value =    0.391(In/Hr)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      301.000 to Point/Station      302.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1460.100(Ft.)
Downstream point elevation =  1458.000(Ft.)
Channel length thru subarea  =   182.000(Ft.)
Channel base width      =   14.750(Ft.)
Slope or 'Z' of left channel bank =   3.270
Slope or 'Z' of right channel bank =  21.470
Estimated mean flow rate at midpoint of channel =      1.548(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    0.330(Ft.)
Flow(q) thru subarea =      1.548(CFS)
Depth of flow =   0.062(Ft.), Average velocity =   1.612(Ft/s)
Channel flow top width =   16.281(Ft.)
Flow Velocity =    1.61(Ft/s)
Travel time  =    1.88 min.
Time of concentration =    9.93 min.
Critical depth =      0.068(Ft.)
 Adding area flow to channel
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Rainfall intensity =      1.500(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.665
Subarea runoff =      0.419(CFS) for    0.620(Ac.)
Total runoff =      1.717(CFS)
Effective area this stream =        1.72(Ac.)
Total Study Area (Main Stream No. 1) =       11.19(Ac.)
Area averaged Fm value =    0.391(In/Hr)
Depth of flow =   0.066(Ft.), Average velocity =   1.676(Ft/s)
Critical depth =      0.073(Ft.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      302.000 to Point/Station      303.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

______________________________________________________________________
Upstream point/station elevation =  1454.400(Ft.)
Downstream point/station elevation =  1454.000(Ft.)
Pipe length  =    32.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     1.717(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     1.717(CFS)
Normal flow depth in pipe =    5.98(In.)
Flow top width inside pipe =   12.00(In.)
Critical Depth =    6.68(In.)
Pipe flow velocity =      4.39(Ft/s)
Travel time through pipe =    0.12 min.
Time of concentration (TC) =    10.06 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      303.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****

______________________________________________________________________
RESIDENTIAL(8 - 10 dwl/acre)
Decimal fraction soil group A = 1.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 32.00
Pervious ratio(Ap) = 0.4000     Max loss rate(Fm)=     0.391(In/Hr)
Time of concentration =    10.06 min.
Rainfall intensity =      1.489(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.664
Subarea runoff =      0.112(CFS) for    0.130(Ac.)
Total runoff =      1.829(CFS)
Effective area this stream =        1.85(Ac.)
Total Study Area (Main Stream No. 1) =       11.32(Ac.)
Area averaged Fm value =    0.391(In/Hr)
End of computations, Total Study Area =           11.32 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.400
Area averaged SCS curve number =  32.0
```

U n i t   H y d r o g r a p h   A n a l y s i s

Study date 12/13/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

UNIT HYDROGRAPH EAST HIGHLAND
PROPOSED CONDITION - BASIN 1
100-YR 24-HR STORM
KIMLEY-HORN

Storm Event Year = 100

Antecedent Moisture Condition = 3

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
9.47	1	0.83
Rainfall data for year 2		
9.47	6	1.24
Rainfall data for year 2		
9.47	24	2.31
Rainfall data for year 100		

```
              9.47            1            1.39
--------------------------------------------------------------------
Rainfall data for year 100
              9.47            6            2.90
--------------------------------------------------------------------
Rainfall data for year 100
              9.47           24            5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area      Area      Fp(Fig C6)    Ap       Fm
No.(AMCII) NO.(AMC 3)    (Ac.)     Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          9.47       1.000     0.785    0.400    0.314

Area-averaged adjusted loss rate Fm (In/Hr) =  0.314

********* Area-Averaged low loss rate fraction, Yb **********

Area        Area          SCS CN    SCS CN      S      Pervious
 (Ac.)       Fract         (AMC2)    (AMC3)            Yield Fr
     3.79   0.400          32.0      52.0       9.23     0.186
     5.68   0.600          98.0      98.0       0.20     0.957

Area-averaged catchment yield fraction, Y =  0.648
Area-averaged low loss fraction, Yb =  0.352
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       9.47(Ac.)
Catchment Lag time =   0.173 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 144.6759
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.314(In/Hr)
Average low loss rate fraction (Yb) = 0.352 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.514(In)
Computed peak 30-minute rainfall =  1.053(In)
Specified peak 1-hour rainfall =  1.390(In)
Computed peak 3-hour rainfall =  2.182(In)
Specified peak 6-hour rainfall =  2.900(In)
Specified peak 24-hour rainfall =  5.460(In)


Rainfall depth area reduction factors:
Using a total area of       9.47(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.514(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.053(In)
1-hour factor = 1.000       Adjusted rainfall =  1.389(In)
3-hour factor = 1.000       Adjusted rainfall =  2.182(In)
6-hour factor = 1.000       Adjusted rainfall =  2.900(In)
24-hour factor = 1.000      Adjusted rainfall =  5.460(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval           'S' Graph          Unit Hydrograph
Number             Mean values            ((CFS))
---------------------------------------------------------------------
                (K =        38.18 (CFS))

  1                 32.670                  12.472
  2                 94.430                  23.578
  3                100.000                   2.126
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =       1.71(In)
Total effective rainfall =       3.75(In)
Peak flow rate in flood hydrograph =      15.90(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft    Q(CFS)  0        5.0       10.0       15.0       20.0
-----------------------------------------------------------------------
  0+15       0.0044      0.21  Q         |         |         |         |
  0+30       0.0170      0.61  VQ        |         |         |         |
  0+45       0.0304      0.65  VQ        |         |         |         |
  1+ 0       0.0440      0.66  VQ        |         |         |         |
  1+15       0.0577      0.66  VQ        |         |         |         |
  1+30       0.0716      0.67  VQ        |         |         |         |
  1+45       0.0855      0.68  |Q        |         |         |         |
  2+ 0       0.0996      0.68  |Q        |         |         |         |
  2+15       0.1139      0.69  |Q        |         |         |         |
  2+30       0.1282      0.70  |Q        |         |         |         |
  2+45       0.1427      0.70  |Q        |         |         |         |
  3+ 0       0.1574      0.71  |QV       |         |         |         |
  3+15       0.1722      0.72  |QV       |         |         |         |
  3+30       0.1872      0.72  |QV       |         |         |         |
  3+45       0.2023      0.73  |QV       |         |         |         |
  4+ 0       0.2176      0.74  |QV       |         |         |         |
  4+15       0.2331      0.75  |Q V      |         |         |         |
```

```
 4+30      0.2487      0.76  |Q V      |         |         |         |
 4+45      0.2645      0.77  |Q V      |         |         |         |
 5+ 0      0.2805      0.78  |Q V      |         |         |         |
 5+15      0.2967      0.78  |Q  V     |         |         |         |
 5+30      0.3132      0.79  |Q  V     |         |         |         |
 5+45      0.3298      0.80  |Q  V     |         |         |         |
 6+ 0      0.3466      0.82  |Q  V     |         |         |         |
 6+15      0.3637      0.83  |Q  V     |         |         |         |
 6+30      0.3810      0.84  |Q   V    |         |         |         |
 6+45      0.3985      0.85  |Q   V    |         |         |         |
 7+ 0      0.4163      0.86  |Q   V    |         |         |         |
 7+15      0.4344      0.87  |Q   V    |         |         |         |
 7+30      0.4527      0.89  |Q    V   |         |         |         |
 7+45      0.4713      0.90  |Q    V   |         |         |         |
 8+ 0      0.4903      0.92  |Q    V   |         |         |         |
 8+15      0.5095      0.93  |Q    V   |         |         |         |
 8+30      0.5291      0.95  |Q     V  |         |         |         |
 8+45      0.5490      0.96  |Q     V  |         |         |         |
 9+ 0      0.5693      0.98  |Q     V  |         |         |         |
 9+15      0.5900      1.00  | Q    V  |         |         |         |
 9+30      0.6111      1.02  | Q     V |         |         |         |
 9+45      0.6326      1.04  | Q     V |         |         |         |
10+ 0      0.6545      1.06  | Q     V |         |         |         |
10+15      0.6770      1.09  | Q      V|         |         |         |
10+30      0.7000      1.11  | Q      V|         |         |         |
10+45      0.7235      1.14  | Q      V|         |         |         |
11+ 0      0.7476      1.17  | Q       V         |         |         |
11+15      0.7724      1.20  | Q       V         |         |         |
11+30      0.7979      1.23  | Q       V         |         |         |
11+45      0.8241      1.27  | Q        V        |         |         |
12+ 0      0.8511      1.31  | Q       |V        |         |         |
12+15      0.8781      1.31  | Q       |V        |         |         |
12+30      0.9042      1.27  | Q       | V       |         |         |
12+45      0.9313      1.31  | Q       | V       |         |         |
13+ 0      0.9596      1.37  | Q       | V       |         |         |
13+15      0.9892      1.43  | Q       |  V      |         |         |
13+30      1.0203      1.51  |  Q      |  V      |         |         |
13+45      1.0532      1.59  |  Q      |   V     |         |         |
14+ 0      1.0881      1.69  |  Q      |   V     |         |         |
14+15      1.1254      1.81  |  Q      |    V    |         |         |
14+30      1.1658      1.95  |  Q      |    V    |         |         |
14+45      1.2098      2.13  |   Q     |     V   |         |         |
15+ 0      1.2586      2.36  |   Q     |      V  |         |         |
15+15      1.3139      2.68  |    Q    |      V  |         |         |
15+30      1.3785      3.13  |     Q   |       V |         |         |
15+45      1.4589      3.89  |      Q  |        V|         |         |
16+ 0      1.5982      6.74  |         |  Q       V        |         |
16+15      1.8990     14.56  |         |         |    V   Q|         |
16+30      2.2275     15.90  |         |         |         VQ        |
16+45      2.3153      4.25  |       Q |         |          V        |
```

```
   17+ 0       2.3653      2.42  |   Q     |         |         |V        |
   17+15       2.4061      1.98  |  Q      |         |         | V       |
   17+30       2.4413      1.70  |  Q      |         |         |  V      |
   17+45       2.4726      1.51  |  Q      |         |         |  V      |
   18+ 0       2.5009      1.37  | Q       |         |         |  V      |
   18+15       2.5280      1.31  | Q       |         |         |   V     |
   18+30       2.5549      1.30  | Q       |         |         |   V     |
   18+45       2.5804      1.23  | Q       |         |         |   V     |
   19+ 0       2.6045      1.17  | Q       |         |         |    V    |
   19+15       2.6276      1.11  | Q       |         |         |    V    |
   19+30       2.6496      1.06  | Q       |         |         |    V    |
   19+45       2.6707      1.02  | Q       |         |         |     V   |
   20+ 0       2.6910      0.98  |Q        |         |         |     V   |
   20+15       2.7106      0.95  |Q        |         |         |     V   |
   20+30       2.7295      0.92  |Q        |         |         |     V   |
   20+45       2.7478      0.89  |Q        |         |         |      V  |
   21+ 0       2.7657      0.86  |Q        |         |         |      V  |
   21+15       2.7830      0.84  |Q        |         |         |      V  |
   21+30       2.7998      0.82  |Q        |         |         |      V  |
   21+45       2.8162      0.79  |Q        |         |         |       V |
   22+ 0       2.8323      0.78  |Q        |         |         |       V |
   22+15       2.8479      0.76  |Q        |         |         |       V |
   22+30       2.8632      0.74  |Q        |         |         |       V |
   22+45       2.8782      0.72  |Q        |         |         |       V |
   23+ 0       2.8928      0.71  |Q        |         |         |        V|
   23+15       2.9072      0.70  |Q        |         |         |        V|
   23+30       2.9213      0.68  |Q        |         |         |        V|
   23+45       2.9352      0.67  |Q        |         |         |        V|
   24+ 0       2.9487      0.66  |Q        |         |         |        V|
-----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

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                Study date  12/17/24

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986


Program License Serial Number 6443

---------------------------------------------------------------------
UNIT HYDROGRAPH EAST HIGHLAND
PROPOSED CONDITION - BASIN 2
100-YR 24-HR STORM
KIMLEY-HORN
--------------------------------------------------------------------

        Storm Event Year = 100

        Antecedent Moisture Condition = 3

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
             1.85            1           0.83
--------------------------------------------------------------------
Rainfall data for year 2
             1.85            6           1.24
--------------------------------------------------------------------
Rainfall data for year 2
             1.85           24           2.31
--------------------------------------------------------------------
Rainfall data for year 100
```

```
             1.85            1            1.39
--------------------------------------------------------------------
Rainfall data for year 100
             1.85            6            2.90
--------------------------------------------------------------------
Rainfall data for year 100
             1.85           24            5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 3)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      52.0          1.85      1.000     0.785    0.580    0.455

Area-averaged adjusted loss rate Fm (In/Hr) =  0.455

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC3)           Yield Fr
     1.07   0.580         32.0      52.0       9.23     0.186
     0.78   0.420         98.0      98.0       0.20     0.957

Area-averaged catchment yield fraction, Y =  0.510
Area-averaged low loss fraction, Yb =  0.490
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.85(Ac.)
Catchment Lag time =   0.125 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 200.8032
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.455(In/Hr)
Average low loss rate fraction (Yb) = 0.490 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.514(In)
Computed peak 30-minute rainfall =  1.053(In)
Specified peak 1-hour rainfall =  1.390(In)
Computed peak 3-hour rainfall =  2.182(In)
Specified peak 6-hour rainfall =  2.900(In)
Specified peak 24-hour rainfall =  5.460(In)


Rainfall depth area reduction factors:
Using a total area of       1.85(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.514(In)
```

```
30-minute factor = 1.000    Adjusted rainfall =  1.053(In)
1-hour factor = 1.000       Adjusted rainfall =  1.390(In)
3-hour factor = 1.000       Adjusted rainfall =  2.182(In)
6-hour factor = 1.000       Adjusted rainfall =  2.900(In)
24-hour factor = 1.000      Adjusted rainfall =  5.460(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval           'S' Graph          Unit Hydrograph
Number             Mean values             ((CFS))
---------------------------------------------------------------------
                (K =         7.46 (CFS))

  1                 48.463                   3.614
  2                100.000                   1.807
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      2.39(In)
Total effective rainfall =      3.07(In)
Peak flow rate in flood hydrograph =      2.50(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+15       0.0010      0.05   Q         |         |         |         |
  0+30       0.0025      0.07   Q         |         |         |         |
  0+45       0.0040      0.07   Q         |         |         |         |
  1+ 0       0.0055      0.07   Q         |         |         |         |
  1+15       0.0071      0.07   Q         |         |         |         |
  1+30       0.0086      0.08   QV        |         |         |         |
  1+45       0.0102      0.08   QV        |         |         |         |
  2+ 0       0.0117      0.08   QV        |         |         |         |
  2+15       0.0133      0.08   QV        |         |         |         |
  2+30       0.0150      0.08   QV        |         |         |         |
  2+45       0.0166      0.08   QV        |         |         |         |
  3+ 0       0.0182      0.08   Q V       |         |         |         |
  3+15       0.0199      0.08   Q V       |         |         |         |
  3+30       0.0216      0.08   Q V       |         |         |         |
  3+45       0.0233      0.08   Q V       |         |         |         |
  4+ 0       0.0250      0.08   Q V       |         |         |         |
  4+15       0.0267      0.08   Q  V      |         |         |         |
  4+30       0.0285      0.08   Q  V      |         |         |         |
```

```
 4+45       0.0302      0.09  Q  V      |         |         |         |
 5+ 0       0.0320      0.09  Q  V      |         |         |         |
 5+15       0.0339      0.09  Q  V      |         |         |         |
 5+30       0.0357      0.09  Q   V     |         |         |         |
 5+45       0.0376      0.09  Q   V     |         |         |         |
 6+ 0       0.0394      0.09  Q   V     |         |         |         |
 6+15       0.0414      0.09  Q   V     |         |         |         |
 6+30       0.0433      0.09  Q    V    |         |         |         |
 6+45       0.0453      0.10  Q    V    |         |         |         |
 7+ 0       0.0473      0.10  Q    V    |         |         |         |
 7+15       0.0493      0.10  Q    V    |         |         |         |
 7+30       0.0514      0.10  Q    V    |         |         |         |
 7+45       0.0535      0.10  Q     V   |         |         |         |
 8+ 0       0.0556      0.10  Q     V   |         |         |         |
 8+15       0.0577      0.10  Q     V   |         |         |         |
 8+30       0.0599      0.11  Q     V   |         |         |         |
 8+45       0.0622      0.11  Q      V  |         |         |         |
 9+ 0       0.0645      0.11  Q      V  |         |         |         |
 9+15       0.0668      0.11  Q      V  |         |         |         |
 9+30       0.0692      0.11  Q       V |         |         |         |
 9+45       0.0716      0.12  Q       V |         |         |         |
10+ 0       0.0741      0.12  Q       V |         |         |         |
10+15       0.0766      0.12  Q       V |         |         |         |
10+30       0.0792      0.13  Q        V|         |         |         |
10+45       0.0818      0.13  Q        V|         |         |         |
11+ 0       0.0846      0.13  Q        V|         |         |         |
11+15       0.0873      0.14  Q         V         |         |         |
11+30       0.0902      0.14  Q         V         |         |         |
11+45       0.0932      0.14  Q         V         |         |         |
12+ 0       0.0962      0.15  Q          V        |         |         |
12+15       0.0992      0.14  Q         |V        |         |         |
12+30       0.1021      0.14  Q         |V        |         |         |
12+45       0.1052      0.15  Q         | V       |         |         |
13+ 0       0.1084      0.16  Q         | V       |         |         |
13+15       0.1118      0.16  Q         |  V      |         |         |
13+30       0.1153      0.17  Q         |  V      |         |         |
13+45       0.1191      0.18  Q         |  V      |         |         |
14+ 0       0.1231      0.19  Q         |   V     |         |         |
14+15       0.1274      0.21  Q         |   V     |         |         |
14+30       0.1320      0.22  Q         |    V    |         |         |
14+45       0.1371      0.25  Q         |    V    |         |         |
15+ 0       0.1428      0.28  |Q        |     V   |         |         |
15+15       0.1493      0.32  |Q        |      V  |         |         |
15+30       0.1570      0.37  |Q        |       V |         |         |
15+45       0.1671      0.49  |Q        |        V|         |         |
16+ 0       0.1897      1.09  |   Q     |           V       |         |
16+15       0.2413      2.50  |         Q         |       V |         |
16+30       0.2678      1.28  |    Q    |         |          V        |
16+45       0.2743      0.32  |Q        |         |         |V        |
17+ 0       0.2794      0.25  Q         |         |         | V       |
```

```
   17+15        0.2837      0.21  Q         |         |         |  V       |
   17+30        0.2874      0.18  Q         |         |         |  V       |
   17+45        0.2907      0.16  Q         |         |         |  V       |
   18+ 0        0.2938      0.15  Q         |         |         |   V      |
   18+15        0.2968      0.15  Q         |         |         |   V      |
   18+30        0.2998      0.14  Q         |         |         |   V      |
   18+45        0.3026      0.13  Q         |         |         |    V     |
   19+ 0        0.3052      0.13  Q         |         |         |    V     |
   19+15        0.3077      0.12  Q         |         |         |    V     |
   19+30        0.3102      0.12  Q         |         |         |     V    |
   19+45        0.3125      0.11  Q         |         |         |     V    |
   20+ 0        0.3147      0.11  Q         |         |         |     V    |
   20+15        0.3169      0.10  Q         |         |         |     V    |
   20+30        0.3190      0.10  Q         |         |         |      V   |
   20+45        0.3210      0.10  Q         |         |         |      V   |
   21+ 0        0.3229      0.10  Q         |         |         |      V   |
   21+15        0.3249      0.09  Q         |         |         |      V   |
   21+30        0.3267      0.09  Q         |         |         |       V  |
   21+45        0.3285      0.09  Q         |         |         |       V  |
   22+ 0        0.3303      0.09  Q         |         |         |       V  |
   22+15        0.3320      0.08  Q         |         |         |       V  |
   22+30        0.3337      0.08  Q         |         |         |       V  |
   22+45        0.3354      0.08  Q         |         |         |        V|
   23+ 0        0.3370      0.08  Q         |         |         |        V|
   23+15        0.3386      0.08  Q         |         |         |        V|
   23+30        0.3402      0.08  Q         |         |         |        V|
   23+45        0.3417      0.07  Q         |         |         |        V|
   24+ 0        0.3432      0.07  Q         |         |         |        V|
----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

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                Study date  12/17/24

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986


Program License Serial Number 6443

---------------------------------------------------------------------
UINT HYDROGRAPH EAST HIGHLAND RANCH
PROPOSED CONDITION - BASIN 1
2-YR 24-HR STORM
KIMLEY-HORN
--------------------------------------------------------------------

        Storm Event Year = 2

        Antecedent Moisture Condition = 1

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format



Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
             9.47            1           0.83
--------------------------------------------------------------------
Rainfall data for year 2
             9.47            6           1.24
--------------------------------------------------------------------
Rainfall data for year 2
             9.47           24           2.31
--------------------------------------------------------------------
Rainfall data for year 100
```

```
             9.47            1           1.39
--------------------------------------------------------------------
Rainfall data for year 100
             9.47            6           2.90
--------------------------------------------------------------------
Rainfall data for year 100
             9.47           24           5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 1)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      16.6          9.47      1.000     1.000    0.400    0.400

Area-averaged adjusted loss rate Fm (In/Hr) =  0.400

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract          (AMC2)    (AMC1)          Yield Fr
     3.79   0.400          32.0      16.6      11.55     0.000
     5.68   0.600          98.0      98.0       0.20     0.901

Area-averaged catchment yield fraction, Y =  0.541
Area-averaged low loss fraction, Yb =  0.459
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       9.47(Ac.)
Catchment Lag time =   0.136 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 61.2160
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.400(In/Hr)
Average low loss rate fraction (Yb) = 0.459 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.160(In)
Computed peak 30-minute rainfall =  0.329(In)
Specified peak 1-hour rainfall =  0.433(In)
Computed peak 3-hour rainfall =  0.826(In)
Specified peak 6-hour rainfall =  1.240(In)
Specified peak 24-hour rainfall =  2.310(In)


Rainfall depth area reduction factors:
Using a total area of       9.47(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.160(In)
```

30-minute factor = 1.000   Adjusted rainfall = 0.328(In)
1-hour factor = 1.000   Adjusted rainfall = 0.433(In)
3-hour factor = 1.000   Adjusted rainfall = 0.826(In)
6-hour factor = 1.000   Adjusted rainfall = 1.240(In)
24-hour factor = 1.000   Adjusted rainfall = 2.310(In)

U n i t   H y d r o g r a p h

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 114.53 (CFS))	
1	6.777	7.761
2	43.138	41.644
3	82.840	45.469
4	95.967	15.035
5	98.759	3.197
6	100.000	1.422

Total soil rain loss =   1.02(In)
Total effective rainfall =   1.29(In)
Peak flow rate in flood hydrograph =   7.05(CFS)

---

24 - H O U R   S T O R M
R u n o f f   H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0001	0.02	Q	|	|	|	|
0+10	0.0008	0.10	Q	|	|	|	|
0+15	0.0020	0.19	Q	|	|	|	|
0+20	0.0035	0.21	Q	|	|	|	|
0+25	0.0050	0.22	Q	|	|	|	|
0+30	0.0066	0.23	Q	|	|	|	|
0+35	0.0082	0.23	Q	|	|	|	|
0+40	0.0097	0.23	Q	|	|	|	|
0+45	0.0113	0.23	Q	|	|	|	|
0+50	0.0128	0.23	Q	|	|	|	|
0+55	0.0144	0.23	Q	|	|	|	|
1+ 0	0.0160	0.23	Q	|	|	|	|
1+ 5	0.0176	0.23	Q	|	|	|	|
1+10	0.0192	0.23	Q	|	|	|	|

```
1+15       0.0208      0.23  Q          |         |         |         |
1+20       0.0224      0.23  Q          |         |         |         |
1+25       0.0240      0.23  Q          |         |         |         |
1+30       0.0256      0.23  QV         |         |         |         |
1+35       0.0272      0.23  QV         |         |         |         |
1+40       0.0288      0.23  QV         |         |         |         |
1+45       0.0304      0.24  QV         |         |         |         |
1+50       0.0321      0.24  QV         |         |         |         |
1+55       0.0337      0.24  QV         |         |         |         |
2+ 0       0.0353      0.24  QV         |         |         |         |
2+ 5       0.0370      0.24  QV         |         |         |         |
2+10       0.0386      0.24  QV         |         |         |         |
2+15       0.0403      0.24  QV         |         |         |         |
2+20       0.0419      0.24  QV         |         |         |         |
2+25       0.0436      0.24  QV         |         |         |         |
2+30       0.0453      0.24  QV         |         |         |         |
2+35       0.0470      0.24  QV         |         |         |         |
2+40       0.0486      0.24  QV         |         |         |         |
2+45       0.0503      0.25  QV         |         |         |         |
2+50       0.0520      0.25  Q V        |         |         |         |
2+55       0.0537      0.25  Q V        |         |         |         |
3+ 0       0.0554      0.25  Q V        |         |         |         |
3+ 5       0.0571      0.25  Q V        |         |         |         |
3+10       0.0589      0.25  Q V        |         |         |         |
3+15       0.0606      0.25  |QV        |         |         |         |
3+20       0.0623      0.25  |QV        |         |         |         |
3+25       0.0640      0.25  |QV        |         |         |         |
3+30       0.0658      0.25  |QV        |         |         |         |
3+35       0.0675      0.25  |QV        |         |         |         |
3+40       0.0693      0.25  |QV        |         |         |         |
3+45       0.0711      0.26  |QV        |         |         |         |
3+50       0.0728      0.26  |QV        |         |         |         |
3+55       0.0746      0.26  |QV        |         |         |         |
4+ 0       0.0764      0.26  |Q V       |         |         |         |
4+ 5       0.0782      0.26  |Q V       |         |         |         |
4+10       0.0800      0.26  |Q V       |         |         |         |
4+15       0.0818      0.26  |Q V       |         |         |         |
4+20       0.0836      0.26  |Q V       |         |         |         |
4+25       0.0854      0.26  |Q V       |         |         |         |
4+30       0.0872      0.26  |Q V       |         |         |         |
4+35       0.0891      0.27  |Q V       |         |         |         |
4+40       0.0909      0.27  |Q V       |         |         |         |
4+45       0.0927      0.27  |Q V       |         |         |         |
4+50       0.0946      0.27  |Q V       |         |         |         |
4+55       0.0964      0.27  |Q V       |         |         |         |
5+ 0       0.0983      0.27  |Q V       |         |         |         |
5+ 5       0.1002      0.27  |Q V       |         |         |         |
5+10       0.1021      0.27  |Q  V      |         |         |         |
5+15       0.1040      0.27  |Q  V      |         |         |         |
5+20       0.1059      0.28  |Q  V      |         |         |         |
```

```
5+25       0.1078      0.28  |Q  V     |         |         |         |
5+30       0.1097      0.28  |Q  V     |         |         |         |
5+35       0.1116      0.28  |Q  V     |         |         |         |
5+40       0.1135      0.28  |Q  V     |         |         |         |
5+45       0.1155      0.28  |Q  V     |         |         |         |
5+50       0.1174      0.28  |Q  V     |         |         |         |
5+55       0.1194      0.28  |Q  V     |         |         |         |
6+ 0       0.1214      0.29  |Q  V     |         |         |         |
6+ 5       0.1233      0.29  |Q  V     |         |         |         |
6+10       0.1253      0.29  |Q  V     |         |         |         |
6+15       0.1273      0.29  |Q   V    |         |         |         |
6+20       0.1293      0.29  |Q   V    |         |         |         |
6+25       0.1313      0.29  |Q   V    |         |         |         |
6+30       0.1333      0.29  |Q   V    |         |         |         |
6+35       0.1354      0.29  |Q   V    |         |         |         |
6+40       0.1374      0.30  |Q   V    |         |         |         |
6+45       0.1395      0.30  |Q   V    |         |         |         |
6+50       0.1415      0.30  |Q   V    |         |         |         |
6+55       0.1436      0.30  |Q   V    |         |         |         |
7+ 0       0.1457      0.30  |Q   V    |         |         |         |
7+ 5       0.1478      0.30  |Q   V    |         |         |         |
7+10       0.1499      0.31  |Q   V    |         |         |         |
7+15       0.1520      0.31  |Q   V    |         |         |         |
7+20       0.1541      0.31  |Q    V   |         |         |         |
7+25       0.1562      0.31  |Q    V   |         |         |         |
7+30       0.1584      0.31  |Q    V   |         |         |         |
7+35       0.1606      0.31  |Q    V   |         |         |         |
7+40       0.1627      0.31  |Q    V   |         |         |         |
7+45       0.1649      0.32  |Q    V   |         |         |         |
7+50       0.1671      0.32  |Q    V   |         |         |         |
7+55       0.1693      0.32  |Q    V   |         |         |         |
8+ 0       0.1715      0.32  |Q    V   |         |         |         |
8+ 5       0.1737      0.32  |Q    V   |         |         |         |
8+10       0.1760      0.33  |Q    V   |         |         |         |
8+15       0.1782      0.33  |Q     V  |         |         |         |
8+20       0.1805      0.33  |Q     V  |         |         |         |
8+25       0.1828      0.33  |Q     V  |         |         |         |
8+30       0.1851      0.33  |Q     V  |         |         |         |
8+35       0.1874      0.34  |Q     V  |         |         |         |
8+40       0.1897      0.34  |Q     V  |         |         |         |
8+45       0.1921      0.34  |Q     V  |         |         |         |
8+50       0.1944      0.34  |Q     V  |         |         |         |
8+55       0.1968      0.34  |Q     V  |         |         |         |
9+ 0       0.1992      0.35  |Q     V  |         |         |         |
9+ 5       0.2016      0.35  |Q     V  |         |         |         |
9+10       0.2040      0.35  |Q      V |         |         |         |
9+15       0.2064      0.35  |Q      V |         |         |         |
9+20       0.2088      0.36  |Q      V |         |         |         |
9+25       0.2113      0.36  |Q      V |         |         |         |
9+30       0.2138      0.36  |Q      V |         |         |         |
```

```
 9+35      0.2163      0.36  |Q      V |         |         |         |
 9+40      0.2188      0.36  |Q      V |         |         |         |
 9+45      0.2213      0.37  |Q      V |         |         |         |
 9+50      0.2239      0.37  |Q      V |         |         |         |
 9+55      0.2264      0.37  |Q      V |         |         |         |
10+ 0      0.2290      0.38  |Q       V|         |         |         |
10+ 5      0.2316      0.38  |Q       V|         |         |         |
10+10      0.2343      0.38  |Q       V|         |         |         |
10+15      0.2369      0.38  |Q       V|         |         |         |
10+20      0.2396      0.39  |Q       V|         |         |         |
10+25      0.2423      0.39  |Q       V|         |         |         |
10+30      0.2450      0.39  |Q       V|         |         |         |
10+35      0.2477      0.40  |Q       V|         |         |         |
10+40      0.2505      0.40  |Q       V|         |         |         |
10+45      0.2532      0.40  |Q       V|         |         |         |
10+50      0.2560      0.41  |Q        V         |         |         |
10+55      0.2589      0.41  |Q        V         |         |         |
11+ 0      0.2617      0.41  |Q        V         |         |         |
11+ 5      0.2646      0.42  |Q        V         |         |         |
11+10      0.2675      0.42  |Q        V         |         |         |
11+15      0.2704      0.43  |Q        V         |         |         |
11+20      0.2734      0.43  |Q        V         |         |         |
11+25      0.2763      0.43  |Q        V         |         |         |
11+30      0.2794      0.44  |Q        V         |         |         |
11+35      0.2824      0.44  |Q        |V        |         |         |
11+40      0.2855      0.45  |Q        |V        |         |         |
11+45      0.2886      0.45  |Q        |V        |         |         |
11+50      0.2917      0.46  |Q        |V        |         |         |
11+55      0.2949      0.46  |Q        |V        |         |         |
12+ 0      0.2981      0.47  |Q        |V        |         |         |
12+ 5      0.3014      0.48  |Q        |V        |         |         |
12+10      0.3051      0.54  | Q       |V        |         |         |
12+15      0.3093      0.60  | Q       | V       |         |         |
12+20      0.3136      0.63  | Q       | V       |         |         |
12+25      0.3180      0.64  | Q       | V       |         |         |
12+30      0.3224      0.65  | Q       | V       |         |         |
12+35      0.3269      0.65  | Q       | V       |         |         |
12+40      0.3314      0.66  | Q       |  V      |         |         |
12+45      0.3360      0.66  | Q       |  V      |         |         |
12+50      0.3406      0.67  | Q       |  V      |         |         |
12+55      0.3453      0.68  | Q       |  V      |         |         |
13+ 0      0.3500      0.69  | Q       |  V      |         |         |
13+ 5      0.3548      0.69  | Q       |  V      |         |         |
13+10      0.3596      0.70  | Q       |   V     |         |         |
13+15      0.3645      0.71  | Q       |   V     |         |         |
13+20      0.3694      0.72  | Q       |   V     |         |         |
13+25      0.3744      0.73  | Q       |   V     |         |         |
13+30      0.3795      0.73  | Q       |   V     |         |         |
13+35      0.3846      0.74  | Q       |    V    |         |         |
13+40      0.3898      0.75  |  Q      |    V    |         |         |
```

```
13+45       0.3951      0.76  |  Q      |    V    |         |         |
13+50       0.4004      0.78  |  Q      |    V    |         |         |
13+55       0.4058      0.79  |  Q      |    V    |         |         |
14+ 0       0.4113      0.80  |  Q      |     V   |         |         |
14+ 5       0.4169      0.81  |  Q      |     V   |         |         |
14+10       0.4226      0.83  |  Q      |     V   |         |         |
14+15       0.4284      0.84  |  Q      |     V   |         |         |
14+20       0.4343      0.86  |  Q      |      V  |         |         |
14+25       0.4403      0.87  |  Q      |      V  |         |         |
14+30       0.4464      0.89  |  Q      |      V  |         |         |
14+35       0.4527      0.91  |  Q      |      V  |         |         |
14+40       0.4591      0.93  |  Q      |       V |         |         |
14+45       0.4656      0.95  |  Q      |       V |         |         |
14+50       0.4723      0.97  |  Q      |       V |         |         |
14+55       0.4792      1.00  |  Q      |       V |         |         |
15+ 0       0.4863      1.03  |   Q     |        V|         |         |
15+ 5       0.4935      1.06  |   Q     |        V|         |         |
15+10       0.5011      1.09  |   Q     |        V|         |         |
15+15       0.5088      1.13  |   Q     |         V         |         |
15+20       0.5169      1.17  |   Q     |         V         |         |
15+25       0.5251      1.19  |   Q     |         V         |         |
15+30       0.5327      1.10  |   Q     |         V         |         |
15+35       0.5396      1.00  |   Q     |         |V        |         |
15+40       0.5468      1.04  |   Q     |         |V        |         |
15+45       0.5546      1.13  |   Q     |         |V        |         |
15+50       0.5634      1.28  |    Q    |         | V       |         |
15+55       0.5738      1.51  |     Q   |         | V       |         |
16+ 0       0.5871      1.93  |      Q  |         |  V      |         |
16+ 5       0.6100      3.32  |         |  Q      |  V      |         |
16+10       0.6585      7.04  |         |         |    V  Q |         |
16+15       0.7070      7.05  |         |         |      VQ |         |
16+20       0.7299      3.31  |         |  Q      |       V |         |
16+25       0.7414      1.67  |     Q   |         |        V|         |
16+30       0.7507      1.36  |    Q    |         |        V|         |
16+35       0.7591      1.21  |   Q     |         |        V|         |
16+40       0.7670      1.15  |   Q     |         |         V         |
16+45       0.7744      1.08  |   Q     |         |         V         |
16+50       0.7815      1.02  |   Q     |         |         V         |
16+55       0.7881      0.97  |  Q      |         |         V         |
17+ 0       0.7945      0.92  |  Q      |         |         |V        |
17+ 5       0.8006      0.89  |  Q      |         |         |V        |
17+10       0.8065      0.85  |  Q      |         |         |V        |
17+15       0.8121      0.82  |  Q      |         |         |V        |
17+20       0.8176      0.80  |  Q      |         |         | V       |
17+25       0.8229      0.77  |  Q      |         |         | V       |
17+30       0.8281      0.75  |  Q      |         |         | V       |
17+35       0.8332      0.73  | Q       |         |         | V       |
17+40       0.8381      0.71  | Q       |         |         | V       |
17+45       0.8429      0.70  | Q       |         |         |  V      |
17+50       0.8476      0.68  | Q       |         |         |  V      |
```

```
17+55       0.8522      0.67  | Q       |         |         |  V      |
18+ 0       0.8567      0.66  | Q       |         |         |  V      |
18+ 5       0.8611      0.63  | Q       |         |         |  V      |
18+10       0.8650      0.57  | Q       |         |         |   V     |
18+15       0.8684      0.50  |Q        |         |         |   V     |
18+20       0.8717      0.47  |Q        |         |         |   V     |
18+25       0.8748      0.46  |Q        |         |         |   V     |
18+30       0.8779      0.44  |Q        |         |         |   V     |
18+35       0.8809      0.44  |Q        |         |         |   V     |
18+40       0.8838      0.43  |Q        |         |         |   V     |
18+45       0.8867      0.42  |Q        |         |         |   V     |
18+50       0.8896      0.41  |Q        |         |         |   V     |
18+55       0.8924      0.41  |Q        |         |         |    V    |
19+ 0       0.8951      0.40  |Q        |         |         |    V    |
19+ 5       0.8978      0.39  |Q        |         |         |    V    |
19+10       0.9005      0.39  |Q        |         |         |    V    |
19+15       0.9031      0.38  |Q        |         |         |    V    |
19+20       0.9057      0.37  |Q        |         |         |    V    |
19+25       0.9082      0.37  |Q        |         |         |    V    |
19+30       0.9107      0.36  |Q        |         |         |    V    |
19+35       0.9132      0.36  |Q        |         |         |    V    |
19+40       0.9156      0.35  |Q        |         |         |     V   |
19+45       0.9180      0.35  |Q        |         |         |     V   |
19+50       0.9204      0.35  |Q        |         |         |     V   |
19+55       0.9228      0.34  |Q        |         |         |     V   |
20+ 0       0.9251      0.34  |Q        |         |         |     V   |
20+ 5       0.9274      0.33  |Q        |         |         |     V   |
20+10       0.9296      0.33  |Q        |         |         |     V   |
20+15       0.9319      0.33  |Q        |         |         |     V   |
20+20       0.9341      0.32  |Q        |         |         |     V   |
20+25       0.9363      0.32  |Q        |         |         |     V   |
20+30       0.9384      0.31  |Q        |         |         |     V   |
20+35       0.9406      0.31  |Q        |         |         |     V   |
20+40       0.9427      0.31  |Q        |         |         |      V  |
20+45       0.9448      0.30  |Q        |         |         |      V  |
20+50       0.9469      0.30  |Q        |         |         |      V  |
20+55       0.9489      0.30  |Q        |         |         |      V  |
21+ 0       0.9510      0.30  |Q        |         |         |      V  |
21+ 5       0.9530      0.29  |Q        |         |         |      V  |
21+10       0.9550      0.29  |Q        |         |         |      V  |
21+15       0.9570      0.29  |Q        |         |         |      V  |
21+20       0.9590      0.29  |Q        |         |         |      V  |
21+25       0.9609      0.28  |Q        |         |         |      V  |
21+30       0.9628      0.28  |Q        |         |         |      V  |
21+35       0.9647      0.28  |Q        |         |         |      V  |
21+40       0.9666      0.28  |Q        |         |         |       V |
21+45       0.9685      0.27  |Q        |         |         |       V |
21+50       0.9704      0.27  |Q        |         |         |       V |
21+55       0.9722      0.27  |Q        |         |         |       V |
22+ 0       0.9741      0.27  |Q        |         |         |       V |
```

```
   22+ 5       0.9759      0.26  |Q         |         |         |       V |
   22+10       0.9777      0.26  |Q         |         |         |       V |
   22+15       0.9795      0.26  |Q         |         |         |       V |
   22+20       0.9813      0.26  |Q         |         |         |       V |
   22+25       0.9830      0.26  |Q         |         |         |       V |
   22+30       0.9848      0.25  |Q         |         |         |       V |
   22+35       0.9865      0.25  |Q         |         |         |       V |
   22+40       0.9883      0.25  |Q         |         |         |       V |
   22+45       0.9900      0.25  Q          |         |         |       V |
   22+50       0.9917      0.25  Q          |         |         |        V|
   22+55       0.9934      0.25  Q          |         |         |        V|
   23+ 0       0.9951      0.24  Q          |         |         |        V|
   23+ 5       0.9967      0.24  Q          |         |         |        V|
   23+10       0.9984      0.24  Q          |         |         |        V|
   23+15       1.0000      0.24  Q          |         |         |        V|
   23+20       1.0017      0.24  Q          |         |         |        V|
   23+25       1.0033      0.24  Q          |         |         |        V|
   23+30       1.0049      0.23  Q          |         |         |        V|
   23+35       1.0065      0.23  Q          |         |         |        V|
   23+40       1.0081      0.23  Q          |         |         |        V|
   23+45       1.0097      0.23  Q          |         |         |        V|
   23+50       1.0113      0.23  Q          |         |         |        V|
   23+55       1.0128      0.23  Q          |         |         |        V|
   24+ 0       1.0144      0.23  Q          |         |         |        V|
----------------------------------------------------------------------
```

```
        U n i t   H y d r o g r a p h   A n a l y s i s

        Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0

                Study date  12/17/24

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------------------------------------------------------------------------

San Bernardino County Synthetic Unit Hydrology Method
                Manual date - August 1986


Program License Serial Number 6443

---------------------------------------------------------------------
UNIT HYDROGRAPH EAST HIGHLAND RANCH
PROPOSED CONDITION - BASIN 2
2-YR 24-HR STORM
KIMLEY-HORN
--------------------------------------------------------------------

        Storm Event Year = 2

        Antecedent Moisture Condition = 1

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

 English Units used in output format




Area averaged rainfall intensity isohyetal data:
        Sub-Area        Duration        Isohyetal
        (Ac.)            (hours)         (In)
Rainfall data for year 10
             1.85            1           0.83
--------------------------------------------------------------------
Rainfall data for year 2
             1.85            6           1.24
--------------------------------------------------------------------
Rainfall data for year 2
             1.85           24           2.31
--------------------------------------------------------------------
Rainfall data for year 100
```

```
             1.85             1            1.39
--------------------------------------------------------------------
Rainfall data for year 100
             1.85             6            2.90
--------------------------------------------------------------------
Rainfall data for year 100
             1.85            24            5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area      Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 1)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 32.0      16.6          1.85      1.000     1.000    0.580    0.580

Area-averaged adjusted loss rate Fm (In/Hr) =  0.580

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S      Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)            Yield Fr
     1.07   0.580         32.0      16.6      11.55     0.000
     0.78   0.420         98.0      98.0       0.20     0.901

Area-averaged catchment yield fraction, Y =  0.379
Area-averaged low loss fraction, Yb =  0.621
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.85(Ac.)
Catchment Lag time =   0.134 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 62.1427
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.580(In/Hr)
Average low loss rate fraction (Yb) = 0.621 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.160(In)
Computed peak 30-minute rainfall =  0.329(In)
Specified peak 1-hour rainfall =  0.433(In)
Computed peak 3-hour rainfall =  0.826(In)
Specified peak 6-hour rainfall =  1.240(In)
Specified peak 24-hour rainfall =  2.310(In)


Rainfall depth area reduction factors:
Using a total area of       1.85(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.160(In)
```

30-minute factor = 1.000 Adjusted rainfall = 0.328(In)
1-hour factor = 1.000 Adjusted rainfall = 0.433(In)
3-hour factor = 1.000 Adjusted rainfall = 0.826(In)
6-hour factor = 1.000 Adjusted rainfall = 1.240(In)
24-hour factor = 1.000 Adjusted rainfall = 2.310(In)

U n i t H y d r o g r a p h

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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
	(K = 22.37 (CFS))	
1	6.976	1.561
2	44.277	8.345
3	83.652	8.810
4	96.267	2.822
5	98.834	0.574
6	100.000	0.261

Total soil rain loss = 1.38(In)
Total effective rainfall = 0.93(In)
Peak flow rate in flood hydrograph = 1.17(CFS)

++

24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0000	0.00	Q	|	|	|	|
0+10	0.0001	0.01	Q	|	|	|	|
0+15	0.0003	0.03	Q	|	|	|	|
0+20	0.0005	0.03	Q	|	|	|	|
0+25	0.0007	0.03	Q	|	|	|	|
0+30	0.0009	0.03	Q	|	|	|	|
0+35	0.0011	0.03	Q	|	|	|	|
0+40	0.0013	0.03	Q	|	|	|	|
0+45	0.0015	0.03	Q	|	|	|	|
0+50	0.0018	0.03	Q	|	|	|	|
0+55	0.0020	0.03	Q	|	|	|	|
1+ 0	0.0022	0.03	Q	|	|	|	|
1+ 5	0.0024	0.03	Q	|	|	|	|
1+10	0.0026	0.03	Q	|	|	|	|

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1+15       0.0028      0.03  Q         |         |         |         |
1+20       0.0031      0.03  Q         |         |         |         |
1+25       0.0033      0.03  Q         |         |         |         |
1+30       0.0035      0.03  Q         |         |         |         |
1+35       0.0037      0.03  QV        |         |         |         |
1+40       0.0039      0.03  QV        |         |         |         |
1+45       0.0042      0.03  QV        |         |         |         |
1+50       0.0044      0.03  QV        |         |         |         |
1+55       0.0046      0.03  QV        |         |         |         |
2+ 0       0.0048      0.03  QV        |         |         |         |
2+ 5       0.0051      0.03  QV        |         |         |         |
2+10       0.0053      0.03  QV        |         |         |         |
2+15       0.0055      0.03  QV        |         |         |         |
2+20       0.0057      0.03  QV        |         |         |         |
2+25       0.0060      0.03  QV        |         |         |         |
2+30       0.0062      0.03  QV        |         |         |         |
2+35       0.0064      0.03  QV        |         |         |         |
2+40       0.0067      0.03  QV        |         |         |         |
2+45       0.0069      0.03  QV        |         |         |         |
2+50       0.0071      0.03  QV        |         |         |         |
2+55       0.0074      0.03  Q V       |         |         |         |
3+ 0       0.0076      0.03  Q V       |         |         |         |
3+ 5       0.0078      0.03  Q V       |         |         |         |
3+10       0.0081      0.03  Q V       |         |         |         |
3+15       0.0083      0.03  Q V       |         |         |         |
3+20       0.0085      0.03  Q V       |         |         |         |
3+25       0.0088      0.03  Q V       |         |         |         |
3+30       0.0090      0.03  Q V       |         |         |         |
3+35       0.0092      0.03  Q V       |         |         |         |
3+40       0.0095      0.03  Q V       |         |         |         |
3+45       0.0097      0.03  Q V       |         |         |         |
3+50       0.0100      0.04  Q V       |         |         |         |
3+55       0.0102      0.04  Q V       |         |         |         |
4+ 0       0.0105      0.04  Q V       |         |         |         |
4+ 5       0.0107      0.04  Q V       |         |         |         |
4+10       0.0109      0.04  Q  V      |         |         |         |
4+15       0.0112      0.04  Q  V      |         |         |         |
4+20       0.0114      0.04  Q  V      |         |         |         |
4+25       0.0117      0.04  Q  V      |         |         |         |
4+30       0.0119      0.04  Q  V      |         |         |         |
4+35       0.0122      0.04  Q  V      |         |         |         |
4+40       0.0124      0.04  Q  V      |         |         |         |
4+45       0.0127      0.04  Q  V      |         |         |         |
4+50       0.0129      0.04  Q  V      |         |         |         |
4+55       0.0132      0.04  Q  V      |         |         |         |
5+ 0       0.0135      0.04  Q  V      |         |         |         |
5+ 5       0.0137      0.04  Q  V      |         |         |         |
5+10       0.0140      0.04  Q  V      |         |         |         |
5+15       0.0142      0.04  Q  V      |         |         |         |
5+20       0.0145      0.04  Q   V     |         |         |         |
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5+25       0.0147      0.04  Q   V      |         |         |         |
5+30       0.0150      0.04  Q   V      |         |         |         |
5+35       0.0153      0.04  Q   V      |         |         |         |
5+40       0.0155      0.04  Q   V      |         |         |         |
5+45       0.0158      0.04  Q   V      |         |         |         |
5+50       0.0161      0.04  Q   V      |         |         |         |
5+55       0.0163      0.04  Q   V      |         |         |         |
6+ 0       0.0166      0.04  Q   V      |         |         |         |
6+ 5       0.0169      0.04  Q   V      |         |         |         |
6+10       0.0171      0.04  Q   V      |         |         |         |
6+15       0.0174      0.04  Q   V      |         |         |         |
6+20       0.0177      0.04  Q   V      |         |         |         |
6+25       0.0180      0.04  Q    V     |         |         |         |
6+30       0.0182      0.04  Q    V     |         |         |         |
6+35       0.0185      0.04  Q    V     |         |         |         |
6+40       0.0188      0.04  Q    V     |         |         |         |
6+45       0.0191      0.04  Q    V     |         |         |         |
6+50       0.0194      0.04  Q    V     |         |         |         |
6+55       0.0196      0.04  Q    V     |         |         |         |
7+ 0       0.0199      0.04  Q    V     |         |         |         |
7+ 5       0.0202      0.04  Q    V     |         |         |         |
7+10       0.0205      0.04  Q    V     |         |         |         |
7+15       0.0208      0.04  Q    V     |         |         |         |
7+20       0.0211      0.04  Q    V     |         |         |         |
7+25       0.0214      0.04  Q    V     |         |         |         |
7+30       0.0217      0.04  Q     V    |         |         |         |
7+35       0.0220      0.04  Q     V    |         |         |         |
7+40       0.0223      0.04  Q     V    |         |         |         |
7+45       0.0226      0.04  Q     V    |         |         |         |
7+50       0.0229      0.04  Q     V    |         |         |         |
7+55       0.0232      0.04  Q     V    |         |         |         |
8+ 0       0.0235      0.04  Q     V    |         |         |         |
8+ 5       0.0238      0.04  Q     V    |         |         |         |
8+10       0.0241      0.04  Q     V    |         |         |         |
8+15       0.0244      0.04  Q     V    |         |         |         |
8+20       0.0247      0.05  Q     V    |         |         |         |
8+25       0.0250      0.05  Q      V   |         |         |         |
8+30       0.0253      0.05  Q      V   |         |         |         |
8+35       0.0256      0.05  Q      V   |         |         |         |
8+40       0.0260      0.05  Q      V   |         |         |         |
8+45       0.0263      0.05  Q      V   |         |         |         |
8+50       0.0266      0.05  Q      V   |         |         |         |
8+55       0.0269      0.05  Q      V   |         |         |         |
9+ 0       0.0272      0.05  Q      V   |         |         |         |
9+ 5       0.0276      0.05  Q      V   |         |         |         |
9+10       0.0279      0.05  Q      V   |         |         |         |
9+15       0.0282      0.05  Q      V   |         |         |         |
9+20       0.0286      0.05  Q       V  |         |         |         |
9+25       0.0289      0.05  Q       V  |         |         |         |
9+30       0.0292      0.05  Q       V  |         |         |         |
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 9+35       0.0296      0.05  Q       V |         |         |         |
 9+40       0.0299      0.05  Q       V |         |         |         |
 9+45       0.0303      0.05  Q       V |         |         |         |
 9+50       0.0306      0.05  Q       V |         |         |         |
 9+55       0.0310      0.05  Q       V |         |         |         |
10+ 0       0.0313      0.05  Q       V |         |         |         |
10+ 5       0.0317      0.05  Q       V |         |         |         |
10+10       0.0320      0.05  Q       V |         |         |         |
10+15       0.0324      0.05  Q        V|         |         |         |
10+20       0.0328      0.05  Q        V|         |         |         |
10+25       0.0331      0.05  Q        V|         |         |         |
10+30       0.0335      0.05  Q        V|         |         |         |
10+35       0.0339      0.05  Q        V|         |         |         |
10+40       0.0343      0.05  Q        V|         |         |         |
10+45       0.0346      0.06  Q        V|         |         |         |
10+50       0.0350      0.06  Q        V|         |         |         |
10+55       0.0354      0.06  Q        V|         |         |         |
11+ 0       0.0358      0.06  Q         V         |         |         |
11+ 5       0.0362      0.06  Q         V         |         |         |
11+10       0.0366      0.06  Q         V         |         |         |
11+15       0.0370      0.06  Q         V         |         |         |
11+20       0.0374      0.06  Q         V         |         |         |
11+25       0.0378      0.06  Q         V         |         |         |
11+30       0.0382      0.06  Q         V         |         |         |
11+35       0.0386      0.06  Q         V         |         |         |
11+40       0.0390      0.06  Q         V         |         |         |
11+45       0.0395      0.06  Q         |V        |         |         |
11+50       0.0399      0.06  Q         |V        |         |         |
11+55       0.0403      0.06  Q         |V        |         |         |
12+ 0       0.0408      0.06  Q         |V        |         |         |
12+ 5       0.0412      0.07  Q         |V        |         |         |
12+10       0.0417      0.07  Q         |V        |         |         |
12+15       0.0423      0.08  Q         |V        |         |         |
12+20       0.0429      0.09  Q         | V       |         |         |
12+25       0.0435      0.09  Q         | V       |         |         |
12+30       0.0441      0.09  Q         | V       |         |         |
12+35       0.0447      0.09  Q         | V       |         |         |
12+40       0.0453      0.09  Q         | V       |         |         |
12+45       0.0460      0.09  Q         | V       |         |         |
12+50       0.0466      0.09  Q         |  V      |         |         |
12+55       0.0472      0.09  Q         |  V      |         |         |
13+ 0       0.0479      0.09  Q         |  V      |         |         |
13+ 5       0.0485      0.09  Q         |  V      |         |         |
13+10       0.0492      0.10  Q         |  V      |         |         |
13+15       0.0499      0.10  Q         |  V      |         |         |
13+20       0.0505      0.10  Q         |   V     |         |         |
13+25       0.0512      0.10  Q         |   V     |         |         |
13+30       0.0519      0.10  Q         |   V     |         |         |
13+35       0.0526      0.10  Q         |   V     |         |         |
13+40       0.0533      0.10  Q         |   V     |         |         |
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13+45       0.0540      0.10  Q         |    V    |         |         |
13+50       0.0548      0.11  Q         |    V    |         |         |
13+55       0.0555      0.11  Q         |    V    |         |         |
14+ 0       0.0563      0.11  Q         |    V    |         |         |
14+ 5       0.0570      0.11  Q         |    V    |         |         |
14+10       0.0578      0.11  Q         |     V   |         |         |
14+15       0.0586      0.11  Q         |     V   |         |         |
14+20       0.0594      0.12  Q         |     V   |         |         |
14+25       0.0602      0.12  Q         |     V   |         |         |
14+30       0.0611      0.12  Q         |      V  |         |         |
14+35       0.0619      0.12  Q         |      V  |         |         |
14+40       0.0628      0.13  Q         |      V  |         |         |
14+45       0.0637      0.13  Q         |      V  |         |         |
14+50       0.0646      0.13  Q         |       V |         |         |
14+55       0.0655      0.14  Q         |       V |         |         |
15+ 0       0.0665      0.14  Q         |       V |         |         |
15+ 5       0.0675      0.14  Q         |       V |         |         |
15+10       0.0685      0.15  Q         |        V|         |         |
15+15       0.0696      0.15  Q         |        V|         |         |
15+20       0.0707      0.16  Q         |        V|         |         |
15+25       0.0718      0.16  Q         |         V         |         |
15+30       0.0729      0.15  Q         |         V         |         |
15+35       0.0738      0.14  Q         |         V         |         |
15+40       0.0748      0.14  Q         |         V         |         |
15+45       0.0759      0.16  Q         |         |V        |         |
15+50       0.0771      0.18  Q         |         |V        |         |
15+55       0.0785      0.21  Q         |         | V       |         |
16+ 0       0.0803      0.27  |Q        |         | V       |         |
16+ 5       0.0837      0.50  |Q        |         |  V      |         |
16+10       0.0918      1.17  |   Q     |         |    V    |         |
16+15       0.0998      1.16  |   Q     |         |      V  |         |
16+20       0.1033      0.51  | Q       |         |       V |         |
16+25       0.1049      0.24  Q         |         |        V|         |
16+30       0.1063      0.19  Q         |         |        V|         |
16+35       0.1074      0.17  Q         |         |         V         |
16+40       0.1085      0.16  Q         |         |         V         |
16+45       0.1095      0.15  Q         |         |         V         |
16+50       0.1105      0.14  Q         |         |         V         |
16+55       0.1114      0.13  Q         |         |         |V        |
17+ 0       0.1122      0.13  Q         |         |         |V        |
17+ 5       0.1131      0.12  Q         |         |         |V        |
17+10       0.1139      0.12  Q         |         |         |V        |
17+15       0.1146      0.11  Q         |         |         | V       |
17+20       0.1154      0.11  Q         |         |         | V       |
17+25       0.1161      0.11  Q         |         |         | V       |
17+30       0.1168      0.10  Q         |         |         | V       |
17+35       0.1175      0.10  Q         |         |         | V       |
17+40       0.1182      0.10  Q         |         |         |  V      |
17+45       0.1188      0.10  Q         |         |         |  V      |
17+50       0.1195      0.09  Q         |         |         |  V      |
```

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17+55       0.1201      0.09  Q         |         |         |  V      |
18+ 0       0.1207      0.09  Q         |         |         |  V      |
18+ 5       0.1213      0.09  Q         |         |         |   V     |
18+10       0.1219      0.08  Q         |         |         |   V     |
18+15       0.1223      0.07  Q         |         |         |   V     |
18+20       0.1228      0.06  Q         |         |         |   V     |
18+25       0.1232      0.06  Q         |         |         |   V     |
18+30       0.1236      0.06  Q         |         |         |   V     |
18+35       0.1240      0.06  Q         |         |         |   V     |
18+40       0.1244      0.06  Q         |         |         |   V     |
18+45       0.1248      0.06  Q         |         |         |    V    |
18+50       0.1252      0.06  Q         |         |         |    V    |
18+55       0.1256      0.06  Q         |         |         |    V    |
19+ 0       0.1260      0.05  Q         |         |         |    V    |
19+ 5       0.1264      0.05  Q         |         |         |    V    |
19+10       0.1267      0.05  Q         |         |         |    V    |
19+15       0.1271      0.05  Q         |         |         |    V    |
19+20       0.1274      0.05  Q         |         |         |    V    |
19+25       0.1278      0.05  Q         |         |         |    V    |
19+30       0.1281      0.05  Q         |         |         |    V    |
19+35       0.1285      0.05  Q         |         |         |     V   |
19+40       0.1288      0.05  Q         |         |         |     V   |
19+45       0.1291      0.05  Q         |         |         |     V   |
19+50       0.1294      0.05  Q         |         |         |     V   |
19+55       0.1298      0.05  Q         |         |         |     V   |
20+ 0       0.1301      0.05  Q         |         |         |     V   |
20+ 5       0.1304      0.05  Q         |         |         |     V   |
20+10       0.1307      0.04  Q         |         |         |     V   |
20+15       0.1310      0.04  Q         |         |         |     V   |
20+20       0.1313      0.04  Q         |         |         |     V   |
20+25       0.1316      0.04  Q         |         |         |     V   |
20+30       0.1319      0.04  Q         |         |         |     V   |
20+35       0.1322      0.04  Q         |         |         |      V  |
20+40       0.1325      0.04  Q         |         |         |      V  |
20+45       0.1328      0.04  Q         |         |         |      V  |
20+50       0.1331      0.04  Q         |         |         |      V  |
20+55       0.1333      0.04  Q         |         |         |      V  |
21+ 0       0.1336      0.04  Q         |         |         |      V  |
21+ 5       0.1339      0.04  Q         |         |         |      V  |
21+10       0.1342      0.04  Q         |         |         |      V  |
21+15       0.1344      0.04  Q         |         |         |      V  |
21+20       0.1347      0.04  Q         |         |         |      V  |
21+25       0.1350      0.04  Q         |         |         |      V  |
21+30       0.1352      0.04  Q         |         |         |      V  |
21+35       0.1355      0.04  Q         |         |         |      V  |
21+40       0.1358      0.04  Q         |         |         |       V |
21+45       0.1360      0.04  Q         |         |         |       V |
21+50       0.1363      0.04  Q         |         |         |       V |
21+55       0.1365      0.04  Q         |         |         |       V |
22+ 0       0.1368      0.04  Q         |         |         |       V |
```

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   22+ 5       0.1370      0.04  Q         |         |         |       V |
   22+10       0.1373      0.04  Q         |         |         |       V |
   22+15       0.1375      0.04  Q         |         |         |       V |
   22+20       0.1378      0.04  Q         |         |         |       V |
   22+25       0.1380      0.04  Q         |         |         |       V |
   22+30       0.1382      0.03  Q         |         |         |       V |
   22+35       0.1385      0.03  Q         |         |         |       V |
   22+40       0.1387      0.03  Q         |         |         |       V |
   22+45       0.1390      0.03  Q         |         |         |       V |
   22+50       0.1392      0.03  Q         |         |         |        V|
   22+55       0.1394      0.03  Q         |         |         |        V|
   23+ 0       0.1396      0.03  Q         |         |         |        V|
   23+ 5       0.1399      0.03  Q         |         |         |        V|
   23+10       0.1401      0.03  Q         |         |         |        V|
   23+15       0.1403      0.03  Q         |         |         |        V|
   23+20       0.1405      0.03  Q         |         |         |        V|
   23+25       0.1408      0.03  Q         |         |         |        V|
   23+30       0.1410      0.03  Q         |         |         |        V|
   23+35       0.1412      0.03  Q         |         |         |        V|
   23+40       0.1414      0.03  Q         |         |         |        V|
   23+45       0.1416      0.03  Q         |         |         |        V|
   23+50       0.1419      0.03  Q         |         |         |        V|
   23+55       0.1421      0.03  Q         |         |         |        V|
   24+ 0       0.1423      0.03  Q         |         |         |        V|
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

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Study date 12/17/24

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San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

EXISTING UNIT HYDROGRAPH EAST HIGHLAND RANCH
EXISTING CONDITION BASIN 1 - DA-1
2-YR 24-HR STORM
KIMLEY-HORN

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
10.00	1	0.83
Rainfall data for year 2		
10.00	6	1.24
Rainfall data for year 2		
10.00	24	2.31
Rainfall data for year 100		

```
           10.00           1           1.39
--------------------------------------------------------------------
Rainfall data for year 100
           10.00           6           2.90
--------------------------------------------------------------------
Rainfall data for year 100
           10.00          24           5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 1)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 50.0      31.0         10.00      1.000     0.983    1.000    0.983

Area-averaged adjusted loss rate Fm (In/Hr) =  0.983

********* Area-Averaged low loss rate fraction, Yb **********

Area        Area          SCS CN    SCS CN      S     Pervious
 (Ac.)       Fract          (AMC2)    (AMC1)          Yield Fr
    10.00   1.000          50.0      31.0      11.55     0.000

Area-averaged catchment yield fraction, Y =  0.000
Area-averaged low loss fraction, Yb =  1.000
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      10.00(Ac.)
Catchment Lag time =   0.380 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 21.9298
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.983(In/Hr)
Average low loss rate fraction (Yb) = 1.000 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.160(In)
Computed peak 30-minute rainfall =  0.329(In)
Specified peak 1-hour rainfall =  0.433(In)
Computed peak 3-hour rainfall =  0.826(In)
Specified peak 6-hour rainfall =  1.240(In)
Specified peak 24-hour rainfall =  2.310(In)


Rainfall depth area reduction factors:
Using a total area of      10.00(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.160(In)
30-minute factor = 1.000    Adjusted rainfall =  0.328(In)
```

```
1-hour factor = 1.000       Adjusted rainfall =  0.433(In)
3-hour factor = 1.000       Adjusted rainfall =  0.826(In)
6-hour factor = 1.000       Adjusted rainfall =  1.240(In)
24-hour factor = 1.000      Adjusted rainfall =  2.310(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
---------------------------------------------------------------------
                (K =       120.94 (CFS))

  1                1.322                   1.599
  2                5.831                   5.453
  3               16.216                  12.559
  4               30.380                  17.130
  5               48.265                  21.629
  6               67.430                  23.178
  7               79.118                  14.135
  8               87.883                  10.600
  9               92.493                   5.576
 10               95.715                   3.897
 11               97.536                   2.202
 12               98.339                   0.972
 13               98.734                   0.477
 14               99.129                   0.477
 15               99.524                   0.477
 16              100.000                   0.239
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      2.23(In)
Total effective rainfall =      0.08(In)
Peak flow rate in flood hydrograph =      1.82(CFS)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00   Q         |         |         |         |
  0+10       0.0000      0.00   Q         |         |         |         |
  0+15       0.0000      0.00   Q         |         |         |         |
  0+20       0.0000      0.00   Q         |         |         |         |
  0+25       0.0000      0.00   Q         |         |         |         |
```

```
 0+30        0.0000       0.00  Q         |         |         |         |
 0+35        0.0000       0.00  Q         |         |         |         |
 0+40        0.0000       0.00  Q         |         |         |         |
 0+45        0.0000       0.00  Q         |         |         |         |
 0+50        0.0000       0.00  Q         |         |         |         |
 0+55        0.0000       0.00  Q         |         |         |         |
 1+ 0        0.0000       0.00  Q         |         |         |         |
 1+ 5        0.0000       0.00  Q         |         |         |         |
 1+10        0.0000       0.00  Q         |         |         |         |
 1+15        0.0000       0.00  Q         |         |         |         |
 1+20        0.0000       0.00  Q         |         |         |         |
 1+25        0.0000       0.00  Q         |         |         |         |
 1+30        0.0000       0.00  Q         |         |         |         |
 1+35        0.0000       0.00  Q         |         |         |         |
 1+40        0.0000       0.00  Q         |         |         |         |
 1+45        0.0000       0.00  Q         |         |         |         |
 1+50        0.0000       0.00  Q         |         |         |         |
 1+55        0.0000       0.00  Q         |         |         |         |
 2+ 0        0.0000       0.00  Q         |         |         |         |
 2+ 5        0.0000       0.00  Q         |         |         |         |
 2+10        0.0000       0.00  Q         |         |         |         |
 2+15        0.0000       0.00  Q         |         |         |         |
 2+20        0.0000       0.00  Q         |         |         |         |
 2+25        0.0000       0.00  Q         |         |         |         |
 2+30        0.0000       0.00  Q         |         |         |         |
 2+35        0.0000       0.00  Q         |         |         |         |
 2+40        0.0000       0.00  Q         |         |         |         |
 2+45        0.0000       0.00  Q         |         |         |         |
 2+50        0.0000       0.00  Q         |         |         |         |
 2+55        0.0000       0.00  Q         |         |         |         |
 3+ 0        0.0000       0.00  Q         |         |         |         |
 3+ 5        0.0000       0.00  Q         |         |         |         |
 3+10        0.0000       0.00  Q         |         |         |         |
 3+15        0.0000       0.00  Q         |         |         |         |
 3+20        0.0000       0.00  Q         |         |         |         |
 3+25        0.0000       0.00  Q         |         |         |         |
 3+30        0.0000       0.00  Q         |         |         |         |
 3+35        0.0000       0.00  Q         |         |         |         |
 3+40        0.0000       0.00  Q         |         |         |         |
 3+45        0.0000       0.00  Q         |         |         |         |
 3+50        0.0000       0.00  Q         |         |         |         |
 3+55        0.0000       0.00  Q         |         |         |         |
 4+ 0        0.0000       0.00  Q         |         |         |         |
 4+ 5        0.0000       0.00  Q         |         |         |         |
 4+10        0.0000       0.00  Q         |         |         |         |
 4+15        0.0000       0.00  Q         |         |         |         |
 4+20        0.0000       0.00  Q         |         |         |         |
 4+25        0.0000       0.00  Q         |         |         |         |
 4+30        0.0000       0.00  Q         |         |         |         |
 4+35        0.0000       0.00  Q         |         |         |         |
```

4+40	0.0000	0.00	Q					
4+45	0.0000	0.00	Q					
4+50	0.0000	0.00	Q					
4+55	0.0000	0.00	Q					
5+ 0	0.0000	0.00	Q					
5+ 5	0.0000	0.00	Q					
5+10	0.0000	0.00	Q					
5+15	0.0000	0.00	Q					
5+20	0.0000	0.00	Q					
5+25	0.0000	0.00	Q					
5+30	0.0000	0.00	Q					
5+35	0.0000	0.00	Q					
5+40	0.0000	0.00	Q					
5+45	0.0000	0.00	Q					
5+50	0.0000	0.00	Q					
5+55	0.0000	0.00	Q					
6+ 0	0.0000	0.00	Q					
6+ 5	0.0000	0.00	Q					
6+10	0.0000	0.00	Q					
6+15	0.0000	0.00	Q					
6+20	0.0000	0.00	Q					
6+25	0.0000	0.00	Q					
6+30	0.0000	0.00	Q					
6+35	0.0000	0.00	Q					
6+40	0.0000	0.00	Q					
6+45	0.0000	0.00	Q					
6+50	0.0000	0.00	Q					
6+55	0.0000	0.00	Q					
7+ 0	0.0000	0.00	Q					
7+ 5	0.0000	0.00	Q					
7+10	0.0000	0.00	Q					
7+15	0.0000	0.00	Q					
7+20	0.0000	0.00	Q					
7+25	0.0000	0.00	Q					
7+30	0.0000	0.00	Q					
7+35	0.0000	0.00	Q					
7+40	0.0000	0.00	Q					
7+45	0.0000	0.00	Q					
7+50	0.0000	0.00	Q					
7+55	0.0000	0.00	Q					
8+ 0	0.0000	0.00	Q					
8+ 5	0.0000	0.00	Q					
8+10	0.0000	0.00	Q					
8+15	0.0000	0.00	Q					
8+20	0.0000	0.00	Q					
8+25	0.0000	0.00	Q					
8+30	0.0000	0.00	Q					
8+35	0.0000	0.00	Q					
8+40	0.0000	0.00	Q					
8+45	0.0000	0.00	Q					

8+50	0.0000	0.00	Q					
8+55	0.0000	0.00	Q					
9+ 0	0.0000	0.00	Q					
9+ 5	0.0000	0.00	Q					
9+10	0.0000	0.00	Q					
9+15	0.0000	0.00	Q					
9+20	0.0000	0.00	Q					
9+25	0.0000	0.00	Q					
9+30	0.0000	0.00	Q					
9+35	0.0000	0.00	Q					
9+40	0.0000	0.00	Q					
9+45	0.0000	0.00	Q					
9+50	0.0000	0.00	Q					
9+55	0.0000	0.00	Q					
10+ 0	0.0000	0.00	Q					
10+ 5	0.0000	0.00	Q					
10+10	0.0000	0.00	Q					
10+15	0.0000	0.00	Q					
10+20	0.0000	0.00	Q					
10+25	0.0000	0.00	Q					
10+30	0.0000	0.00	Q					
10+35	0.0000	0.00	Q					
10+40	0.0000	0.00	Q					
10+45	0.0000	0.00	Q					
10+50	0.0000	0.00	Q					
10+55	0.0000	0.00	Q					
11+ 0	0.0000	0.00	Q					
11+ 5	0.0000	0.00	Q					
11+10	0.0000	0.00	Q					
11+15	0.0000	0.00	Q					
11+20	0.0000	0.00	Q					
11+25	0.0000	0.00	Q					
11+30	0.0000	0.00	Q					
11+35	0.0000	0.00	Q					
11+40	0.0000	0.00	Q					
11+45	0.0000	0.00	Q					
11+50	0.0000	0.00	Q					
11+55	0.0000	0.00	Q					
12+ 0	0.0000	0.00	Q					
12+ 5	0.0000	0.00	Q					
12+10	0.0000	0.00	Q					
12+15	0.0000	0.00	Q					
12+20	0.0000	0.00	Q					
12+25	0.0000	0.00	Q					
12+30	0.0000	0.00	Q					
12+35	0.0000	0.00	Q					
12+40	0.0000	0.00	Q					
12+45	0.0000	0.00	Q					
12+50	0.0000	0.00	Q					
12+55	0.0000	0.00	Q					

```
13+ 0       0.0000      0.00  Q         |         |         |         |
13+ 5       0.0000      0.00  Q         |         |         |         |
13+10       0.0000      0.00  Q         |         |         |         |
13+15       0.0000      0.00  Q         |         |         |         |
13+20       0.0000      0.00  Q         |         |         |         |
13+25       0.0000      0.00  Q         |         |         |         |
13+30       0.0000      0.00  Q         |         |         |         |
13+35       0.0000      0.00  Q         |         |         |         |
13+40       0.0000      0.00  Q         |         |         |         |
13+45       0.0000      0.00  Q         |         |         |         |
13+50       0.0000      0.00  Q         |         |         |         |
13+55       0.0000      0.00  Q         |         |         |         |
14+ 0       0.0000      0.00  Q         |         |         |         |
14+ 5       0.0000      0.00  Q         |         |         |         |
14+10       0.0000      0.00  Q         |         |         |         |
14+15       0.0000      0.00  Q         |         |         |         |
14+20       0.0000      0.00  Q         |         |         |         |
14+25       0.0000      0.00  Q         |         |         |         |
14+30       0.0000      0.00  Q         |         |         |         |
14+35       0.0000      0.00  Q         |         |         |         |
14+40       0.0000      0.00  Q         |         |         |         |
14+45       0.0000      0.00  Q         |         |         |         |
14+50       0.0000      0.00  Q         |         |         |         |
14+55       0.0000      0.00  Q         |         |         |         |
15+ 0       0.0000      0.00  Q         |         |         |         |
15+ 5       0.0000      0.00  Q         |         |         |         |
15+10       0.0000      0.00  Q         |         |         |         |
15+15       0.0000      0.00  Q         |         |         |         |
15+20       0.0000      0.00  Q         |         |         |         |
15+25       0.0000      0.00  Q         |         |         |         |
15+30       0.0000      0.00  Q         |         |         |         |
15+35       0.0000      0.00  Q         |         |         |         |
15+40       0.0000      0.00  Q         |         |         |         |
15+45       0.0000      0.00  Q         |         |         |         |
15+50       0.0000      0.00  Q         |         |         |         |
15+55       0.0000      0.00  Q         |         |         |         |
16+ 0       0.0000      0.00  Q         |         |         |         |
16+ 5       0.0009      0.13  Q         |         |         |         |
16+10       0.0038      0.43  |QV       |         |         |         |
16+15       0.0106      0.98  |  Q  V   |         |         |         |
16+20       0.0198      1.34  |    Q    | V       |         |         |
16+25       0.0315      1.70  |     Q   |        V|         |         |
16+30       0.0440      1.82  |      Q  |         |      V  |         |
16+35       0.0517      1.11  |   Q     |         |         |V        |
16+40       0.0574      0.83  |  Q      |         |         |    V    |
16+45       0.0604      0.44  |Q        |         |         |      V  |
16+50       0.0625      0.31  |Q        |         |         |       V |
16+55       0.0637      0.17  Q         |         |         |        V|
17+ 0       0.0642      0.08  Q         |         |         |        V|
17+ 5       0.0645      0.04  Q         |         |         |        V|
```

```
17+10        0.0648       0.04  Q          |          |          |         V|
17+15        0.0650       0.04  Q          |          |          |         V|
17+20        0.0651       0.02  Q          |          |          |          V
17+25        0.0651       0.00  Q          |          |          |          V
17+30        0.0651       0.00  Q          |          |          |          V
17+35        0.0651       0.00  Q          |          |          |          V
17+40        0.0651       0.00  Q          |          |          |          V
17+45        0.0651       0.00  Q          |          |          |          V
17+50        0.0651       0.00  Q          |          |          |          V
17+55        0.0651       0.00  Q          |          |          |          V
18+ 0        0.0651       0.00  Q          |          |          |          V
18+ 5        0.0651       0.00  Q          |          |          |          V
18+10        0.0651       0.00  Q          |          |          |          V
18+15        0.0651       0.00  Q          |          |          |          V
18+20        0.0651       0.00  Q          |          |          |          V
18+25        0.0651       0.00  Q          |          |          |          V
18+30        0.0651       0.00  Q          |          |          |          V
18+35        0.0651       0.00  Q          |          |          |          V
18+40        0.0651       0.00  Q          |          |          |          V
18+45        0.0651       0.00  Q          |          |          |          V
18+50        0.0651       0.00  Q          |          |          |          V
18+55        0.0651       0.00  Q          |          |          |          V
19+ 0        0.0651       0.00  Q          |          |          |          V
19+ 5        0.0651       0.00  Q          |          |          |          V
19+10        0.0651       0.00  Q          |          |          |          V
19+15        0.0651       0.00  Q          |          |          |          V
19+20        0.0651       0.00  Q          |          |          |          V
19+25        0.0651       0.00  Q          |          |          |          V
19+30        0.0651       0.00  Q          |          |          |          V
19+35        0.0651       0.00  Q          |          |          |          V
19+40        0.0651       0.00  Q          |          |          |          V
19+45        0.0651       0.00  Q          |          |          |          V
19+50        0.0651       0.00  Q          |          |          |          V
19+55        0.0651       0.00  Q          |          |          |          V
20+ 0        0.0651       0.00  Q          |          |          |          V
20+ 5        0.0651       0.00  Q          |          |          |          V
20+10        0.0651       0.00  Q          |          |          |          V
20+15        0.0651       0.00  Q          |          |          |          V
20+20        0.0651       0.00  Q          |          |          |          V
20+25        0.0651       0.00  Q          |          |          |          V
20+30        0.0651       0.00  Q          |          |          |          V
20+35        0.0651       0.00  Q          |          |          |          V
20+40        0.0651       0.00  Q          |          |          |          V
20+45        0.0651       0.00  Q          |          |          |          V
20+50        0.0651       0.00  Q          |          |          |          V
20+55        0.0651       0.00  Q          |          |          |          V
21+ 0        0.0651       0.00  Q          |          |          |          V
21+ 5        0.0651       0.00  Q          |          |          |          V
21+10        0.0651       0.00  Q          |          |          |          V
21+15        0.0651       0.00  Q          |          |          |          V
```

```
    21+20        0.0651       0.00  Q          |          |          |         V
    21+25        0.0651       0.00  Q          |          |          |         V
    21+30        0.0651       0.00  Q          |          |          |         V
    21+35        0.0651       0.00  Q          |          |          |         V
    21+40        0.0651       0.00  Q          |          |          |         V
    21+45        0.0651       0.00  Q          |          |          |         V
    21+50        0.0651       0.00  Q          |          |          |         V
    21+55        0.0651       0.00  Q          |          |          |         V
    22+ 0        0.0651       0.00  Q          |          |          |         V
    22+ 5        0.0651       0.00  Q          |          |          |         V
    22+10        0.0651       0.00  Q          |          |          |         V
    22+15        0.0651       0.00  Q          |          |          |         V
    22+20        0.0651       0.00  Q          |          |          |         V
    22+25        0.0651       0.00  Q          |          |          |         V
    22+30        0.0651       0.00  Q          |          |          |         V
    22+35        0.0651       0.00  Q          |          |          |         V
    22+40        0.0651       0.00  Q          |          |          |         V
    22+45        0.0651       0.00  Q          |          |          |         V
    22+50        0.0651       0.00  Q          |          |          |         V
    22+55        0.0651       0.00  Q          |          |          |         V
    23+ 0        0.0651       0.00  Q          |          |          |         V
    23+ 5        0.0651       0.00  Q          |          |          |         V
    23+10        0.0651       0.00  Q          |          |          |         V
    23+15        0.0651       0.00  Q          |          |          |         V
    23+20        0.0651       0.00  Q          |          |          |         V
    23+25        0.0651       0.00  Q          |          |          |         V
    23+30        0.0651       0.00  Q          |          |          |         V
    23+35        0.0651       0.00  Q          |          |          |         V
    23+40        0.0651       0.00  Q          |          |          |         V
    23+45        0.0651       0.00  Q          |          |          |         V
    23+50        0.0651       0.00  Q          |          |          |         V
    23+55        0.0651       0.00  Q          |          |          |         V
    24+ 0        0.0651       0.00  Q          |          |          |         V
-----------------------------------------------------------------------
```

U n i t   H y d r o g r a p h   A n a l y s i s

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Study date 12/17/24

++

San Bernardino County Synthetic Unit Hydrology Method
Manual date - August 1986

Program License Serial Number 6443

EXISTING UNIT HYDROGRAPH EAST HIGHLAND RANCH
EXISTING CONDITION - BASIN 2 - DA-2
2-YR 24-HR STORM
KIMLEY-HORN

Storm Event Year = 2

Antecedent Moisture Condition = 1

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
1.98	1	0.83
Rainfall data for year 2		
1.98	6	1.24
Rainfall data for year 2		
1.98	24	2.31
Rainfall data for year 100		

```
             1.98            1           1.39
--------------------------------------------------------------------
Rainfall data for year 100
             1.98            6           2.90
--------------------------------------------------------------------
Rainfall data for year 100
             1.98           24           5.46
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** Area-averaged max loss rate, Fm ********


SCS curve  SCS curve     Area     Area     Fp(Fig C6)    Ap      Fm
No.(AMCII) NO.(AMC 1)    (Ac.)    Fraction     (In/Hr)  (dec.)   (In/Hr)
 50.0      31.0          1.98      1.000     0.983    1.000    0.983

Area-averaged adjusted loss rate Fm (In/Hr) =  0.983

********* Area-Averaged low loss rate fraction, Yb **********

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     1.98   1.000         50.0      31.0      11.55     0.000

Area-averaged catchment yield fraction, Y =  0.000
Area-averaged low loss fraction, Yb =  1.000
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.98(Ac.)
Catchment Lag time =   0.155 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 53.8329
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.983(In/Hr)
Average low loss rate fraction (Yb) = 1.000 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.160(In)
Computed peak 30-minute rainfall =  0.329(In)
Specified peak 1-hour rainfall =  0.433(In)
Computed peak 3-hour rainfall =  0.826(In)
Specified peak 6-hour rainfall =  1.240(In)
Specified peak 24-hour rainfall =  2.310(In)


Rainfall depth area reduction factors:
Using a total area of       1.98(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.160(In)
30-minute factor = 1.000    Adjusted rainfall =  0.328(In)
```

```
1-hour factor = 1.000       Adjusted rainfall =  0.433(In)
3-hour factor = 1.000       Adjusted rainfall =  0.826(In)
6-hour factor = 1.000       Adjusted rainfall =  1.240(In)
24-hour factor = 1.000      Adjusted rainfall =  2.310(In)
---------------------------------------------------------------------

                        U n i t  H y d r o g r a p h
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval            'S' Graph           Unit Hydrograph
Number              Mean values              ((CFS))
---------------------------------------------------------------------
                 (K =        23.95 (CFS))

  1                  5.278                     1.264
  2                 34.177                     6.920
  3                 74.562                     9.671
  4                 92.589                     4.317
  5                 97.915                     1.275
  6                 99.129                     0.291
  7                100.000                     0.208
---------------------------------------------------------------------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      2.23(In)
Total effective rainfall =      0.08(In)
Peak flow rate in flood hydrograph =      0.76(CFS)
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f      H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft    Q(CFS)  0        2.5       5.0       7.5      10.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
  0+15       0.0000      0.00  Q         |         |         |         |
  0+20       0.0000      0.00  Q         |         |         |         |
  0+25       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+35       0.0000      0.00  Q         |         |         |         |
  0+40       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  0+50       0.0000      0.00  Q         |         |         |         |
  0+55       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+ 5       0.0000      0.00  Q         |         |         |         |
  1+10       0.0000      0.00  Q         |         |         |         |
```

```
 1+15        0.0000       0.00  Q          |          |          |          |
 1+20        0.0000       0.00  Q          |          |          |          |
 1+25        0.0000       0.00  Q          |          |          |          |
 1+30        0.0000       0.00  Q          |          |          |          |
 1+35        0.0000       0.00  Q          |          |          |          |
 1+40        0.0000       0.00  Q          |          |          |          |
 1+45        0.0000       0.00  Q          |          |          |          |
 1+50        0.0000       0.00  Q          |          |          |          |
 1+55        0.0000       0.00  Q          |          |          |          |
 2+ 0        0.0000       0.00  Q          |          |          |          |
 2+ 5        0.0000       0.00  Q          |          |          |          |
 2+10        0.0000       0.00  Q          |          |          |          |
 2+15        0.0000       0.00  Q          |          |          |          |
 2+20        0.0000       0.00  Q          |          |          |          |
 2+25        0.0000       0.00  Q          |          |          |          |
 2+30        0.0000       0.00  Q          |          |          |          |
 2+35        0.0000       0.00  Q          |          |          |          |
 2+40        0.0000       0.00  Q          |          |          |          |
 2+45        0.0000       0.00  Q          |          |          |          |
 2+50        0.0000       0.00  Q          |          |          |          |
 2+55        0.0000       0.00  Q          |          |          |          |
 3+ 0        0.0000       0.00  Q          |          |          |          |
 3+ 5        0.0000       0.00  Q          |          |          |          |
 3+10        0.0000       0.00  Q          |          |          |          |
 3+15        0.0000       0.00  Q          |          |          |          |
 3+20        0.0000       0.00  Q          |          |          |          |
 3+25        0.0000       0.00  Q          |          |          |          |
 3+30        0.0000       0.00  Q          |          |          |          |
 3+35        0.0000       0.00  Q          |          |          |          |
 3+40        0.0000       0.00  Q          |          |          |          |
 3+45        0.0000       0.00  Q          |          |          |          |
 3+50        0.0000       0.00  Q          |          |          |          |
 3+55        0.0000       0.00  Q          |          |          |          |
 4+ 0        0.0000       0.00  Q          |          |          |          |
 4+ 5        0.0000       0.00  Q          |          |          |          |
 4+10        0.0000       0.00  Q          |          |          |          |
 4+15        0.0000       0.00  Q          |          |          |          |
 4+20        0.0000       0.00  Q          |          |          |          |
 4+25        0.0000       0.00  Q          |          |          |          |
 4+30        0.0000       0.00  Q          |          |          |          |
 4+35        0.0000       0.00  Q          |          |          |          |
 4+40        0.0000       0.00  Q          |          |          |          |
 4+45        0.0000       0.00  Q          |          |          |          |
 4+50        0.0000       0.00  Q          |          |          |          |
 4+55        0.0000       0.00  Q          |          |          |          |
 5+ 0        0.0000       0.00  Q          |          |          |          |
 5+ 5        0.0000       0.00  Q          |          |          |          |
 5+10        0.0000       0.00  Q          |          |          |          |
 5+15        0.0000       0.00  Q          |          |          |          |
 5+20        0.0000       0.00  Q          |          |          |          |
```

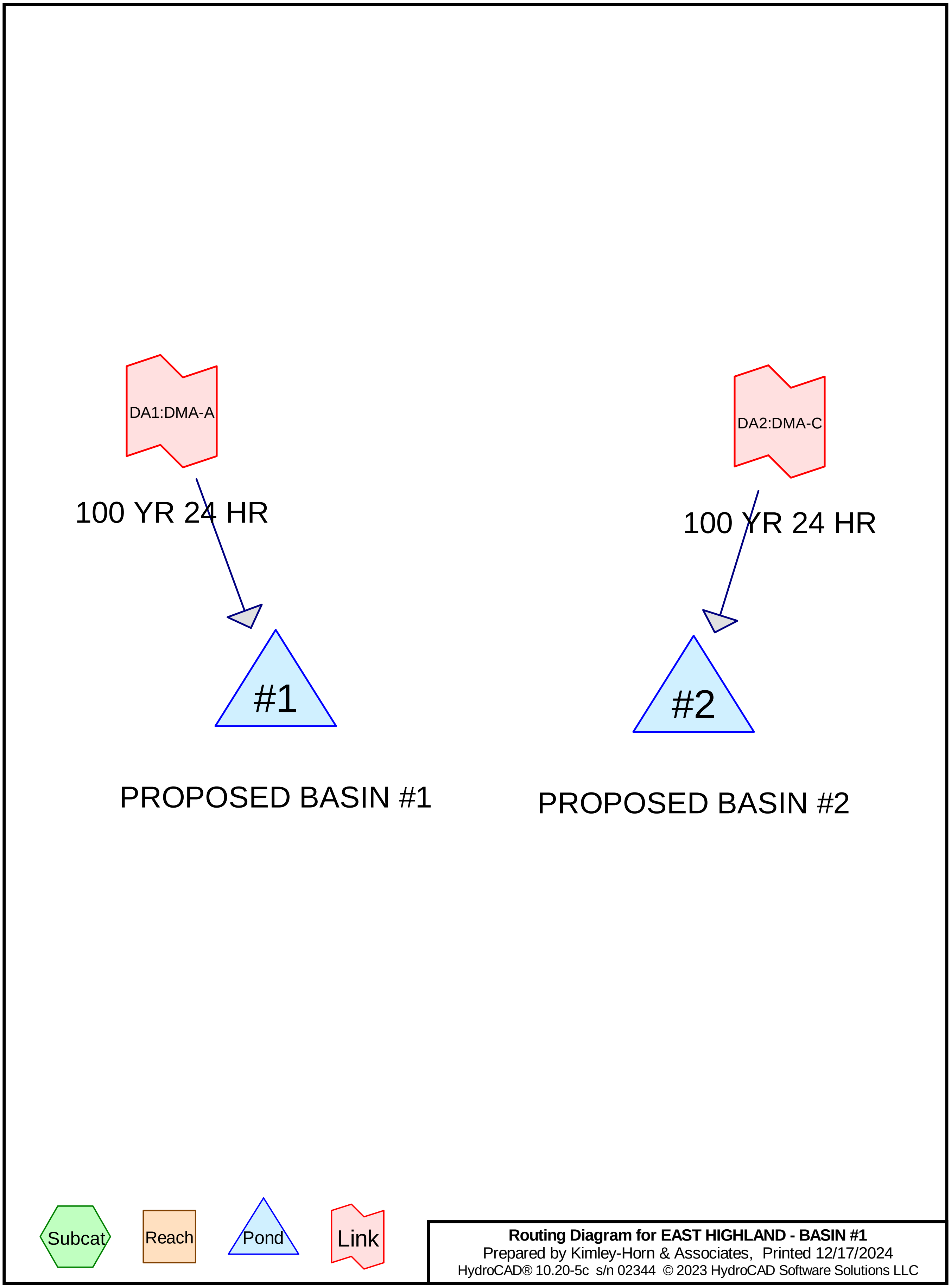
5+25	0.0000	0.00	Q	|	|	|	|
5+30	0.0000	0.00	Q	|	|	|	|
5+35	0.0000	0.00	Q	|	|	|	|
5+40	0.0000	0.00	Q	|	|	|	|
5+45	0.0000	0.00	Q	|	|	|	|
5+50	0.0000	0.00	Q	|	|	|	|
5+55	0.0000	0.00	Q	|	|	|	|
6+ 0	0.0000	0.00	Q	|	|	|	|
6+ 5	0.0000	0.00	Q	|	|	|	|
6+10	0.0000	0.00	Q	|	|	|	|
6+15	0.0000	0.00	Q	|	|	|	|
6+20	0.0000	0.00	Q	|	|	|	|
6+25	0.0000	0.00	Q	|	|	|	|
6+30	0.0000	0.00	Q	|	|	|	|
6+35	0.0000	0.00	Q	|	|	|	|
6+40	0.0000	0.00	Q	|	|	|	|
6+45	0.0000	0.00	Q	|	|	|	|
6+50	0.0000	0.00	Q	|	|	|	|
6+55	0.0000	0.00	Q	|	|	|	|
7+ 0	0.0000	0.00	Q	|	|	|	|
7+ 5	0.0000	0.00	Q	|	|	|	|
7+10	0.0000	0.00	Q	|	|	|	|
7+15	0.0000	0.00	Q	|	|	|	|
7+20	0.0000	0.00	Q	|	|	|	|
7+25	0.0000	0.00	Q	|	|	|	|
7+30	0.0000	0.00	Q	|	|	|	|
7+35	0.0000	0.00	Q	|	|	|	|
7+40	0.0000	0.00	Q	|	|	|	|
7+45	0.0000	0.00	Q	|	|	|	|
7+50	0.0000	0.00	Q	|	|	|	|
7+55	0.0000	0.00	Q	|	|	|	|
8+ 0	0.0000	0.00	Q	|	|	|	|
8+ 5	0.0000	0.00	Q	|	|	|	|
8+10	0.0000	0.00	Q	|	|	|	|
8+15	0.0000	0.00	Q	|	|	|	|
8+20	0.0000	0.00	Q	|	|	|	|
8+25	0.0000	0.00	Q	|	|	|	|
8+30	0.0000	0.00	Q	|	|	|	|
8+35	0.0000	0.00	Q	|	|	|	|
8+40	0.0000	0.00	Q	|	|	|	|
8+45	0.0000	0.00	Q	|	|	|	|
8+50	0.0000	0.00	Q	|	|	|	|
8+55	0.0000	0.00	Q	|	|	|	|
9+ 0	0.0000	0.00	Q	|	|	|	|
9+ 5	0.0000	0.00	Q	|	|	|	|
9+10	0.0000	0.00	Q	|	|	|	|
9+15	0.0000	0.00	Q	|	|	|	|
9+20	0.0000	0.00	Q	|	|	|	|
9+25	0.0000	0.00	Q	|	|	|	|
9+30	0.0000	0.00	Q	|	|	|	|

9+35	0.0000	0.00	Q				
9+40	0.0000	0.00	Q				
9+45	0.0000	0.00	Q				
9+50	0.0000	0.00	Q				
9+55	0.0000	0.00	Q				
10+ 0	0.0000	0.00	Q				
10+ 5	0.0000	0.00	Q				
10+10	0.0000	0.00	Q				
10+15	0.0000	0.00	Q				
10+20	0.0000	0.00	Q				
10+25	0.0000	0.00	Q				
10+30	0.0000	0.00	Q				
10+35	0.0000	0.00	Q				
10+40	0.0000	0.00	Q				
10+45	0.0000	0.00	Q				
10+50	0.0000	0.00	Q				
10+55	0.0000	0.00	Q				
11+ 0	0.0000	0.00	Q				
11+ 5	0.0000	0.00	Q				
11+10	0.0000	0.00	Q				
11+15	0.0000	0.00	Q				
11+20	0.0000	0.00	Q				
11+25	0.0000	0.00	Q				
11+30	0.0000	0.00	Q				
11+35	0.0000	0.00	Q				
11+40	0.0000	0.00	Q				
11+45	0.0000	0.00	Q				
11+50	0.0000	0.00	Q				
11+55	0.0000	0.00	Q				
12+ 0	0.0000	0.00	Q				
12+ 5	0.0000	0.00	Q				
12+10	0.0000	0.00	Q				
12+15	0.0000	0.00	Q				
12+20	0.0000	0.00	Q				
12+25	0.0000	0.00	Q				
12+30	0.0000	0.00	Q				
12+35	0.0000	0.00	Q				
12+40	0.0000	0.00	Q				
12+45	0.0000	0.00	Q				
12+50	0.0000	0.00	Q				
12+55	0.0000	0.00	Q				
13+ 0	0.0000	0.00	Q				
13+ 5	0.0000	0.00	Q				
13+10	0.0000	0.00	Q				
13+15	0.0000	0.00	Q				
13+20	0.0000	0.00	Q				
13+25	0.0000	0.00	Q				
13+30	0.0000	0.00	Q				
13+35	0.0000	0.00	Q				
13+40	0.0000	0.00	Q				

```
13+45       0.0000      0.00  Q         |         |         |         |
13+50       0.0000      0.00  Q         |         |         |         |
13+55       0.0000      0.00  Q         |         |         |         |
14+ 0       0.0000      0.00  Q         |         |         |         |
14+ 5       0.0000      0.00  Q         |         |         |         |
14+10       0.0000      0.00  Q         |         |         |         |
14+15       0.0000      0.00  Q         |         |         |         |
14+20       0.0000      0.00  Q         |         |         |         |
14+25       0.0000      0.00  Q         |         |         |         |
14+30       0.0000      0.00  Q         |         |         |         |
14+35       0.0000      0.00  Q         |         |         |         |
14+40       0.0000      0.00  Q         |         |         |         |
14+45       0.0000      0.00  Q         |         |         |         |
14+50       0.0000      0.00  Q         |         |         |         |
14+55       0.0000      0.00  Q         |         |         |         |
15+ 0       0.0000      0.00  Q         |         |         |         |
15+ 5       0.0000      0.00  Q         |         |         |         |
15+10       0.0000      0.00  Q         |         |         |         |
15+15       0.0000      0.00  Q         |         |         |         |
15+20       0.0000      0.00  Q         |         |         |         |
15+25       0.0000      0.00  Q         |         |         |         |
15+30       0.0000      0.00  Q         |         |         |         |
15+35       0.0000      0.00  Q         |         |         |         |
15+40       0.0000      0.00  Q         |         |         |         |
15+45       0.0000      0.00  Q         |         |         |         |
15+50       0.0000      0.00  Q         |         |         |         |
15+55       0.0000      0.00  Q         |         |         |         |
16+ 0       0.0000      0.00  Q         |         |         |         |
16+ 5       0.0007      0.10  Q V       |         |         |         |
16+10       0.0044      0.54  | Q          V      |         |         |
16+15       0.0097      0.76  |  Q      |         |        V|         |
16+20       0.0120      0.34  |Q        |         |         |      V  |
16+25       0.0127      0.10  Q         |         |         |        V|
16+30       0.0128      0.02  Q         |         |         |        V|
16+35       0.0129      0.02  Q         |         |         |        V|
16+40       0.0129      0.00  Q         |         |         |        V|
16+45       0.0129      0.00  Q         |         |         |        V|
16+50       0.0129      0.00  Q         |         |         |        V|
16+55       0.0129      0.00  Q         |         |         |        V|
17+ 0       0.0129      0.00  Q         |         |         |        V|
17+ 5       0.0129      0.00  Q         |         |         |        V|
17+10       0.0129      0.00  Q         |         |         |        V|
17+15       0.0129      0.00  Q         |         |         |        V|
17+20       0.0129      0.00  Q         |         |         |        V|
17+25       0.0129      0.00  Q         |         |         |        V|
17+30       0.0129      0.00  Q         |         |         |        V|
17+35       0.0129      0.00  Q         |         |         |        V|
17+40       0.0129      0.00  Q         |         |         |        V|
17+45       0.0129      0.00  Q         |         |         |        V|
17+50       0.0129      0.00  Q         |         |         |        V|
```

17+55	0.0129	0.00	Q	|	|	|	V|
18+ 0	0.0129	0.00	Q	|	|	|	V|
18+ 5	0.0129	0.00	Q	|	|	|	V|
18+10	0.0129	0.00	Q	|	|	|	V|
18+15	0.0129	0.00	Q	|	|	|	V|
18+20	0.0129	0.00	Q	|	|	|	V|
18+25	0.0129	0.00	Q	|	|	|	V|
18+30	0.0129	0.00	Q	|	|	|	V|
18+35	0.0129	0.00	Q	|	|	|	V|
18+40	0.0129	0.00	Q	|	|	|	V|
18+45	0.0129	0.00	Q	|	|	|	V|
18+50	0.0129	0.00	Q	|	|	|	V|
18+55	0.0129	0.00	Q	|	|	|	V|
19+ 0	0.0129	0.00	Q	|	|	|	V|
19+ 5	0.0129	0.00	Q	|	|	|	V|
19+10	0.0129	0.00	Q	|	|	|	V|
19+15	0.0129	0.00	Q	|	|	|	V|
19+20	0.0129	0.00	Q	|	|	|	V|
19+25	0.0129	0.00	Q	|	|	|	V|
19+30	0.0129	0.00	Q	|	|	|	V|
19+35	0.0129	0.00	Q	|	|	|	V|
19+40	0.0129	0.00	Q	|	|	|	V|
19+45	0.0129	0.00	Q	|	|	|	V|
19+50	0.0129	0.00	Q	|	|	|	V|
19+55	0.0129	0.00	Q	|	|	|	V|
20+ 0	0.0129	0.00	Q	|	|	|	V|
20+ 5	0.0129	0.00	Q	|	|	|	V|
20+10	0.0129	0.00	Q	|	|	|	V|
20+15	0.0129	0.00	Q	|	|	|	V|
20+20	0.0129	0.00	Q	|	|	|	V|
20+25	0.0129	0.00	Q	|	|	|	V|
20+30	0.0129	0.00	Q	|	|	|	V|
20+35	0.0129	0.00	Q	|	|	|	V|
20+40	0.0129	0.00	Q	|	|	|	V|
20+45	0.0129	0.00	Q	|	|	|	V|
20+50	0.0129	0.00	Q	|	|	|	V|
20+55	0.0129	0.00	Q	|	|	|	V|
21+ 0	0.0129	0.00	Q	|	|	|	V|
21+ 5	0.0129	0.00	Q	|	|	|	V|
21+10	0.0129	0.00	Q	|	|	|	V|
21+15	0.0129	0.00	Q	|	|	|	V|
21+20	0.0129	0.00	Q	|	|	|	V|
21+25	0.0129	0.00	Q	|	|	|	V|
21+30	0.0129	0.00	Q	|	|	|	V|
21+35	0.0129	0.00	Q	|	|	|	V|
21+40	0.0129	0.00	Q	|	|	|	V|
21+45	0.0129	0.00	Q	|	|	|	V|
21+50	0.0129	0.00	Q	|	|	|	V|
21+55	0.0129	0.00	Q	|	|	|	V|
22+ 0	0.0129	0.00	Q	|	|	|	V|

```
   22+ 5        0.0129      0.00  Q          |          |          |        V|
   22+10        0.0129      0.00  Q          |          |          |        V|
   22+15        0.0129      0.00  Q          |          |          |        V|
   22+20        0.0129      0.00  Q          |          |          |        V|
   22+25        0.0129      0.00  Q          |          |          |        V|
   22+30        0.0129      0.00  Q          |          |          |        V|
   22+35        0.0129      0.00  Q          |          |          |        V|
   22+40        0.0129      0.00  Q          |          |          |        V|
   22+45        0.0129      0.00  Q          |          |          |        V|
   22+50        0.0129      0.00  Q          |          |          |        V|
   22+55        0.0129      0.00  Q          |          |          |        V|
   23+ 0        0.0129      0.00  Q          |          |          |        V|
   23+ 5        0.0129      0.00  Q          |          |          |        V|
   23+10        0.0129      0.00  Q          |          |          |        V|
   23+15        0.0129      0.00  Q          |          |          |        V|
   23+20        0.0129      0.00  Q          |          |          |        V|
   23+25        0.0129      0.00  Q          |          |          |        V|
   23+30        0.0129      0.00  Q          |          |          |        V|
   23+35        0.0129      0.00  Q          |          |          |        V|
   23+40        0.0129      0.00  Q          |          |          |        V|
   23+45        0.0129      0.00  Q          |          |          |        V|
   23+50        0.0129      0.00  Q          |          |          |        V|
   23+55        0.0129      0.00  Q          |          |          |        V|
   24+ 0        0.0129      0.00  Q          |          |          |        V|
-----------------------------------------------------------------------
```



Routing Diagram for EAST HIGHLAND - BASIN #1
Prepared by Kimley-Horn & Associates, Printed 12/17/2024
HydroCAD® 10.20-5c s/n 02344 © 2023 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond #1: PROPOSED BASIN #1 Peak Elev=1,445.56' Storage=28,641 cf Inflow=16.10 cfs 2.944 af
Primary=15.26 cfs 2.429 af Secondary=0.00 cfs 0.000 af Outflow=15.26 cfs 2.429 af

Pond #2: PROPOSED BASIN #2 Peak Elev=1,455.48' Storage=3,819 cf Inflow=2.50 cfs 0.343 af
Primary=2.28 cfs 0.270 af Secondary=0.00 cfs 0.000 af Outflow=2.28 cfs 0.270 af

Link 09 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND10024-15min.csv Inflow=16.10 cfs 2.944 af
Primary=16.10 cfs 2.944 af

Link 009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND10024-15min.csv Inflow=2.50 cfs 0.343 af
Primary=2.50 cfs 0.343 af

Summary for Pond #1: PROPOSED BASIN #1

Inflow	=	16.10 cfs @	16.48 hrs,	Volume=	2.944 af
Outflow	=	15.26 cfs @	16.51 hrs,	Volume=	2.429 af, Atten= 5%, Lag= 1.6 min
Primary	=	15.26 cfs @	16.51 hrs,	Volume=	2.429 af
Secondary	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,445.56' @ 16.51 hrs Surf.Area= 12,949 sf Storage= 28,641 cf

Plug-Flow detention time= 204.6 min calculated for 2.424 af (82% of inflow)
Center-of-Mass det. time= 124.5 min (960.6 - 836.1)

Volume	Invert	Avail.Storage	Storage Description
#1	1,443.00'	56,451 cf	**BASIN #1 (Prismatic)** Listed below (Recalc)

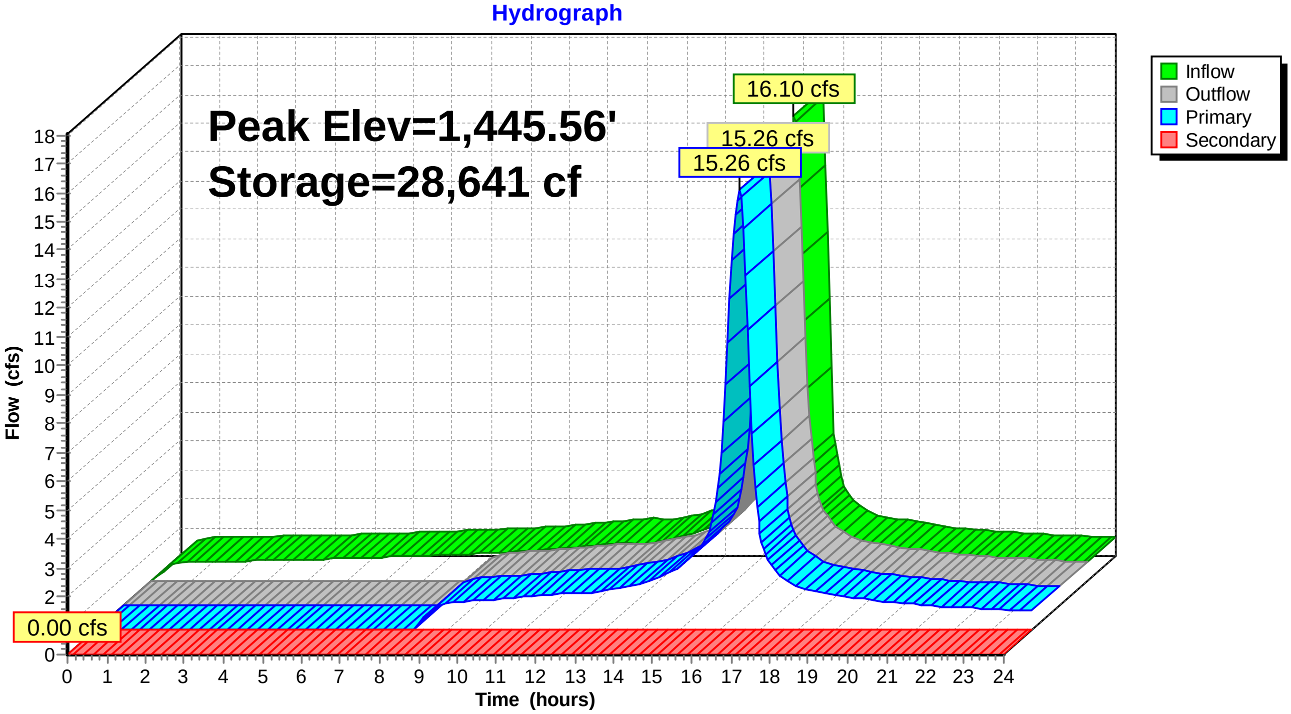
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,443.00	9,444	0	0
1,444.00	10,764	10,104	10,104
1,445.00	12,140	11,452	21,556
1,446.00	13,572	12,856	34,412
1,447.00	15,062	14,317	48,729
1,447.50	15,827	7,722	56,451

Device	Routing	Invert	Outlet Devices
#1	Primary	1,445.00'	**42.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1,447.00'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=15.23 cfs @ 16.51 hrs HW=1,445.56' (Free Discharge)
└─**1=Orifice/Grate** (Weir Controls 15.23 cfs @ 2.46 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,443.00' (Free Discharge)
└─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond #1: PROPOSED BASIN #1



Summary for Pond #2: PROPOSED BASIN #2

Inflow =	2.50 cfs @	16.25 hrs,	Volume=	0.343 af
Outflow =	2.28 cfs @	16.31 hrs,	Volume=	0.270 af, Atten= 9%, Lag= 3.2 min
Primary =	2.28 cfs @	16.31 hrs,	Volume=	0.270 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,455.48' @ 16.31 hrs Surf.Area= 2,577 sf Storage= 3,819 cf

Plug-Flow detention time= 232.4 min calculated for 0.269 af (79% of inflow)
Center-of-Mass det. time= 142.0 min (979.2 - 837.2)

Volume	Invert	Avail.Storage	Storage Description
#1	1,453.60'	10,763 cf	**BASIN #2 (Prismatic)** Listed below (Recalc)

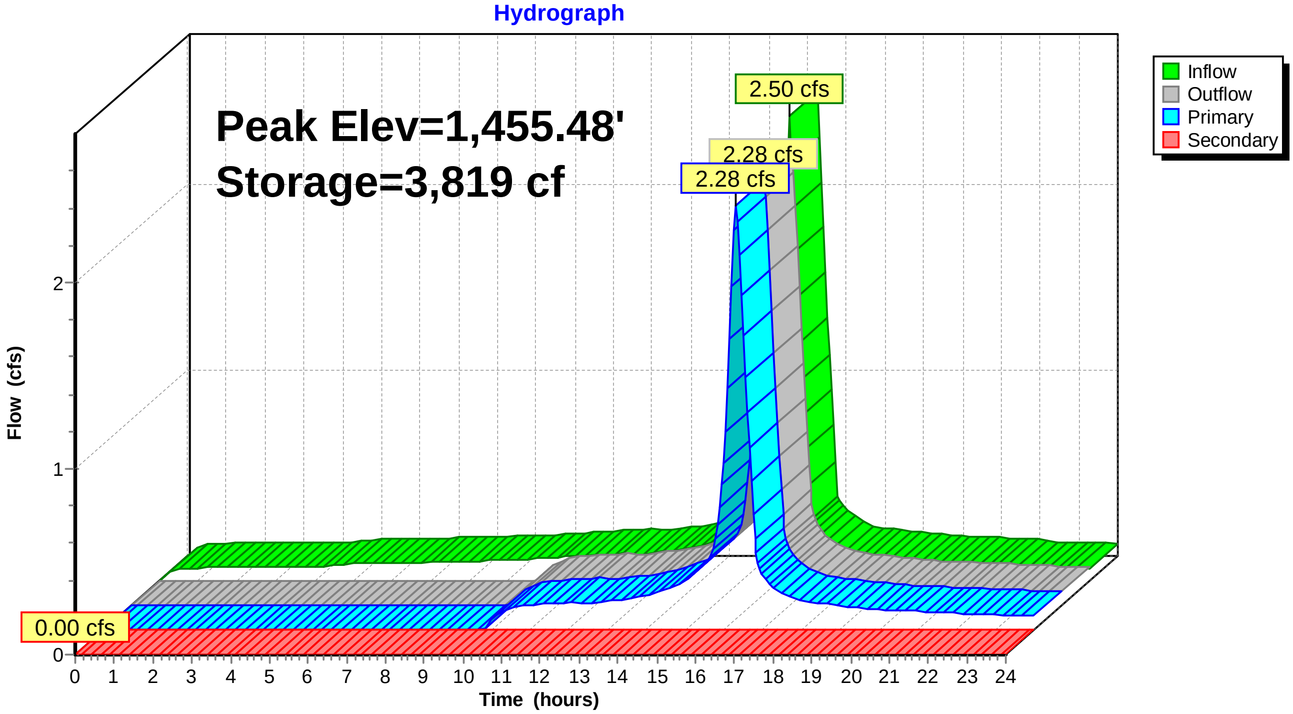
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,453.60	1,513	0	0
1,454.60	2,052	1,783	1,783
1,455.60	2,648	2,350	4,133
1,456.60	3,301	2,975	7,107
1,457.60	4,010	3,656	10,763

Device	Routing	Invert	Outlet Devices
#1	Primary	1,455.20'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1,456.10'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=2.27 cfs @ 16.31 hrs HW=1,455.48' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 2.27 cfs @ 1.73 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,453.60' (Free Discharge)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond #2: PROPOSED BASIN #2



Summary for Link DA1:DMA-A: 100 YR 24 HR

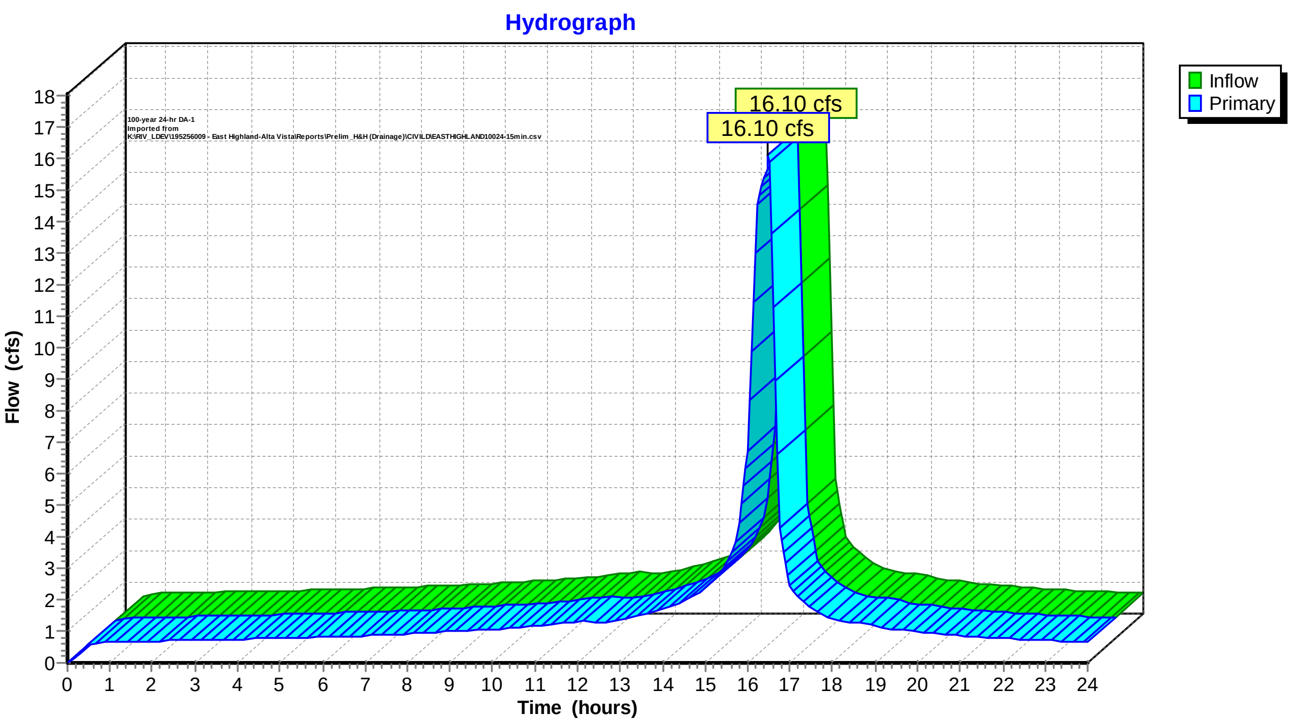
Inflow	=	16.10 cfs @	16.48 hrs,	Volume=	2.944 af
Primary	=	16.10 cfs @	16.48 hrs,	Volume=	2.944 af, Atten= 0%, Lag= 0.0 min

Routed to Pond #1 : PROPOSED BASIN #1

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

100-year 24-hr DA-1 Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)

Link DA1:DMA-A: 100 YR 24 HR



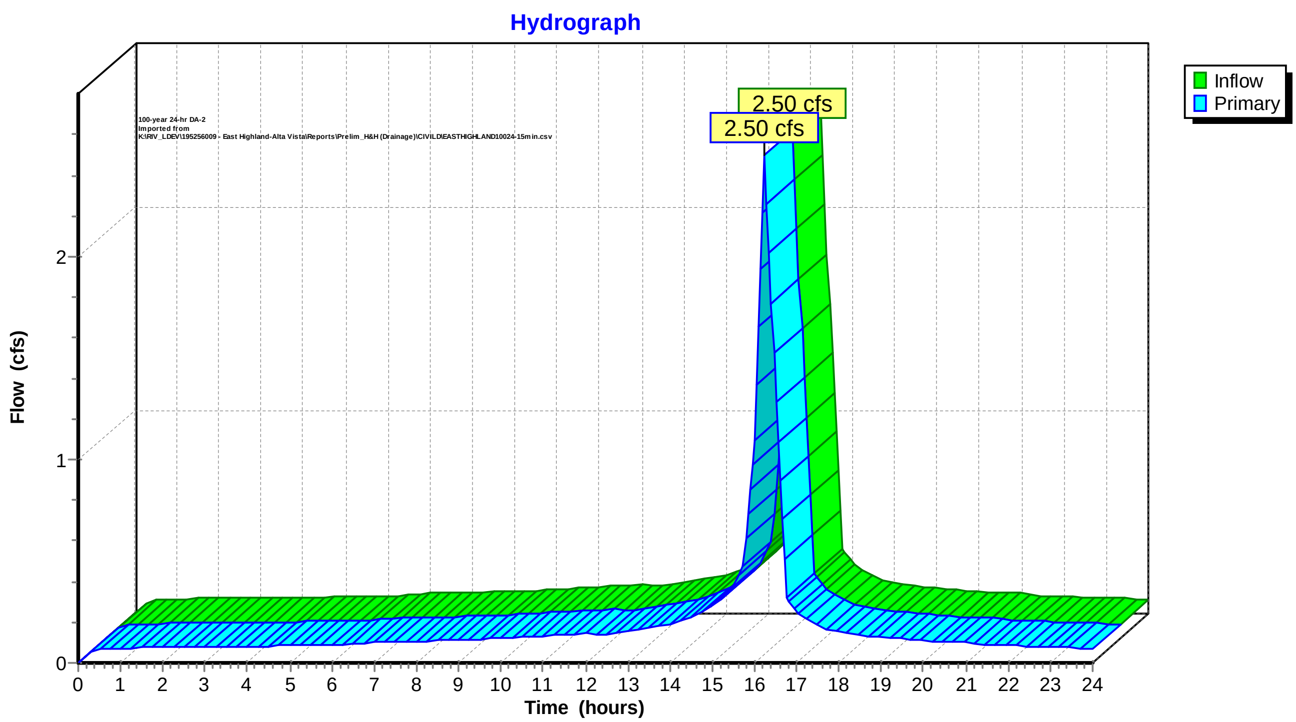
Summary for Link DA2:DMA-C: 100 YR 24 HR

Inflow = 2.50 cfs @ 16.25 hrs, Volume= 0.343 af
Primary = 2.50 cfs @ 16.25 hrs, Volume= 0.343 af, Atten= 0%, Lag= 0.0 min
Routed to Pond #2 : PROPOSED BASIN #2

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

100-year 24-hr DA-2 Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)

Link DA2:DMA-C: 100 YR 24 HR



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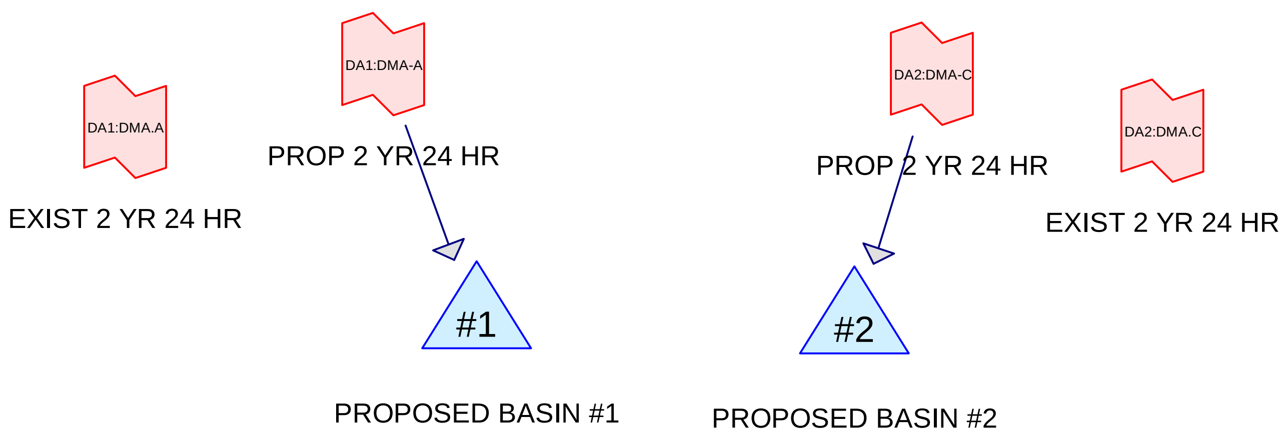
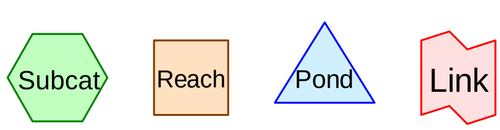




Routing Diagram for EAST HIGHLAND - 2 YR BASIN #1&2
Prepared by Kimley-Horn & Associates, Printed 12/17/2024
HydroCAD® 10.20-5c s/n 02344 © 2023 HydroCAD Software Solutions LLC

Time span=0.00-24.00 hrs, dt=0.05 hrs, 481 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Pond #1: PROPOSED BASIN #1 Peak Elev=1,445.28' Storage=25,005 cf Inflow=7.34 cfs 1.015 af
Primary=5.32 cfs 0.511 af Secondary=0.00 cfs 0.000 af Outflow=5.32 cfs 0.511 af

Pond #2: PROPOSED BASIN #2 Peak Elev=1,455.36' Storage=3,515 cf Inflow=1.18 cfs 0.142 af
Primary=0.99 cfs 0.070 af Secondary=0.00 cfs 0.000 af Outflow=0.99 cfs 0.070 af

Link 56009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND 2_24-5min.csv Inflow=7.34 cfs 1.015 af
Primary=7.34 cfs 1.015 af

Link 56009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND 2_24-5min.csv Inflow=1.85 cfs 0.065 af
Primary=1.85 cfs 0.065 af

Link 56009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND 2_24-5min.csv Inflow=1.18 cfs 0.142 af
Primary=1.18 cfs 0.142 af

Link 56009 - East Highland-Alta Vista\Reports\Prelim_H&H (Drainage)\CIVILD\EASTHIGHLAND 2_24-5min.csv Inflow=0.76 cfs 0.013 af
Primary=0.76 cfs 0.013 af

Summary for Pond #1: PROPOSED BASIN #1

Inflow =	7.34 cfs @	16.23 hrs,	Volume=	1.015 af
Outflow =	5.32 cfs @	16.29 hrs,	Volume=	0.511 af, Atten= 27%, Lag= 4.1 min
Primary =	5.32 cfs @	16.29 hrs,	Volume=	0.511 af
Secondary =	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,445.28' @ 16.29 hrs Surf.Area= 12,540 sf Storage= 25,005 cf

Plug-Flow detention time= 485.5 min calculated for 0.511 af (50% of inflow)
Center-of-Mass det. time= 248.4 min (1,071.1 - 822.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,443.00'	56,451 cf	**BASIN #1 (Prismatic)** Listed below (Recalc)

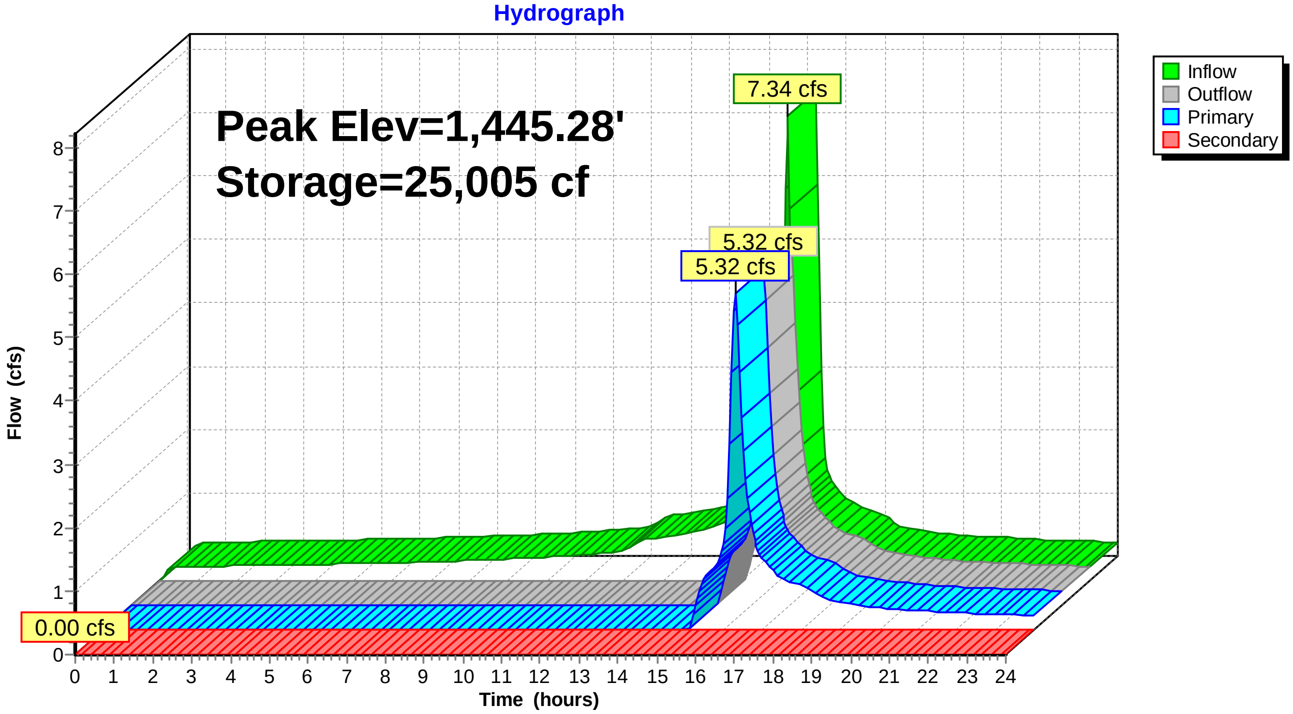
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,443.00	9,444	0	0
1,444.00	10,764	10,104	10,104
1,445.00	12,140	11,452	21,556
1,446.00	13,572	12,856	34,412
1,447.00	15,062	14,317	48,729
1,447.50	15,827	7,722	56,451

Device	Routing	Invert	Outlet Devices
#1	Primary	1,445.00'	**42.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1,447.00'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=5.27 cfs @ 16.29 hrs HW=1,445.28' (Free Discharge)
└─**1=Orifice/Grate** (Weir Controls 5.27 cfs @ 1.72 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,443.00' (Free Discharge)
└─**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond #1: PROPOSED BASIN #1



Summary for Pond #2: PROPOSED BASIN #2

Inflow	=	1.18 cfs @	16.22 hrs,	Volume=	0.142 af
Outflow	=	0.99 cfs @	16.27 hrs,	Volume=	0.070 af, Atten= 16%, Lag= 3.0 min
Primary	=	0.99 cfs @	16.27 hrs,	Volume=	0.070 af
Secondary	=	0.00 cfs @	0.00 hrs,	Volume=	0.000 af

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs
Peak Elev= 1,455.36' @ 16.27 hrs Surf.Area= 2,505 sf Storage= 3,515 cf

Plug-Flow detention time= 480.8 min calculated for 0.070 af (49% of inflow)
Center-of-Mass det. time= 242.6 min (1,070.6 - 828.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,453.60'	10,763 cf	**BASIN #2 (Prismatic)** Listed below (Recalc)

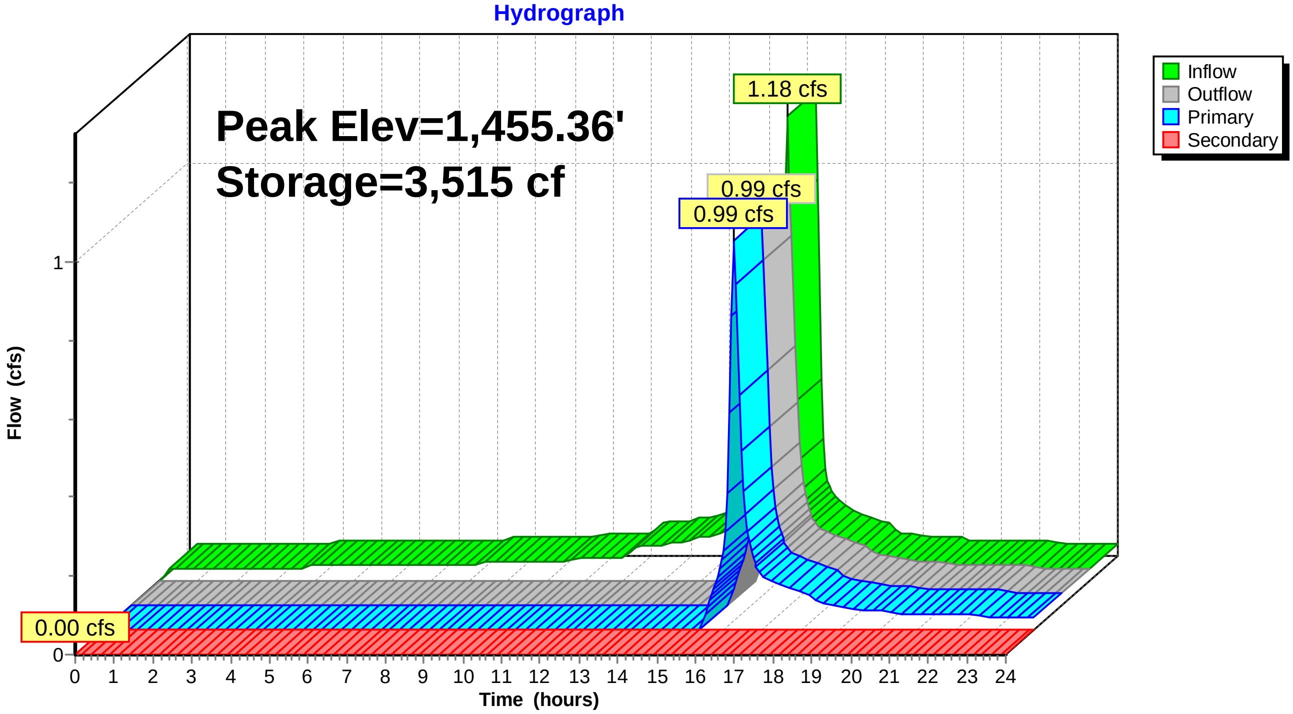
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,453.60	1,513	0	0
1,454.60	2,052	1,783	1,783
1,455.60	2,648	2,350	4,133
1,456.60	3,301	2,975	7,107
1,457.60	4,010	3,656	10,763

Device	Routing	Invert	Outlet Devices
#1	Primary	1,455.20'	**18.0" Horiz. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#2	Secondary	1,456.10'	**5.0' long Sharp-Crested Rectangular Weir** 2 End Contraction(s)

Primary OutFlow Max=0.97 cfs @ 16.27 hrs HW=1,455.36' (Free Discharge)
↑—**1=Orifice/Grate** (Weir Controls 0.97 cfs @ 1.30 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=1,453.60' (Free Discharge)
↑—**2=Sharp-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond #2: PROPOSED BASIN #2

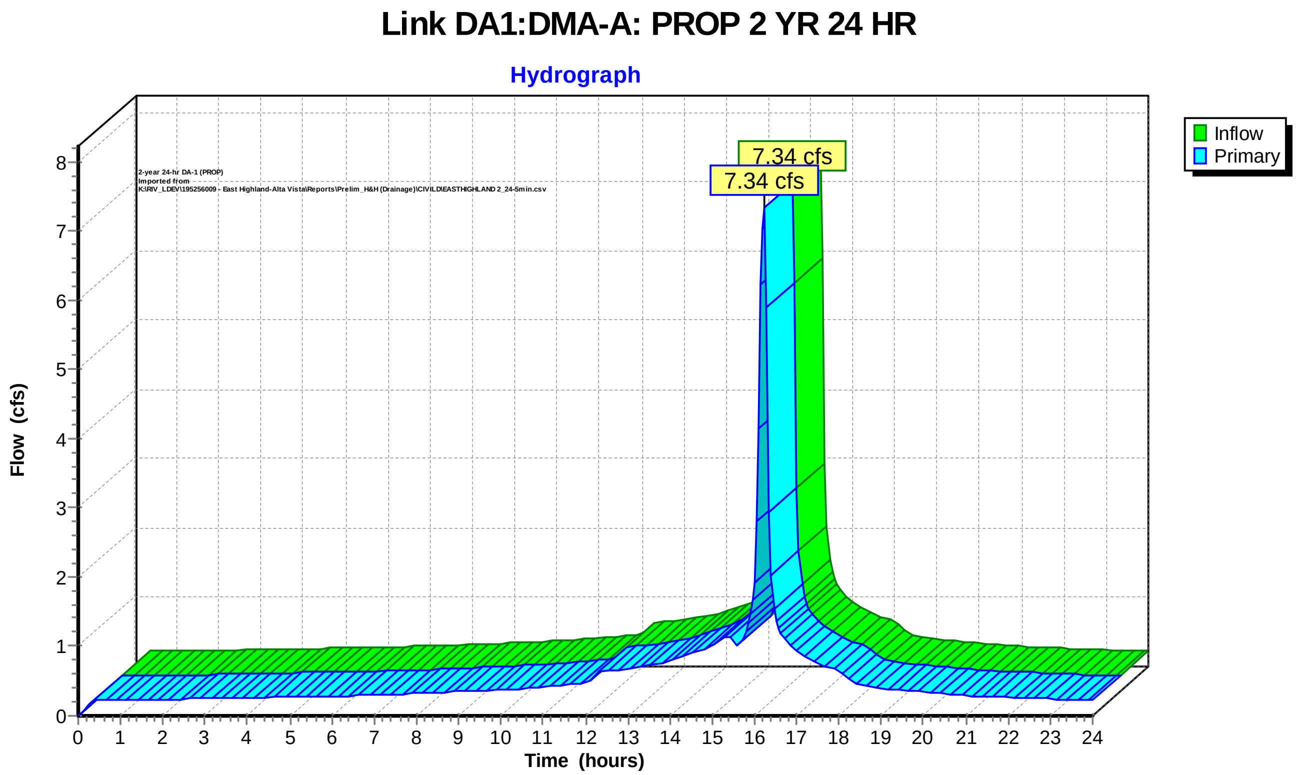


Summary for Link DA1:DMA-A: PROP 2 YR 24 HR

Inflow = 7.34 cfs @ 16.23 hrs, Volume= 1.015 af
Primary = 7.34 cfs @ 16.23 hrs, Volume= 1.015 af, Atten= 0%, Lag= 0.0 min
Routed to Pond #1 : PROPOSED BASIN #1

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

2-year 24-hr DA-1 (PROP) Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Dra

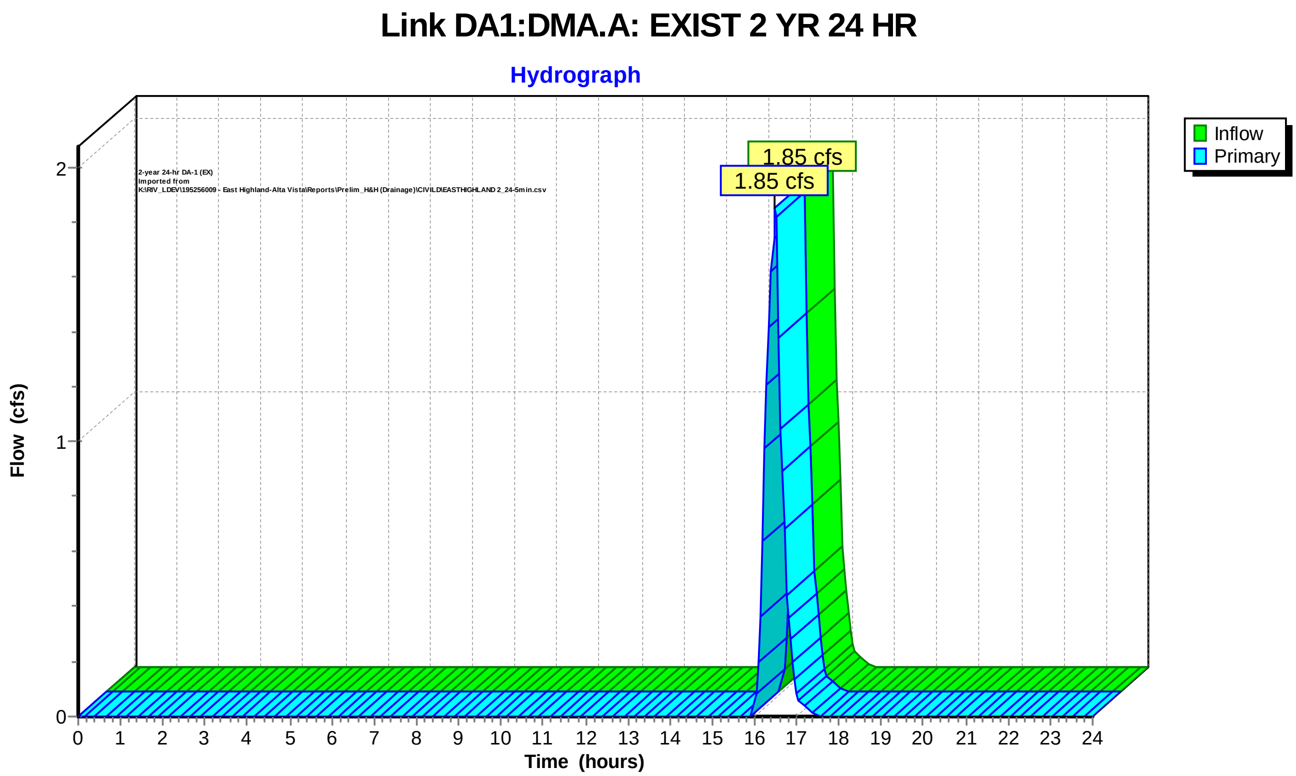


Summary for Link DA1:DMA.A: EXIST 2 YR 24 HR

Inflow	=	1.85 cfs @	16.48 hrs, Volume=	0.065 af
Primary	=	1.85 cfs @	16.48 hrs, Volume=	0.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

2-year 24-hr DA-1 (EX) Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Draina



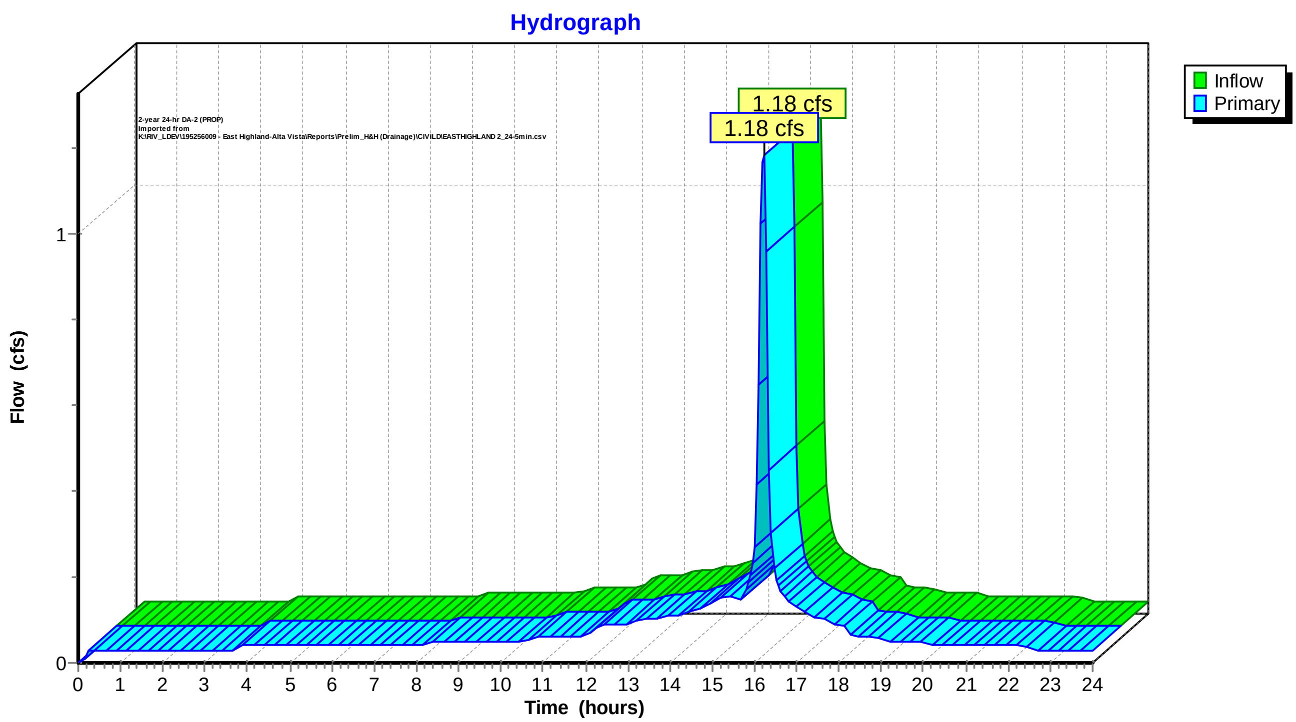
Summary for Link DA2:DMA-C: PROP 2 YR 24 HR

Inflow = 1.18 cfs @ 16.22 hrs, Volume= 0.142 af
Primary = 1.18 cfs @ 16.22 hrs, Volume= 0.142 af, Atten= 0%, Lag= 0.0 min
Routed to Pond #2 : PROPOSED BASIN #2

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

2-year 24-hr DA-2 (PROP) Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Dra

Link DA2:DMA-C: PROP 2 YR 24 HR

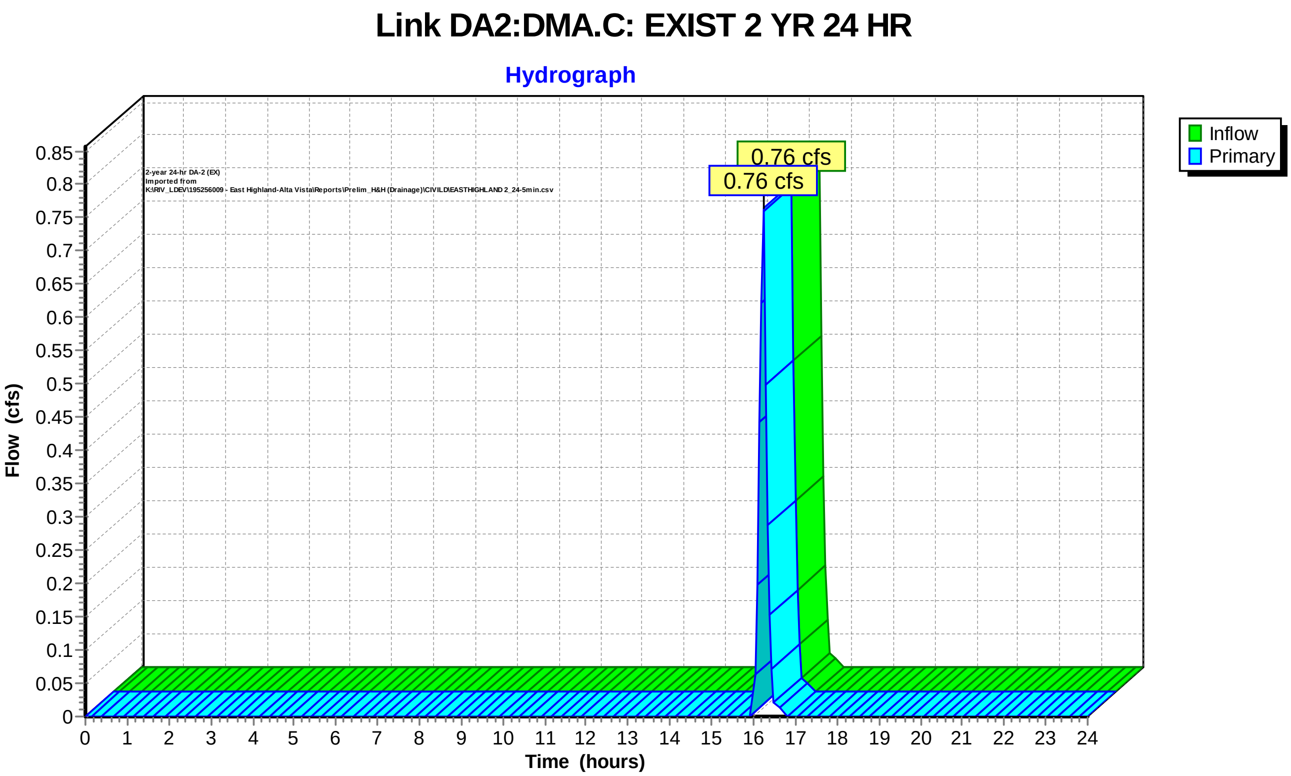


Summary for Link DA2:DMA.C: EXIST 2 YR 24 HR

Inflow	=	0.76 cfs @	16.24 hrs, Volume=	0.013 af
Primary	=	0.76 cfs @	16.24 hrs, Volume=	0.013 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.05 hrs

2-year 24-hr DA-2 (EX) Imported from K:\RIV_LDEV\195256009 - East Highland-Alta Vista\Reports\Prelim_H&H (Draina



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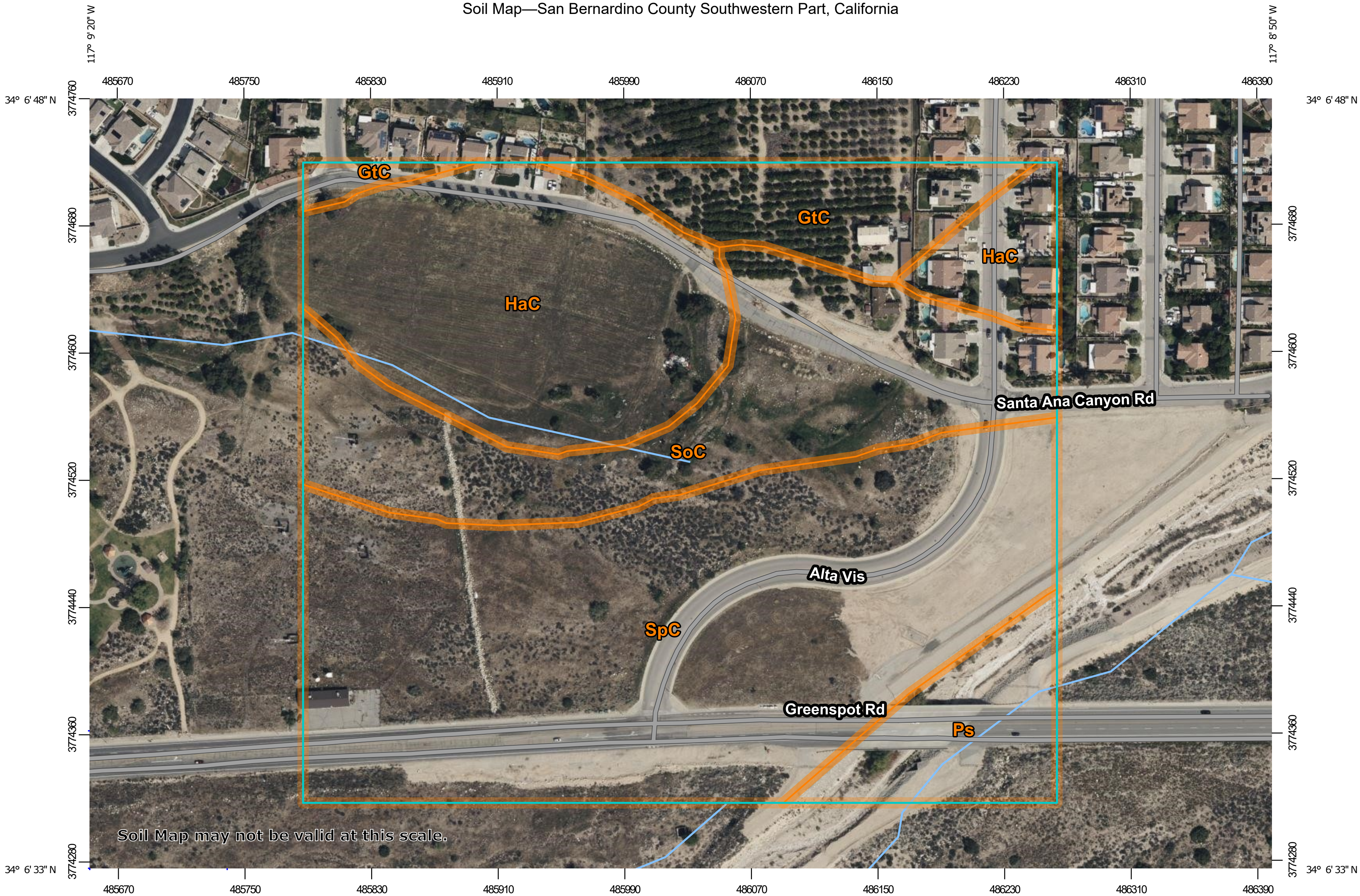
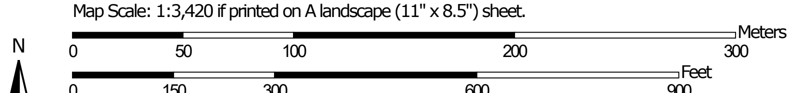
Soil Map—San Bernardino County Southwestern Part, California



Map Scale: 1:3,420 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 15, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 17, 2022—Jun 12, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GtC	Greenfield sandy loam, 2 to 9 percent slopes	3.6	7.6%
HaC	Hanford coarse sandy loam, 2 to 9 percent slopes	10.8	22.8%
Ps	Psamments, Fluvents and Frequently flooded soils	3.0	6.4%
SoC	Soboba gravelly loamy sand, 0 to 9 percent slopes	9.3	19.5%
SpC	Soboba stony loamy sand, 2 to 9 percent slopes	20.8	43.7%
Totals for Area of Interest		**47.6**	**100.0%**

San Bernardino County Southwestern Part, California

HaC—Hanford coarse sandy loam, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: 2y8tl
Elevation: 890 to 2,860 feet
Mean annual precipitation: 11 to 22 inches
Mean annual air temperature: 64 to 65 degrees F
Frost-free period: 320 to 365 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hanford and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hanford

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

A - 0 to 12 inches: sandy loam
C - 12 to 60 inches: fine sandy loam

Properties and qualities

Slope: 2 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: R019XG911CA - Loamy Fan
Hydric soil rating: No

Minor Components

Greenfield, sandy loam

Percent of map unit: 10 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Tujunga, loamy sand

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 15, Aug 30, 2023

San Bernardino County Southwestern Part, California

SoC—Soboba gravelly loamy sand, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hckt
Elevation: 30 to 4,200 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 61 to 63 degrees F
Frost-free period: 175 to 250 days
Farmland classification: Not prime farmland

Map Unit Composition

Soboba and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Soboba

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 12 inches: gravelly loamy sand
H2 - 12 to 36 inches: very gravelly loamy sand
H3 - 36 to 60 inches: very stony sand

Properties and qualities

Slope: 0 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: R019XG912CA - Sandy Fan
Hydric soil rating: No

Minor Components

Unnamed

Percent of map unit: 5 percent
Hydric soil rating: No

Delhi, fine sand

Percent of map unit: 5 percent
Hydric soil rating: No

Tujunga, gravelly loam

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 2 percent
Landform: Drainageways
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 15, Aug 30, 2023

San Bernardino County Southwestern Part, California

SpC—Soboba stony loamy sand, 2 to 9 percent slopes

Map Unit Setting

National map unit symbol: hckv
Elevation: 960 to 3,690 feet
Mean annual precipitation: 12 to 39 inches
Mean annual air temperature: 60 to 65 degrees F
Frost-free period: 260 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Soboba and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Soboba

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

Ap - 0 to 10 inches: stony loamy sand
C1 - 10 to 24 inches: very stony loamy sand
C2 - 24 to 60 inches: very stony sand

Properties and qualities

Slope: 2 to 9 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 19.99 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R019XG912CA - Sandy Fan

Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Ramona

Percent of map unit: 5 percent
Landform: Fan remnants
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Tujunga, gravelly loamy sand

Percent of map unit: 5 percent
Landform: Alluvial fans
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 15, Aug 30, 2023

PETRA GEOSCIENCES INC.

SOLID AS A ROCK

PRELIMINARY GEOTECHNICAL EVALUATION REPORT
EAST HIGHLAND RANCH, APPROXIMATELY 12.5-ACRE OF VACANT LAND NORTH OF GREENSPOT ROAD AND BISECTED BY ALTA VISTA
CITY OF HIGHLAND, SAN BERNARDINO COUNTY, CALIFORNIA

DIVERSIFIED PACIFIC COMMUNITIES

AUGUST 12, 2024
J.N. 24-156

ENGINEERS + GEOLOGISTS + ENVIRONMENTAL SCIENTISTS

August 12, 2024
J.N. 24-156

DIVERSIFIED PACIFIC COMMUNITIES
10621 Civic Center Drive
Rancho Cucamonga, California 91730

Attention: Mr. Jake Sowder

Subject: Preliminary Geotechnical Evaluation Report, *East Highland Ranch*, Approximately 12.5-Acre of Vacant Land North of Greenspot Road and Bisected by Alta Vista, City of Highland, San Bernardino County, California

Dear Mr. Sowder:

In accordance with your request and authorization, **Petra Geosciences, Inc. (Petra)** is submitting this preliminary geotechnical evaluation report for the proposed multi-family residential development in the city of Highland, California.

The purpose of our evaluation was to obtain available geotechnical and geologic information on the nature of current site conditions, to evaluate the potential geologic constraints that may affect development of the property, and to provide recommendations pertaining to site remedial grading and construction of anticipated site improvements. This report presents the results of our preliminary field exploration, limited laboratory testing, engineering judgement, opinions, conclusions, and recommendations pertaining to geotechnical design aspects for the presumed site development.

Should you have questions regarding the contents of this report, or should you require additional information, please contact the undersigned.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

Paul D. Theriault, CEG
Associate Geologist

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CITY OF HIGHLAND, SAN BERNARDINO COUNTY, CALIFORNIA

INTRODUCTION

Petra Geosciences, Inc. (Petra) is presenting herein the results of our preliminary geotechnical evaluation for the proposed development of a multi-family residential tract on 12.5-acres located north of Greenspot Road and bisected by Alta Vista, in the city of Highland, California. The purpose of this study was to obtain preliminary information on the general geologic and geotechnical conditions within the project area in order to provide conclusions and recommendations for the feasibility of the proposed project and preliminary geotechnical recommendations for site grading and improvements. Our geotechnical evaluation included a review of geological maps and data for the site and surrounding area, excavation of exploratory test pits, percolation testing, laboratory testing, and geologic and engineering analysis.

SCOPE OF WORK

The scope of our evaluation consisted of the following.

- Review of available published and unpublished data and geotechnical reports concerning geologic and soil conditions within the site and nearby area that could impact on the proposed development.
- Review readily available aerial photographs of the site and surrounding area.
- Excavation, logging, and select sampling of 12 exploratory test pits.
- Perform four percolation tests to aid in evaluating infiltration rates.
- Perform laboratory tests including maximum density at optimum moisture, grain size analyses, expansion index, corrosivity, and remolded shear.
- Preparation of this geotechnical report presenting the results of our analysis and providing recommendations for the proposed site development in general conformance with the requirements of the 2022 California Building Code (2022 CBC) and applicable state and local jurisdictional requirements.

LOCATION AND SITE DESCRIPTION

The irregularly shaped site is situated immediately north of Greenspot Road and bisected by Alta Vista in the city of Highland. The approximately 12.5-acre parcel is currently vacant and bounded by Santa Ana Canyon Road on the north, vacant parcels on the east and west, and Greenspot Road on the south. A Metropolitan Water District (MWD) easement traverses the site from northwest to southeast. Existing improvements within Greenspot Road and Alta Vista were observed to include sewer, water, storm drain, and electrical (street lights). Overhead power lines are present along Santa Ana Canyon Road. A structure associated with the MWD easement was observed at the eastern boundary just north of the easement. Oak Creek, an ephemeral tributary of the Santa Ana River flows southwest just to the east of the site.

A chain-link fence and some debris were observed on the western portion of the property. Sparse shrubs and bushes were observed west of Alta Vista while sparse grasses were observed on the east. The property descends at a low gradient generally towards the west-northwest, with elevations ranging from approximately 1,467 feet above mean sea level (MSL) in the southeast corner to 1,445 feet above MSL in the northwest corner. The surficial soils across the site are generally loose and dry with some cobbles and boulders exposed on the ground surface.

PROPOSED DEVELOPMENT AND GRADING

Conceptual Design, prepared by KTGY Architecture + Planning (2024) indicates the planned development will consist of two- and three-story residential units with attached garages, appurtenant interior alleyways, and drive aisles. Anticipated ancillary site improvements include underground utilities, perimeter walls, storm water basins, a recreation site, and landscaping. Entry to the development will be from Alta Vista. The proposed grading is expected to entail shallow cuts and fills on the order of 2 to 5 feet from existing grades. Appreciable cut or fill slopes are not anticipated.

EVALUATION METHODOLOGY

Literature and Aerial Photo Review

We have reviewed the geotechnical investigation report by RMA GeoScience (RMA, 2015) for the subject site, available online aerial imagery, historic aerial photographs, published geologic maps, and geotechnical literature related to the property and surrounding area (References).

Pertinent findings from our review of RMA's 2015 report are provided below. Clarification to recommendations provided by RMA are presented in parentheses and italics as needed.

RMA Geotechnical Investigation (2015)

- Based on a review of aerial photographs, the site appears to have been vacant dating back to 1938.
- Based on field exploration and analysis, mapping lab testing and geotechnical evaluations, the subject site is geotechnically feasible for the proposed development. The scope of fieldwork included geologic mapping, subsurface exploration with 7 test pits via a backhoe to a maximum depth of 8 feet.

- The site consists of a veneer of topsoil underlain by alluvial fan deposits. Topsoil was approximately 0.5 to 2 feet in depth and consisted of sand with some gravel, cobble, and boulders up to 14 inches in diameter. Alluvial fan deposits generally consisted of sand and gravelly sand with cobbles and some boulders up to 6 feet in diameter. *(Petra: Our field exploration encountered approximately 15-25% more cobbles and boulders.)*

- A review of California Department of Water resource Water Data Library indicates that historic high groundwater is approximately 131 feet below ground surface, as measured in 2011.

- Faults, active or potentially active, are not known to project through the site and the site does not lie within an AP hazard zone. The possibility of damage due to ground rupture is considered low. However, the closest active fault is the San Bernardino strand of the San Andreas fault, located approximately 0.5 miles northeast of the site.

- The potential of damage due to liquefaction is considered nil due to the depth to groundwater.

- Laboratory testing of upper soils indicate a very low expansion potential.

- The existing onsite soils appear to be suitable material for use as fill, provided they are relatively free of rocks larger than 12 inches in maximum dimension, debris and/or organic material. Oversize material greater than 12 inches should be reduced in size or nested a minimum of 10 feet below final grades. (*Petra: Oversize rock should be placed in accordance with our Earthwork Recommendations provided herein.)*

- Following the recommend overexcavation of compressible soils to competent alluvial soils, exposed bottom surface should be scarified to approximately 6 inches, watered to achieve a moisture content of optimum or higher and then compacted in-place to relative compaction of 90 percent or more prior to fill placement.

Field Exploration and Laboratory Testing

Field Exploration

Petra performed a subsurface exploration on March 26, 2024, and included the excavation of 12 exploratory test pits (TP-1 through TP-12) to a maximum depth of 10 feet below the existing ground surface (bgs). Based on the results of our exploratory trenches, the site consists of alluvial fan deposits to the depths explored. A minor amount of artificial fill, likely associated with the construction of Santa Ana Canyon Road and Alta Vista. The alluvial fan deposits consist of sands, gravelly sands, with varying amounts of cobbles and of boulders. As observed during our exploration, the cobble and boulder content (3+ inches in diameter) is estimated to vary between 20 and 60 percent. Test pit logs (Petra, this report; RMA, 2015) are presented in Appendix A. In-situ moisture and density results presented on the boring logs were taken with a nuclear moisture density gauge.

Percolation Testing

Petra performed four percolation tests to evaluate the infiltration rates of the site soils at two proposed basin locations as shown on Figure 2. Methodology and test results are provided in Appendix C

Laboratory Testing

Limited laboratory testing was conducted on various representative undisturbed and bulk soil samples collected from the test pits for engineering properties. Based on the laboratory testing conducted, site soils have a negligible corrosion potential to concrete materials, low exposure to chlorides, and are not considered corrosive with respect to buried metallic elements. Site soils are very sandy and have a very low expansion potential. A summary of the lab results (Petra, this report; RMA, 2015) is included in Appendix B. In-situ dry density and moisture content performed during our site exploration are presented in Appendix A.

FINDINGS

Regional Geologic Setting

The subject property is situated within the northmost portion of the Peninsular Ranges Geomorphic Province (PRGP), near the boundary with the Transverse Ranges Geomorphic Province on the proximal portion of a large alluvial fan that extends southwest from the flanks of the adjacent San Bernardino Mountains to the northeast. The PRGP is composed of series of ranges, separated by northwest trending valleys, subparallel to faults and extends south to Baja California, east to the Colorado Desert, and west into the Pacific Ocean.

Locally, the subject site is located on alluvial fan and active wash deposits emanating from tributaries of the Santa Ana River in the eastern Upper Santa Ana River Valley, causing erosion of the San Bernardino Mountains, located less than one mile to the northeast. The alluvial-fan deposits in the vicinity of the site are on the order of hundreds of feet thick, and composed of silty sands, sands, gravel, cobble, and boulders.

Local Geology and Subsurface Soil Conditions

Earth units encountered within our field evaluation consisted of artificial fill, and alluvial fan deposits. The onsite soil units are discussed in detail below.

- Artificial Fill – Artificial fill was observed overlying alluvial fan deposits in test pits TP-1 and TP-2 to depths of 1.5 to 2.5 feet. These soils were generally composed of silty fine to coarse sand with gravels, cobbles, and boulders, which was light brown to brown, dry, and loose.

- Alluvial Fan Deposits – Alluvial fan deposits were observed beneath the artificial fill and at all test pit locations. The alluvial fan deposits generally consisted of sand to gravelly sand with lesser amounts of sandy gravels with abundant subrounded cobbles and boulders, generally on the order of 20 to 40 percent and occasionally up to 60 percent. These fan deposits were locally weathered and generally loose to medium dense. This unit was non-cohesive and slight caving was observed within all the test pits.

Groundwater

Neither groundwater nor seepage was encountered in the test pits during our subsurface exploration. Based on our review of published geotechnical literature, the depth to groundwater is in excess of 100 feet bgs. Groundwater is not anticipated to affect the proposed development.

Faulting

The geologic structure of the southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. Active faults in the system include Newport-Inglewood, Whittier, Elsinore, San Jacinto, and San Andreas faults. The San Andreas, Elsinore, and San Jacinto faults have ruptured the ground surface in historic times.

Based on our review of published and unpublished geotechnical maps and literature pertaining to site and regional geology, the closest active fault to the site is the San Bernadino section of the San Andreas fault, approximately 0.62 miles to the northeast. Based on our review of the referenced geologic literature no active faults appear to project through or toward the site, nor does the site lie within an Alquist-Priolo Earthquake Fault Hazard Zone. Additionally, based on historic aerial photos, no lineaments appear to cross or trend towards the property. The potential for active fault rupture at the site is considered to be very low.

Secondary Seismic Effects

Secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure. Various general types of ground failures, which might occur due to severe ground shaking at the site include ground subsidence, ground lurching, and lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsoil and groundwater conditions, among other factors. The potential for ground lurching and lateral spreading are considered very low.

The potential for seismically induced flooding due to tsunami, seiche (i.e., a wave-like oscillation of the surface of water in an enclosed basin), is considered negligible due to the sites distance from the ocean and closed bodies of water, respectively. Extrapolation of the County of San Bernardino Flood Control District, Seven Oaks Dam, Dam Inundation Based on Dam Breach Map 2 of 7 (References), failure of the Seven Oaks Dam, located approximately 3 miles to the east, would result in inundation in roughly 15 minutes from the breach, with water encompassing the entire site, ranging from approximately 5 feet in the north to 20 feet in the south. These numbers are based on the dam failing while at capacity. To date, the dam has only ever been filled to one-third of its capacity. The dam was built to withstand a magnitude 8.0 earthquake (Orange County Department of Public Works, 2012). Based on the dam's design and limited actual storage (Riverside County Flood Control and Water Conservation District, 2012), the probability of the site becoming inundated is considered very low.

Liquefaction and Seismically-Induced Settlement

Liquefaction is the transformation of a cohesionless soil from a solid to a liquid state caused by an increase in pore pressure and a reduction of effective stress. Liquefaction can occur when loose saturated cohesionless (sandy) soils are subjected to strong ground motion during an earthquake. Typically, liquefaction occurs in areas where groundwater lies within the upper 50 feet of the ground surface. The site is within a San Bernardino County Liquefaction Zone, generally susceptible to medium liquefaction. However, due to the gravelly to cobbly nature of the underlying alluvial-fan materials, as well as the depth to groundwater (expected to be deeper than 100 feet bgs), the potential for liquefaction is considered to be very low. Thus, neither liquefaction nor dynamic settlement should be considered as major geotechnical concerns for site development.

Compressible Near-Surface Soils

A geotechnical factor affecting the project is the presence of low-density and dry, near-surface alluvial fan deposits. Such materials in their present state are not considered suitable for support of fill or structural loads. Accordingly, these materials will require removal to competent alluvial fan deposits as observed by the geotechnical consultant. The unsuitable material may be reused as engineered fill, provided it is placed in accordance with the recommendations provided herein.

CONCLUSIONS AND RECOMMENDATIONS

General

From a geotechnical engineering and engineering geologic point of view, the subject property is considered suitable for the proposed grading and development provided the following conclusions and recommendations are incorporated into the design criteria and project specifications and implemented during construction.

Earthwork Recommendations

General Earthwork Recommendations

Earthwork should be performed in accordance with the Grading Code of the city of Highland and with the applicable provisions of the 2022 California Building Code (2022 CBC), and the site-specific recommendations presented herein.

Geotechnical Observations and Testing

Prior to the start of earthwork, a meeting should be held at the site with the owner, contractor, and geotechnical consultant to discuss the work schedule and geotechnical aspects of the grading. Earthwork, which in this instance will generally entail removal and re-compaction of the near surface soils, should be accomplished under full-time observation and testing of the geotechnical consultant. A representative of the project geotechnical consultant should be present onsite during all earthwork operations to document placement and compaction of fills, as well as to document compliance with the other recommendations presented herein.

Clearing and Grubbing

Clearing operations will include the removal of all existing vegetation, shrubs, stumps any existing dumped trash or construction debris, oversize boulders, undocumented fill, and deleterious materials. All weeds, grasses, bushes, shrubs, tree stumps etc. existing within areas to be graded should be stripped and removed from the site. Any deleterious materials encountered within the site may need to be removed by hand (i.e. by root pickers) during the grading operations.

The project geotechnical consultant should provide periodic observation services during clearing and grubbing operations to document compliance with the above recommendations. In addition, should unusual or adverse soil conditions or buried structures be encountered during grading that are not described herein, these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations.

Excavation Characteristics

The existing site soils can be readily excavated with conventional earthmoving equipment, however, oversize rocks, those exceeding 12 inches in maximum dimension, are very likely to be encountered during grading.

Ground Preparation

Unsuitable Soil Removals

All existing surficial soils (artificial fill and the upper portions of the alluvial fan deposits) are considered unsuitable in their current state for support of proposed fills, structures, flatwork, pavement, and other improvements. These materials should be removed to underlying competent alluvial fan deposits, as approved by the project geotechnical consultant. Remedial removals are estimated to be approximately 3 to 4 feet below existing grades to expose competent alluvial fan deposits, however, soil removals may also need to be locally deeper depending upon the exposed conditions encountered during grading. The actual depths and horizontal limits of removals and over-excavations should be evaluated during grading by the project geotechnical consultant.

Prior to placing engineered fill, all exposed removal bottom surfaces in the building pad areas should be moisture conditioned (watered or dried) as necessary, to achieve moisture conditions at to slightly above optimum and compacted in-place to a relative compaction of at least 90 percent per ASTM D1557. Horizontal limits of removals should extend across the entire level portion of the lot.

Overexcavation of Cut and Cut-Fill Transition Lots

After removal of unsuitable materials, lots located entirely in cut or cut/fill transitions should be eliminated from building pad areas to reduce the detrimental effects of differential settlement. Cut and cut/fill transition lots should be overexcavated to a minimum of 3 feet below proposed finished pad grade elevations and replaced as properly compacted fill. Prior to placing engineered fill, all exposed overexcavation bottom surfaces in the building pad areas should be moisture conditioned as above, as necessary, to achieve moisture conditions at to slightly above optimum and compacted in-place to a relative compaction of at least 90 percent per ASTM D1557. Horizontal limits of over-excavation should extend across the entire level portion of the lot.

Suitability of Site Soils as Fill

Site soils are suitable for use in engineered fills provided they are clean from any organics, debris, and oversize rocks (greater than 12 inches in diameter). Oversize rocks are likely to be encountered during remedial grading and may be incorporated within specified depths of the engineered fills as discussed in the following section.

<u>Oversize Rock</u>

Removals and over-excavation during grading are expected to produce oversize rock, defined as rock or irreducible rock fragments greater than 12 inches in maximum diameter. Rock less than 12 inches in diameter may be placed as general fill so long as they are placed in a manner to avoid nesting. Oversize rock up greater than 12 inches in diameter may be placed deeper than 5 feet below finished pad grades in a manner to avoid nesting and then completely covered/mixed with granular soil materials. As with the placement of all oversized rock in engineered fills, the granular materials should be watered in a manner to assure the infilling of all voids.

Due to the anticipated relatively shallow fills onsite, i.e., generally expected to be less than 5 feet in depth, exporting of oversize rock greater than 12 inches should be anticipated. The grading contactor should provide either a screening operation to remove oversize rocks from the fill soils or utilize mechanical removal of oversize rocks from the fill areas by heavy equipment equipped with rock rakes or similar equipment.

<u>Fill Placement</u>

Fill materials for building pad areas should be placed in approximately 6- to 8-inch-thick loose lifts, watered or air-dried as necessary to achieve a moisture content at or slightly above optimum moisture, then compacted in-place to a minimum relative compaction of 90 percent. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with ASTM D 1557.

<u>Import Soils for Grading</u>

If imported soils are needed to achieve final design grades, the soils should be free of deleterious materials, oversize rock, and any hazardous materials. Additionally, soils should be non-expansive (i.e., have “very low” expansion potential), non-corrosive, and be approved by the project geotechnical consultant *prior* to being brought onsite.

<u>Soil Shrinkage</u>

Volumetric changes in earth quantities will occur when excavated onsite soils are replaced as engineered fill. Based on similar soil conditions in the nearby area, we estimated the soil shrinkage factor to be on the order of 10 to 15 percent for soil removed and replaced as compacted fill and a subsidence factor of 0.1 foot during recompaction of removal bottoms and overexcavation surfaces. *Also note that volume associated with the removal of oversize rocks greater than 12 inches from the site during planned removals,* *over-excavations, or deep utility trenching should also be accounted for in determining final earthwork quantities*.

The estimate of shrinkage is intended as an aid for project engineers in determining earthwork quantities, however, this estimate should not be considered as absolute values and should be used with some caution. Contingencies should be made for balancing earthwork quantities based on actual shrinkage that occurs during the grading operations.

Temporary Excavations

Temporary excavations up to a depth of 4 feet below existing grades may be required to accommodate the recommended overexcavation. Based on the physical properties of the onsite soils, temporary excavations exceeding 4 feet in height should be cut back to an inclination of 1:1 (h:v) or flatter for the duration of the overexcavation of unsuitable soil material and replacement as compacted fill, as well as placement of underground utilities. It is the responsibility of the contractor and their competent person to ensure that all excavations are constructed in accordance with applicable OSHA guidelines. Other factors to be considered with respect to the stability of the temporary slopes include construction traffic and storage of materials near the tops of slopes, construction scheduling, presence of nearby walls, structures on adjacent properties, and weather conditions at the time of construction.

Geotechnical Observations

Observation of clearing operations, overexcavation of unsuitable surficial materials, fill placement, slope construction, and general grading procedures should be performed by the project geotechnical consultant. Fills should not be placed without prior observation and approval of the removal bottom surfaces by the geotechnical consultant. The project geotechnical consultant or his representative should be present onsite during grading operations to observe and document proper placement and compaction of fill, as well as to observe and document compliance with the other recommendations presented herein.

PRELIMINARY FOUNDATION DESIGN GUIDELINES

Seismic Design Parameters

Earthquake loads on earthen structures and buildings are a function of ground acceleration which may be determined from the site-specific ground motion analysis. Alternatively, a design response spectrum can be developed for certain sites based on the code guidelines. We used two computer applications to provide the design team with the parameters necessary to construct the design acceleration response spectrum for this project. The first was developed by Structural Engineering Association of California (SEA) and California's Office of Statewide Health Planning and Development (OSHPD). The SEA/OSHPD Seismic Design Maps Tool website, https://seismicmaps.org, is used to calculate ground motion parameters. The second, the United Stated Geological Survey (USGS) Unified Hazard Tool website, https://earthquake.usgs.gov/hazards/interactive/, is used to estimate the earthquake magnitude and the distance to surface projection of the fault.

To run the applications discussed above, the following parameters are required: site latitude and longitude; seismic risk category; and site class. The site class designation depends on the direct measurement and the ASCE 7-16 recommended procedure for calculating average small-strain shear wave velocity, Vs30, within the upper 30 meters (approximately 100 feet) of site soils.

A seismic risk category of II was assigned to the proposed building in accordance with 2022 CBC, Table 1604.5. Shear wave velocity measurement were not performed as part of this exploration. However, the subsurface materials at the site exhibit the characteristics of a stiff soil, in accordance with ASCE 7-16, Table 20.3-1 for a Site Class D-Default designation. As such, the following table, Table 1, provides parameters required to construct the seismic response coefficient, C_s, curve based on ASCE 7-16, Article 12.8 guidelines.

TABLE 1

Seismic Design Parameters

Ground Motion Parameters	Specific Reference	Parameter Value	Unit
Site Latitude (North)	-	34.110981	°
Site Longitude (West)	-	-117.150963	°
Site Class Definition	Section 1613.2.2 [(1)], Chapter 20 [(2)]	D-Default [(4)]	-
Assumed Seismic Risk Category	Table 1604.5 [(1)]	II	-
M_w - Earthquake Magnitude	USGS Unified Hazard Tool [(3)]	7.9 [(3)]	-
R – Distance to Surface Projection of Fault	USGS Unified Hazard Tool [(3)]	1.9[(3)]	km
S_s - Mapped Spectral Response Acceleration Short Period (0.2 second)	Figure 1613.2.1(1) [(1)]	2.53 [(4)]	g
S_1 - Mapped Spectral Response Acceleration Long Period (1.0 second)	Figure 1613.2.1(2) [(1)]	1.016 [(4)]	g
F_a – Short Period (0.2 second) Site Coefficient	Table 1613.2.3(1) [(1)]	1.2 [(4)]	-
F_v – Long Period (1.0 second) Site Coefficient	Table 1613.2.3(2) [(1)]	Null [(4)]	-
S_{MS} – MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (0.2 second)	Equation 16-36 [(1)]	3.036 [(4)]	g
S_{M1} - MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (1.0 second)	Equation 16-37 [(1)]	Null [(4)]	g
S_{DS} - Design Spectral Response Acceleration at 0.2-s	Equation 16-38 [(1)]	2.024 [(4)]	g
S_{D1} - Design Spectral Response Acceleration at 1-s	Equation 16-39 [(1)]	Null [(4)]	g
$T_o = 0.2\ S_{D1}/\ S_{DS}$	Section 11.4.6 [(2)]	Null	s
$T_s = S_{D1}/\ S_{DS}$	Section 11.4.6 [(2)]	Null	s
T_L - Long Period Transition Period	Figure 22-14 [(2)]	8 [(4)]	s
PGA - Peak Ground Acceleration at MCE_G [(*)]	Figure 22-9 [(2)]	1.045	g
F_{PGA} - Site Coefficient Adjusted for Site Class Effect [(2)]	Table 11.8-1 [(2)]	1.2 [(4)]	-
PGA_M –Peak Ground Acceleration [(2)] Adjusted for Site Class Effect	Equation 11.8-1 [(2)]	1.254 [(4)]	g
Design PGA ≈ (⅔ PGA_M) - Slope Stability [(†)]	Similar to Eqs. 16-38 & 16-39 [(2)]	0.836	g
Design PGA ≈ (0.4 S_{DS}) – Short Retaining Walls [(‡)]	Equation 11.4-5 [(2)]	0.81	g
C_{RS} - Short Period Risk Coefficient	Figure 22-18A [(2)]	0.906 [(4)]	-
C_{R1} - Long Period Risk Coefficient	Figure 22-19A [(2)]	0.886 [(4)]	-
SDC - Seismic Design Category [(§)]	Section 1613.2.5 [(1)]	Null [(4)]	-

References:
[(1)] California Building Code (CBC), 2022, California Code of Regulations, Title 24, Part 2, Volume I and II.
[(2)] American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Standards 7-16.
[(3)] USGS Unified Hazard Tool - https://earthquake.usgs.gov/hazards/interactive/
[(4)] SEI/OSHPD Seismic Design Map Application – https://seismicmaps.org
Related References:
Federal Emergency Management Agency (FEMA), 2015, NEHERP (National Earthquake Hazards Reduction Program) Recommended Seismic Provision for New Building and Other Structures (FEMA P-1050).

Notes:
* PGA Calculated at the MCE return period of 2475 years (2 percent chance of exceedance in 50 years).
† PGA Calculated at the Design Level of ⅔ of MCE; approximately equivalent to a return period of 475 years (10 percent chance of exceedance in 50 years).
‡ PGA Calculated for short, stubby retaining walls with an infinitesimal (zero) fundamental period.
§ The designation provided herein may be superseded by the structural engineer in accordance with Section 1613.2.5.1, if applicable.

<u>Discussion</u>

<u>General</u>

Owing to the characteristics of the subsurface soils, as defined by Site Class D-Default designation, and proximity of the site to the sources of major ground shaking, the site is expected to experience strong ground shaking during its anticipated life span. Under these circumstances, where the code-specified design response spectrum may not adequately characterize site response, the 2022 CBC typically requires a site-specific seismic response analysis to be performed. This requirement is signified/identified by the "null" values that are output using SEAOC/OSHPD software in determination of short period, but mostly, in determination of long period seismic parameters, see Table 1.

For conditions where a "null" value is reported for the site, a variety of analytical design approaches are permitted by 2022 CBC and ASCE 7-16 (see Table 12.6-1)in lieu of a site-specific seismic hazard analysis. For any specific site, these alternative design approaches, which include Equivalent Lateral Force (ELF) procedure, Modal Response Spectrum Analysis (MRSA) procedure, Linear Response History Analysis (LRHA) procedure and Simplified Design procedure, among other methods, are expected to provide results that may or may not be more economical than those that are obtained if a site-specific seismic hazards analysis is performed. These design approaches and their limitations should be evaluated by the project structural engineer.

<u>Seismic Design Category</u>

Please note that the Seismic Design Category, SDC, is also designated as "null" in Table 1. For Risk Category I, II or III structures, where the mapped spectral response acceleration parameter at 1 – second period, S_1, is greater than or equal to 0.75, the 2022 CBC, Section 1613.2.5 requires that these structures be assigned to Seismic Design Category E.

<u>Allowable Bearing Capacity, Estimated Settlement and Lateral Resistance</u>

<u>Allowable Soil Bearing Capacities</u>

<u>Pad Footings</u>

An allowable soil bearing capacity of 1,500 pounds per square foot may be utilized for design of isolated 24-inch-square footings founded at a minimum depth of 12 inches below the lowest adjacent final grade for pad footings that are not a part of the slab system and are used for support of such features as roof overhang, second-story decks, patio covers, etc. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width, to a maximum value of 2,500 pounds per square foot. The recommended allowable bearing value includes both dead and live loads and may be increased by one-third for short duration wind and seismic forces.

Continuous Footings

An allowable soil bearing capacity of 1,500 pounds per square foot may be utilized for design of continuous footings founded at a minimum depth of 12 inches below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width, to a maximum value of 2,500 pounds per square foot. The recommended allowable bearing value includes both dead and live loads and may be increased by one-third for short duration wind and seismic forces.

Estimated Footing Settlement

Based on the allowable bearing values provided above, total static settlement of the footings under the anticipated loads is expected to be less than ¾ inch. Differential settlement is expected to be less than ½ inch over a horizontal span of 30 feet. Most of the settlement is likely to take place as footing loads are applied or shortly thereafter.

Lateral Resistance

A passive earth pressure of 250 pounds per square foot per foot of depth, to a maximum value of 2,500 pounds per square foot, may be used to determine lateral bearing resistance for footings. In addition, a coefficient of friction of 0.40 times the dead load forces may be used between concrete and the supporting soils to determine lateral sliding resistance. The above values may be increased by one-third when designing for transient wind or seismic forces. It should be noted that the above values are based on the condition where footings are cast in direct contact with compacted fill or competent native soils. In cases where the footing sides are formed, all backfill placed against the footings upon removal of forms should be compacted to at least 90 percent of the applicable maximum dry density.

Guidelines for Footings and Slabs on-Grade Design and Construction

Near-surface soils within the site will exhibit expansion indices (EI's) that are in the Very Low category (EI $\leq$ 20) following site grading. As indicated in Section 1803.5.3 of 2022 California Building Code (2022 CBC), these soils are considered non-expansive and, as such, the design of slabs on-grade is exempt from the procedures outlined in Sections 1808.6.2 of the 2022 CBC and may be performed using any method deemed rational and appropriate by the project structural engineer. However, the following minimum recommendations are presented herein for conditions where the project design team may require geotechnical engineering guidelines for design and construction of footings and slabs on-grade the project site.

The design and construction guidelines that follow are based on the above soil conditions and may be considered for reducing the effects of variability in fabric, composition and, therefore, the detrimental behavior of the site soils such as excessive short- and long-term total and differential heave or settlement. These guidelines have been developed based on the previous experience of this firm on projects with similar soil conditions. Although construction performed in accordance with these guidelines has been found to reduce post-construction movement and distress, they do not eliminate all potential effects of variability in soils characteristics and future heave or settlement.

It should also be noted that the suggestions for dimension and reinforcement provided herein are performance-based and intended only as preliminary guidelines to achieve adequate performance under the anticipated soil conditions. However, they should not be construed as replacement for structural engineering analyses, experience, and judgment. The project structural engineer, architect or civil engineer should make appropriate adjustments to slab and footing dimensions, and reinforcement type, size and spacing to account for internal (e.g., thermal, shrinkage and expansion) and external (e.g., applied loads) concrete forces as deemed necessary. Consideration should also be given to minimum design criteria as dictated by local building code requirements.

Conventional Slab-on-Grade System

Given the expansion index is expected to be less than 20, we recommend that footings and floor slabs be designed and constructed in accordance with the following minimum criteria.

Footings

1. Exterior continuous footings supporting one- and two-story structures should be founded at a minimum depth of 12 inches below the lowest adjacent final grade, respectively. Interior continuous footings may be founded at a minimum depth of 10 inches below the top of the adjacent finish floor slabs.

2. In accordance with Table 1809.7 of 2022 CBC for light-frame construction, all continuous footings should have minimum widths of 12 inches for one- and two-story construction. We recommend all continuous footings should be reinforced with a minimum of two No. 4 bars, one top and one bottom.

3. A minimum 12-inch-wide grade beam founded at the same depth as adjacent footings should be provided across garage entrances or similar openings (such as large doors or bay windows). The grade beam should be reinforced with a similar manner as provided above.

4. Interior isolated pad footings, if required, should be a minimum of 24 inches square and founded at a minimum depth of 12 inches below the bottoms of the adjacent floor slabs for one- and two-story

buildings. Pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings.

5. Exterior isolated pad footings intended for support of roof overhangs such as second-story decks, patio covers, and similar construction should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. The pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings. Exterior isolated pad footings may need to be connected to adjacent pad and/or continuous footings via tie beams at the discretion of the project structural engineer.

6. The minimum footing dimensions and reinforcement recommended herein may be modified (increased or decreased subject to the constraints of Chapter 18 of the 2022 CBC) by the structural engineer responsible for foundation design based on his/her calculations, engineering experience and judgment.

Building Floor Slabs

1. Concrete floor slabs should be a minimum of 4 inches thick and reinforced with No. 3 bars spaced a maximum of 24 inches on centers, both ways. Alternatively, the structural engineer may recommend the use of prefabricated welded wire mesh for slab reinforcement. For this condition, the welded wire mesh should be of sheet type (not rolled) and should consist of 6x6/W2.9xW2.9 WWF (per the Wire Reinforcement Institute, WRI, designation) or stronger. All slab reinforcement should be properly supported to ensure the desired placement near mid-depth. Care should be exercised to prevent warping of the welded wire mesh between the chairs in order to ensure its placement at the desired mid-slab position.

   Slab dimension, reinforcement type, size and spacing need to account for internal concrete forces (e.g., thermal, shrinkage, and expansion) as well as external forces (e.g., applied loads), as deemed necessary.

2. Living area concrete floor slabs and areas to receive moisture sensitive floor covering should be underlain with a moisture vapor retarder consisting of a minimum 10-mil-thick polyethylene or polyolefin membrane that meets the minimum requirements of ASTM E96 and ASTM E1745 for vapor retarders (such as Husky Yellow Guard®, Stego® Wrap, or equivalent). All laps within the membrane should be sealed, and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface cannot be achieved by grading, consideration should be given to lowering the pad finished grade an additional inch and then placing a 1-inch-thick leveling course of sand across the pad surface prior to the placement of the membrane.

   At the present time, some slab designers, geotechnical professionals, and concrete experts view the sand layer below the slab (blotting sand) as a place for entrapment of excess moisture that could adversely impact moisture-sensitive floor coverings. As a preventive measure, the potential for moisture intrusion into the concrete slab could be reduced if the concrete is placed directly on the vapor retarder. However, if this sand layer is omitted, appropriate curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified materials engineer with experience in slab design and construction should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing. Additional steps would also need to be taken to prevent puncturing of the vapor retarder during concrete placement.

3. Garage floor slabs should be a minimum 4 inches thick and reinforced in a similar manner as living area floor slabs. Garage slabs should also be poured separately from adjacent wall footings with a positive separation maintained using ¾-inch-minimum felt expansion joint material. To control the propagation of shrinkage cracks, garage floor slabs should be quartered with weakened plane joints. Consideration should be given to placement of a moisture vapor retarder below the garage slab, like that provided in Item 2 above, should the garage slab be overlain with moisture sensitive floor covering.

4. Pre-saturation of the subgrade below floor slabs will not be required; however, prior to placing concrete, the subgrade below all dwelling and garage floor slab areas should be thoroughly moistened to achieve a moisture content that is at least equal to or slightly greater than optimum moisture content. This moisture content should penetrate to a minimum depth of 12 inches below the bottoms of the slabs.

5. The minimum dimensions and reinforcement recommended herein for building floor slabs may be modified (increased or decreased subject to the constraints of Chapter 18 of the 2022 CBC) by the structural engineer responsible for foundation design based on his/her calculations, engineering experience and judgment.

Foundation Excavation Observations

Foundation excavations should be observed by a representative of this firm to document that they have been excavated into competent engineered fill soils prior to the placement of forms, reinforcement, or concrete. Following grading, the presence of rock, up to 12 inches diameter, in the compacted fill may result in larger footings than designed and may require the use of forms when pouring concrete. The excavations should be trimmed neat, level, and square. All loose, sloughed or moisture-softened soils and any construction debris should be removed prior to placing of concrete. Excavated soils derived from footing or utility trenches should not be placed in building slab-on-grade areas or exterior concrete flatwork areas unless the soils are compacted to at least 90 percent of maximum dry density.

Foundation Concrete Over-Pour

As noted in the previous section, the on-site soils contain a large percentage of cobbles which will result in widened and potentially deepened footing excavations due to the excavation of rocks in the fill. Even with forming, concrete quantities in excess of calculated footing volumes should be expected.

General Corrosivity Screening

As a screening level study, limited chemical and electrical tests were performed on select samples considered representative of the onsite soils to identify potential corrosive characteristics of these soils. The common indicators associated with soil corrosivity include water-soluble sulfate and chloride levels, pH (a measure of acidity), and minimum electrical resistivity. Test results are presented in Table 2 below and summarized on Plate B-1 in Appendix B.

> *It should be noted that Petra does not practice corrosion engineering; therefore, the test results, opinion and engineering judgment provided herein should be considered general guidelines. Additional analyses would be warranted, especially, for cases where buried metallic building materials (such as copper and cast or ductile iron pipes) in contact with site soils are planned for the project.*
>
> *In many cases, the project geotechnical engineer may not be informed of these choices. Therefore, for conditions where such elements are considered, we recommend that other, relevant project design professionals (e.g., the architect, landscape architect, civil, or structural engineer) also consider recommending a qualified corrosion engineer to conduct additional sampling and testing of near-surface soils during the final stages of site grading to provide a complete assessment of soil corrosivity. Recommendations to mitigate the detrimental effects of corrosive soils on buried metallic and other building materials that may be exposed to corrosive soils should be provided by the corrosion engineer as deemed appropriate.*

In general, a soil's water-soluble sulfate levels and pH relate to the potential for concrete degradation; water-soluble chlorides in soils impact ferrous metals embedded or encased in concrete, e.g., reinforcing steel; and electrical resistivity is a measure of a soil's corrosion potential to a variety of buried metals used in the building industry, such as copper tubing and cast or ductile iron pipes. Table 2, below, presents test results with an interpretation of current code indicators and guidelines that are commonly used in this industry. The table includes the classifications of the soils as they relate to the various tests, as well as a general recommendation for possible mitigation measures in view of the potential adverse impact on various components of the proposed structures in direct contact with site soils. The guidelines provided herein should be evaluated and confirmed, or modified, in their entirety by the project structural engineer, corrosion engineer, or the contractor responsible for concrete placement for structural concrete used in exterior and interior footings, interior slabs on-ground, garage slabs, wall foundations and concrete exposed to weather such as driveways, patios, porches, walkways, ramps, steps, curbs, etc.

TABLE 2

Soil Corrosivity Screening Results

Test	Test Results	Classification	General Recommendations
Soluble Sulfates (Cal 417)	0.0030 percent	S0(1)	Type II cement; min. fc' = 2,500 psi; no water/cement ratio restrictions
pH (Cal 643)	6.4	Neutral	No special requirements
Soluble Chloride (Cal 422)	315 ppm	C1(2) C2(3)	Residence: No special recommendations Pools/Decking: water/cement ratio 0.40, fc' = 5,000 psi
Resistivity (Cal 643)	3,200 ohm-cm	Mildly Corrosive(4)	No special requirements, however, may need to consult a corrosion engineer for sensitive applications.

Notes:
1. ACI 318-14, Section 19.3
2. ACI 318-14, Section 19.3
3. Exposure classification C2 applies specifically to swimming pools and appurtenant concrete elements
4. Pierre R. Roberge, "Handbook of Corrosion Engineering"

Post-Grading Considerations

Precise Grading and Drainage

Surface and subsurface drainage systems consisting of sloping concrete flatwork, drainage swales and possibly subsurface area drains will be constructed on the subject lots to collect and direct all surface water to the adjacent streets. In addition, the ground surface around the proposed buildings should be sloped to provide a positive drainage gradient away from the structures. The purpose of the drainage systems is to prevent ponding of surface water within the level areas of the site and against building foundations and associated site improvements. The drainage systems should be properly maintained throughout the life of the proposed development.

Section 1804.3 of the 2022 CBC requires that "The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than one unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall". Further, "Swales used for this purpose shall be sloped a minimum of 2 percent where located within 10 feet (3048 mm) of the building foundation".

These provisions fall under the purview of the Design Civil Engineer. However, exceptions to allow modifications to these criteria are provided within the same section of the Code as "Where climatic or soil conditions warrant, the slope of the ground away from the building foundations is permitted to be reduced to not less than one unit in 48 units horizontal (2-percent slope)". This exemption provision appears to fall under the purview of the Geotechnical Engineer-of-Record.

It is our understanding that the state-of-the-practice for projects in various cities and unincorporated areas of San Bernardino County, as well as throughout Southern California, has been to construct earthen slopes at 2 percent minimum gradient away from the foundations and at 1 percent minimum for earthen swale gradients. Structures constructed and properly maintained under those criteria have performed satisfactorily. Therefore, considering the semi-arid climate, site soil conditions and an appropriate irrigation regime, Petra considers that the implementation of 2 percent slopes away from the structures and 1 percent swales to be acceptable for the subject lots.

It should be emphasized that the homeowners are cautioned that the slopes away from the structures and swales be properly maintained, not be obstructed, and that future improvements do not alter established gradients unless replaced with suitable alternative drainage systems. Further, where the flow line of the swale exists within five feet of the structure, adjacent footings shall be deepened appropriately to maintain minimum embedment requirements, measured from the flow line of the swale.

Utility Trench Backfill

Utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be screened of any rock greater than 6 inches in diameter. The backfill should be placed in 8- to 12-inch lifts, moisture-conditioned as necessary to achieve slightly above optimum moisture conditions and compacted in place to achieve a minimum relative compaction of 90 percent. A representative of this firm should observe and test the backfill to document the adequate compaction has been achieved.

For shallow trenches where pipe or utilities might be damaged by mechanical compaction equipment, imported sand having a Sand Equivalent (SE) value of 30 or greater may be used for backfill. Sand backfill materials should be watered to achieve above optimum moisture conditions, and then tamped with hand-operated pneumatic tampers to ensure proper consolidation of the backfill. No specific relative compaction will be required; however, observation, probing and, if deemed necessary, testing should be performed by a representative of this firm to verify that the backfill is adequately compacted and will not be subject to excessive settlement.

Where a utility trench is proposed in a direction that is parallel to a building footing, the bottom of the trench should not extend below a 1:1 (h:v) plane projected downward from the bottom edge of the adjacent footing. Where this condition occurs, the adjacent footing should be deepened or the trench backfilled and compacted prior to construction of the footing.

Masonry Block Screen Walls

Construction on Level Ground

Where masonry walls are proposed on level ground and 5 feet or more from the tops of descending slopes, the footings may be founded a minimum of 18 inches below the lowest adjacent final grade. Footing trenches should be observed by the project geotechnical representative to document that the footing trenches have been excavated into competent bearing soils and to the recommended embedment. These observations should be performed prior to placing forms or reinforcing steel. The footings should be reinforced with two No. 4 bars, one top and one bottom. The footings should be placed monolithically with continuous rebars to serve as effective "grade beams" along the full lengths of the walls.

Construction Joints

To reduce the potential for cracking related to the effects of differential settlement, positive separations (construction joints) should be provided in the walls at horizontal intervals of approximately 20 to 25 feet and at each corner. The separations should be provided in the blocks only and not extend through the footings.

Retaining Walls

Footing Embedment

The base of retaining wall footings constructed on level ground may be founded a minimum of 12 inches below the lowest adjacent final grade. Footing trenches should be observed by the project geotechnical representative to document that the footing trenches have been excavated into competent bearing soils and to the recommended embedment. These observations should be performed prior to placing forms or reinforcing steel. The footings should be reinforced with two No. 4 bars, one top and one bottom. The footings should be placed monolithically with continuous rebars to serve as effective "grade beams" along the full lengths of the walls.

Allowable Soil Bearing Capacity

An allowable soil bearing capacity of 1,500 pounds per square foot, including dead and live loads, may be utilized for design of 12-inch-wide continuous footings founded in compacted fill at a minimum depth of 12 inches below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width to a maximum value of 2,500 pounds per square foot. Recommended allowable bearing values include both dead and live loads and may be increased by one-third for short duration wind and seismic forces.

Lateral Resistance

A passive earth pressure of 250 pounds per square foot per foot of depth, to a maximum value of 2,500 pounds per square foot, may be used to determine lateral bearing resistance for footings. In addition, a coefficient of friction of 0.40 times the dead load forces may be used between concrete and the supporting soils to determine lateral sliding resistance. When calculating passive resistance, the resistance of the upper 6 inches of the soil cover in front of the wall should be ignored in areas where the front of the wall will not be covered with concrete flatwork. The above values may be increased by one-third when designing for transient wind or seismic forces. It should be noted that the above values are based on the condition where footings are cast in direct contact with compacted fill or competent native soils. In cases where the footing sides are formed, all backfill placed against the footings upon removal of forms should be compacted to at least 90 percent of the applicable maximum dry density.

Active Earth Pressures

Existing site soils exhibit expansion potentials that are very low in expansion potential; therefore, the proposed retaining walls are expected to be backfilled with on-site soils. Retaining wall plans should specify the type of backfill to be used by the project structural engineer.

On-Site Soils Used for Backfill

On-site soils used for retaining wall backfill should use an active lateral earth pressure equivalent to a fluid having a density of 35 pounds per cubic foot (pcf) for design of cantilevered walls retaining a drained level backfill. Where the wall backfill slopes upward at 2:1 (h:v), the above value should be increased to 51 pcf.

All wall backfill soils should be screened of rock particles greater than 6-inches in diameter. The values provided herein are for retaining walls that have been supplied with a proper subdrain system (see Figure RW-1). Retaining walls should be designed to resist surcharge loads imposed by other nearby walls or structures in addition to the above active earth pressures.

Geotechnical Observation and Testing

All earthwork associated with retaining wall construction, including backcut excavations, observation of the footing trenches, installation of the backdrain systems, and placement of backfill should be provided by a representative of the project geotechnical consultant.

Backdrains

To reduce the likelihood of the entrapment of water in the backfill soils, weepholes or open vertical masonry joints may be considered for retaining walls not exceeding a height of 3 feet. Weepholes, if used, should be 3-inches minimum diameter and provided at maximum intervals of 6 feet along the wall. Open vertical masonry joints, if used, should be provided at 32-inch intervals. A continuous gravel fill, 3 inches by 12 inches, should be placed behind the weepholes or open masonry joints. The gravel should be wrapped in filter fabric to prevent infiltration of fines and subsequent clogging of the gravel. Filter fabric should consist of Mirafi 140N or equivalent.

A perforated pipe-and-gravel subdrain should be constructed behind retaining walls exceeding a height of 3 feet (see Figure RW-1). Perforated pipe should consist of 4-inch-minimum diameter PVC Schedule 40, or ABS SDR-35, with the perforations laid down. The pipe should be encased in a 1-foot-wide column of ¾-inch to 1½-inch open-graded gravel. If on-site soils are used as backfill, the open-graded gravel should extend above the wall footings to a minimum height equal to one-third the wall height or to a minimum height of 1.5 feet above the footing, whichever is greater. The open-graded gravel should be completely wrapped in filter fabric consisting of Mirafi 140N or equivalent. Solid outlet pipes should be connected to the subdrains and routed to a suitable area for discharge of accumulated water.

Waterproofing

The backfilled sides of retaining walls should be coated with an approved waterproofing compound or covered with a similar material to inhibit migration of moisture through the walls.

Wall Backfill

Recommended active pressures for design of retaining walls are based on the physical and mechanical properties of the onsite soil materials. The backfill behind the proposed retaining walls should be screened of rock fragments greater than 6-inches in diameter, placed in approximately 6- to 8-inch-thick maximum lifts, watered as necessary to achieve slightly above optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. Flooding or jetting of the backfill materials should be avoided. A representative of the project geotechnical consultant should observe the backfill procedures and test the wall backfill to verify adequate compaction.

Preliminary Pavement Section

Onsite soils are granular and testing within adjacent developments have resulted in R-values over 50. Based on an assumed traffic index of 5.5 and utilizing a preliminary design R-Value of 50, the recommended preliminary pavement sections for the in-tract streets is 3 inches of asphalt concrete over 3.5 inches of aggregate base on properly compacted subgrade soils. R-value testing and final pavement design recommendations should be conducted based on the as-graded conditions at the conclusion grading operations and wet utility trench backfill placement.

The upper 12 inches of subgrade soil immediately below the aggregate base should be compacted to a minimum relative compaction of 95 percent based on ASTM D1557 approximately two percent above optimum moisture content. Final subgrade compaction should be performed prior to placing base materials and after utility-trench backfills have been compacted and tested. Asphaltic concrete materials and construction should conform to Section 203 of the Greenbook or by City of Highland specifications.

Exterior Concrete Flatwork

General

Near-surface compacted fill soils within the site are expected to exhibit an expansion index of 0 to 20, i.e., non-expansive. We recommend that all exterior concrete flatwork such as sidewalks, patio slabs, large decorative slabs, concrete subslabs that will be covered with decorative pavers, vehicular driveways, and access roads within and adjacent to the site, be designed by the project architect or structural engineer with consideration given to mitigating the potential cracking and uplift that can develop in soils exhibiting expansion index values that fall in the very low category. The guidelines that follow should be considered as minimums and are subject to review and revision by the project architect, structural engineer, or landscape consultant as deemed appropriate.

Thickness and Joint Spacing

To reduce the potential of cracking, concrete walkways, patio-type slabs, large decorative slabs and concrete subslabs to be covered with decorative pavers should be at least 4 inches thick and provided with construction joints or expansion joints every 6 feet or less. Private driveways that will be designed for the use of passenger cars for access to private garages should also be at least 4 inches thick and provided with construction joints or expansion joints every 10 feet or less. Concrete pavement that will be designed based on an unlimited number of applications of an 18-kip single-axle load in public access areas, segments of road that will be paved with concrete (such as bus stops and cross-walks) or access roads and driveways, which serve multiple residential units or garages, which will be subject to heavy truck loadings should have a minimum thickness of 5 inches and be provided with control joints spaced at maximum 10-foot intervals. A modulus of subgrade reaction of 125 pounds per cubic foot may be used for design of the public and access roads.

Reinforcement

All concrete flatwork having their largest plan-view panel dimension exceeding 10 feet should be reinforced with a minimum of No. 3 bars spaced 24 inches on centers, both ways. Alternatively, the slab reinforcement may consist of welded wire mesh of the sheet type (not rolled) with 6x6/W1.4xW1.4 designation in accordance with the Wire Reinforcement Institute (WRI). The reinforcement should be properly positioned near the middle of the slabs.

> *The reinforcement recommendations provided herein are intended as guidelines to achieve adequate performance for anticipated soil conditions. The project architect, civil, or structural engineer should make appropriate adjustments in reinforcement type, size and spacing to account for concrete internal (e.g., shrinkage and thermal) and external (e.g., applied loads) forces as deemed necessary.*

Edge Beams

Where the outer edges of concrete flatwork are to be bordered by landscaping, it is recommended that consideration be given to the use of edge beams (thickened edges) to prevent excessive infiltration and accumulation of water under the slabs. Edge beams, if used, should be 6 to 8 inches wide, extend 8 inches below the tops of the finish slab surfaces. Although edge beams are not required, their inclusion in flatwork construction adjacent to landscaped areas is intended to reduce the potential for vertical and horizontal movement and subsequent cracking of the flatwork related to uplift forces that can develop in expansive soils.

Subgrade Preparation

Compaction

To reduce the potential for distress to concrete flatwork, the subgrade soils below concrete flatwork areas should be moisture conditioned to at least optimum moisture content and compacted to a minimum relative compaction of 90 percent to a minimum depth of 12 inches (or deeper, as either prescribed elsewhere in this report or determined in the field). Where concrete public roads, concrete segments of roads, or concrete access driveways are proposed, the upper 12 inches of subgrade soil should be compacted to at least 95 percent relative compaction.

Pre-Moistening

To further reduce the potential for concrete flatwork cracking, subgrade soils should be thoroughly moistened prior to placing concrete. The moisture content of the soils should be at least 1.2 times the optimum moisture content and penetrate to a minimum depth of 12 inches into the subgrade. Flooding or ponding of the subgrade is not recommended as this would require construction of numerous earth berms to contain the water. Moisture conditioning should be achieved with a light spray applied to the subgrade over a period of time until recommended moisture content is achieved prior to pouring concrete. Pre-watering of the soils is intended to promote uniform curing of the concrete, reduce the development of shrinkage cracks, and reduce the potential for differential expansion pressure on freshly poured flatwork. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soils, and the depth of moisture penetration prior to pouring concrete.

Drainage

Drainage from patios and other flatwork areas should be directed to local area drains or graded earth swales designed to carry runoff water to approved drainage structures. The concrete flatwork should be sloped at a minimum gradient of one percent, or as prescribed by project civil engineer or local codes, away from building foundations, retaining walls, masonry garden walls and slope areas.

Tree Wells

Tree wells are not recommended in concrete flatwork areas since they introduce excessive water into the subgrade soils and allow root invasion, both of which can cause heaving and cracking of the flatwork.

GRADING AND FINAL PLAN REVIEWS

This report has been prepared for the exclusive use of Diversified Pacific Communities to assist the project engineers and architect in the design of the proposed development. It is recommended that Petra be engaged to review the rough grading and any other final-design drawings and specifications prior to construction to ensure that the recommendations contained in this report have been properly interpreted and are incorporated into the project specifications. If Petra is not given the opportunity to review these documents, we take no responsibility for misinterpretation of our recommendations.

We recommend that Petra be retained to provide soil-engineering services during construction of the excavation and foundation phases of the work to ensure compliance with the design, specifications, and recommendations, and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

If the project plans change significantly (e.g., major slopes or type of structures), we should review our original design recommendations and their applicability to the revised construction. If conditions are encountered during construction that are different than those indicated in this report, this office should be notified immediately. Design and construction revisions may be needed.

REPORT LIMITATIONS

This report is based on the proposed residential development, our preliminary subsurface exploration, geotechnical laboratory testing, and analysis. The materials encountered on the project site and utilized in our laboratory evaluation are believed representative of the total area; however, soil materials, moisture contents, and oversize rock conditions can vary in characteristics between excavations, both laterally and vertically.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and in the same time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes. In addition, this report should be reviewed and updated after a period of 1 year or if the site ownership or project concept changes from that described herein.

This opportunity to be of service is sincerely appreciated. If you have any additional questions or concerns, please feel free contact this office.

Respectfully submitted,
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RMA GeoScience, 2015, Geotechnical Investigation, East Highland Land, LLC, APNs 1210-371-14 & 1210-371-16, Between Greenspot Rd and Santa Ana Canyon Rd, West of Alta Vista, Highland, California, Project Number 15-127-0, dated October 13.

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Wire Reinforcement Institute (WRI), 1996, Design of Slabs on Ground.

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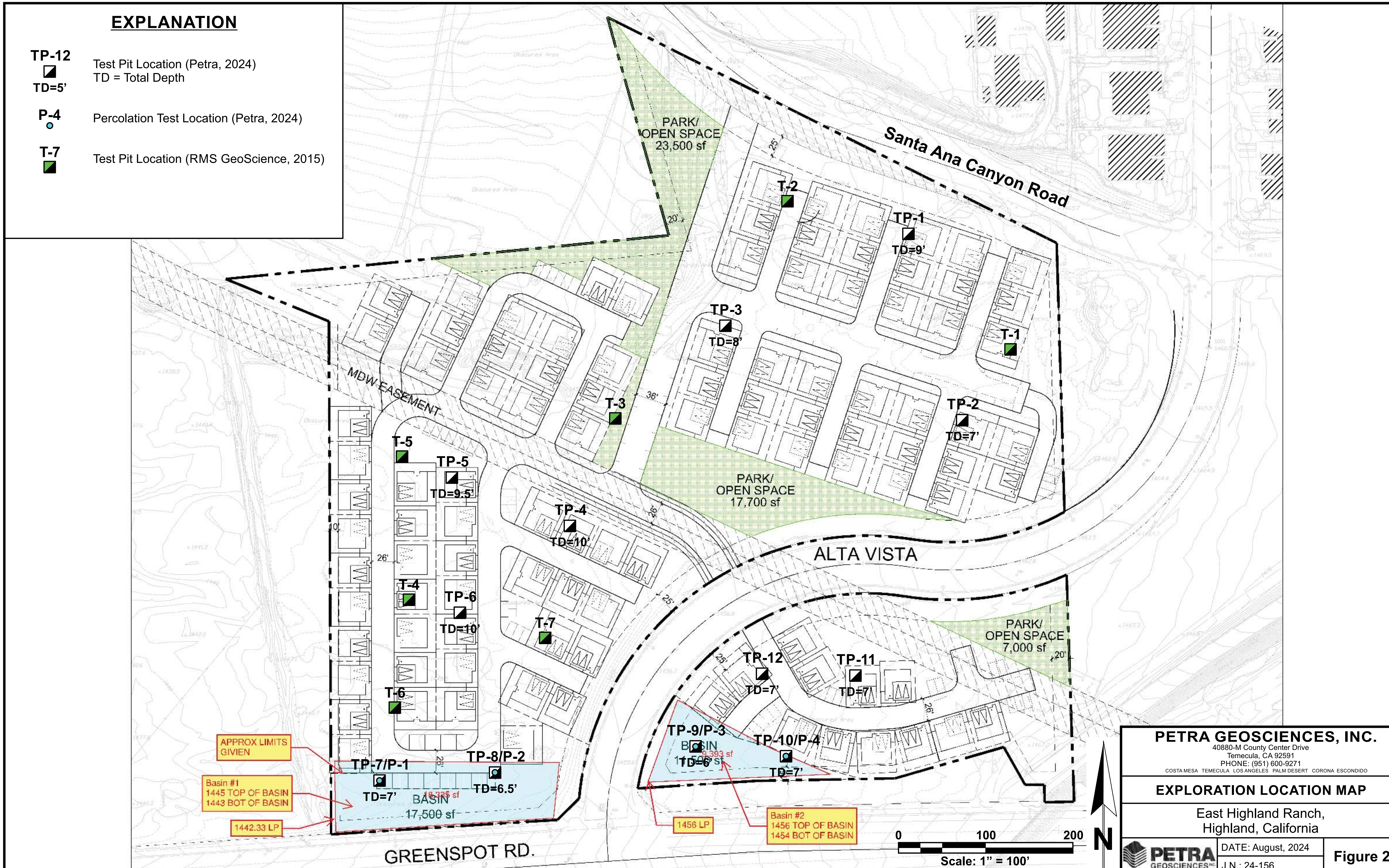
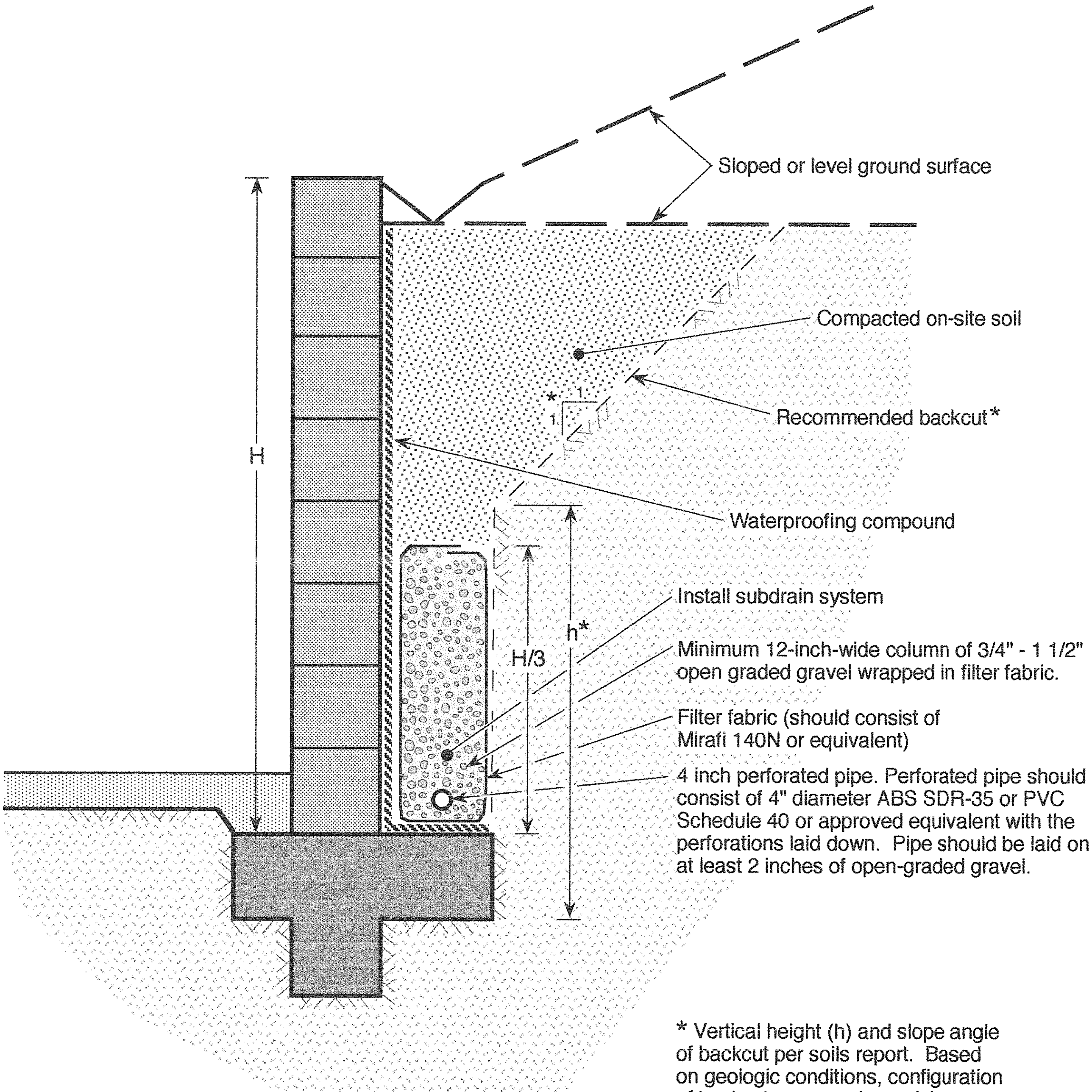
FIGURES


Santa Ana Canyon Road
Alta Vista
Site
Site
Greenspot Road
N
0
500
1000
Scale: 1" = 500'
PETRA GEOSCIENCES, INC.
3186 Airway Avenue, Suite K
Costa Mesa, California 92626
PHONE: (714) 549-8921
COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO
SITE LOCATION MAP
EAST HIGHLAND RANCH
HIGHLAND, CALIFORNIA
PETRA GEOSCIENCES
DATE: August, 2024
J.N.: 24-156
Figure 1


EXPLANATION
TP-12
TD=5'
Test Pit Location (Petra, 2024)
TD = Total Depth
P-4
Percolation Test Location (Petra, 2024)
T-7
Test Pit Location (RMS GeoScience, 2015)
PARK/
OPEN SPACE
23,500 sf
Santa Ana Canyon Road
T-2
TP-1
TD=9'
TP-3
TD=8'
T-1
MDW EASEMENT
T-3
TP-2
TD=7'
T-5
TP-5
TD=9.5'
PARK/
OPEN SPACE
17,700 sf
TP-4
TD=10'
ALTA VISTA
T-4
TP-6
TD=10'
T-7
PARK/
OPEN SPACE
7,000 sf
TP-12
TD=7'
TP-11
TD=7'
T-6
APPROX LIMITS
GIVIEN
Basin #1
1445 TOP OF BASIN
1443 BOT OF BASIN
1442.33 LP
TP-7/P-1
TD=7'
TP-8/P-2
TD=6.5'
BASIN
17,500 sf
TP-9/P-3
TD=6'
TP-10/P-4
TD=7'
1456 LP
Basin #2
1456 TOP OF BASIN
1454 BOT OF BASIN
GREENSPOT RD.
0
100
200
Scale: 1" = 100'
N
PETRA GEOSCIENCES, INC.
40880-M County Center Drive
Temecula, CA 92591
PHONE: (951) 600-9271
COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO
EXPLORATION LOCATION MAP
East Highland Ranch,
Highland, California
DATE: August, 2024
J.N.: 24-156
Figure 2

NATIVE SOIL BACKFILL



* Vertical height (h) and slope angle of backcut per soils report. Based on geologic conditions, configuration of backcut may require revisions (i.e. reduced vertical height, revised slope angle, etc.)

PETRA	RETAINING WALL BACKFILL AND SUBDRAIN DETAILS	FIGURE RW-1

APPENDIX A

FIELD EXPLORATION LOGS
(PETRA, 2024; RMA, 2015)

Key to Soil and Bedrock Symbols and Terms

PETRA

Unified Soil Classification System

Major Divisions				Symbol	Description
Coarse-grained Soils > 1/2 of materials is larger than #200 sieve	The No. 200 U.S. Standard Sieve is about the smallest particle visible to the naked eye	GRAVELS more than half of coarse fraction is larger than #4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
			Gravels with fines	GM	Silty Gravels, poorly-graded gravel-sand-silt mixtures
				GC	Clayey Gravels, poorly-graded gravel-sand-clay mixtures
		SANDS more than half of coarse fraction is smaller than #4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
				SP	Poorly-graded sands, gravelly sands, little or no fines
			Sands with fines	SM	Silty Sands, poorly-graded sand-gravel-silt mixtures
				SC	Clayey Sands, poorly-graded sand-gravel-clay mixtures
Fine-grained Soils > 1/2 of materials is smaller than #200 sieve		SILTS & CLAYS Liquid Limit Less Than 50		ML	Inorganic silts & very fine sands, silty or clayey fine sands, clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	Organic silts & clays of low plasticity
		SILTS & CLAYS Liquid Limit Greater Than 50		MH	Inorganic silts, micaceous or diatomaceous fine sand or silt
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic silts and clays of medium-to-high plasticity
Highly Organic Soils				PT	Peat, humus swamp soils with high organic content

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		>12"	>12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19"	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized to
Fines		Passing #200	<0.0029"	Flour-sized and smaller

Modifiers

Trace	< 1 %
Few	1 - 5%
Some	5 - 12 %
Numerous	12 - 20 %

Laboratory Test Abbreviations

MAX	Maximum Dry Density	MA	Mechanical (Particle Size) Analysis
EXP	Expansion Potential	AT	Atterberg Limits
SO4	Soluble Sulfate Content	#200	#200 Screen Wash
RES	Resistivity	DSU	Direct Shear (Undisturbed Sample)
pH	Acidity	DSR	Direct Shear (Remolded Sample)
CON	Consolidation	HYD	Hydrometer Analysis
SW	Swell	SE	Sand Equivalent
CL	Chloride Content	OC	Organic Content
RV	R-Value	COMP	Mortar Cylinder Compression

Bedrock Hardness

Soft	Can be crushed and granulated by hand; "soil like" and structureless
Moderately Hard	Can be grooved with fingernails; gouged easily with butter knife; crumbles under light hammer blows
Hard	Cannot break by hand; can be grooved with a sharp knife; breaks with a moderate hammer blow
Very Hard	Sharp knife leaves scratch; chips with repeated hammer blows

Sampler and Symbol Descriptions

Approximate Depth of Groundwater Encountered

Approximate Depth of Standing Groundwater

Modified California Split Spoon Sample

No Recovery in Mod. Calif. Split Spoon Sample

Standard Penetration Test

Shelby Tube Sample

Bulk Sample

No Recovery in SPT Sampler

No Recovery in Shelby Tube

Notes:
Blows Per Foot: Number of blows required to advance sampler 1 foot (unless a lesser distance is specified). Samplers in general were driven into the soil or bedrock at the bottom of the hole with a standard (140 lb.) hammer dropping a standard 30 inches unless noted otherwise in Log Notes. Drive samples collected in bucket auger borings may be obtained by dropping non-standard weight from variable heights. When a SPT sampler is used the blow count conforms to ASTM D-1586

TEST PIT LOG

Project:	East Highland Ranch			Boring No.:	TP-1
Location:	Highland			Elevation:	1464±
Job No.:	24-156	Client:	Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight:	N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Silty SAND (SM): Light brown to brown, slightly moist, loose, fine- to coarse-grained, some gravel, 15% cobbles and boulders.							
		ALLUVIUM (Qal) SAND with Silt (SP-SM): Light brown, slightly moist, loose medium dense, fine- to coarse-grained, some gravel, 50% cobbles and boulders.					6.3	93.1	
						■			
							8.1	86.6	
5									
							4.8	104.1	
		25% cobbles and boulders.							
10		Total Depth = 9' No groundwater encountered Slight caving from 6-9' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
15									
20									
25									
30									
35									

PLATE A-1

Petra Geosciences, Inc.

TEST PIT LOG

Project: **East Highland Ranch**		Boring No.:	**TP-2**
Location: **Highland**		Elevation:	**1461±**
Job No.: **24-156**	Client: **Diversified Pacific Communities**	Date:	**3/26/24**
Drill Method: **Backhoe**	Driving Weight: **N/A**	Logged By:	**SS**

Depth (Feet)	Lithology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ARTIFICIAL FILL (af)** Silty SAND (SM): Light brown, dry to slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles and boulders.				■	2.2	93.1	
		ALLUVIUM (Qal) SAND (SP): Light brown to gray, slightly moist, loose to medium dense, fine- to coarse-grained, some gravel, 35% cobbles and boulders.				■	4.0	94.2	
5							3.6	100.0	
		Total Depth = 7' No groundwater encountered Slight caving from 5-7' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

PLATE A-2

Petra Geosciences, Inc.

TEST PIT LOG

Project:	East Highland Ranch		Boring No.:	TP-3
Location:	Highland		Elevation:	1453±
Job No.:	24-156	Client: Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight: N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, slightly moist, loose, fine- to medium-grained, some gravel, 35% cobbles and boulders.					5.3	90.8	
		SAND (SP): Light brown to gray, slightly moist, loose, fine- to coarse-grained, some gravel, 35% cobbles and boulders.							
		SAND with Silt (SP-SM): Light brown to brown, slightly moist, loose, fine- to coarse-grained, some gravel, 55% cobbles and boulders.				■	8.6	97.8	
5							4.4	98.3	
		Total Depth = 8' No groundwater encountered Slight caving from 6-8' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project:	East Highland Ranch		Boring No.:	TP-4
Location:	Highland		Elevation:	1454±
Job No.:	24-156	Client: Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight: N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown to brown, dry to slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles.							
		SAND with Silt (SP-SM): Light brown, slightly moist, loose to medium dense, fine- to coarse-grained, some gravel, 35% cobbles and boulders.				■	5.7	88.5	
		55% cobbles and boulders.				■	5.8	83.7	MAX, DSR, MA
5							3.6	101.3	
		45% cobbles and boulders.							
10		Total Depth = 10' No groundwater encountered Slight caving from 6-10' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project:	East Highland Ranch			Boring No.:	TP-5
Location:	Highland			Elevation:	1447±
Job No.:	24-156	Client:	Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight:	N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to coarse-grained, some gravel, 35% cobbles.					3.7	114.8	
		SAND (SP): Light brown to brown, slightly moist, loose, some gravel, 50% cobbles and boulders.				■	3.0	114.3	
5							3.6	104.3	
10		Total Depth = 9.5' No groundwater encountered Slight caving from 5-9.5' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
15									
20									
25									
30									
35									

PLATE A-5

Petra Geosciences, Inc.

TEST PIT LOG

Project: **East Highland Ranch**		Boring No.:	**TP-6**
Location: **Highland**		Elevation:	**1449±**
Job No.: **24-156**	Client: **Diversified Pacific Communities**	Date:	**3/26/24**
Drill Method: **Backhoe**	Driving Weight: **N/A**	Logged By:	**SS**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown to brown, dry to slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles.				■			
		SAND with Silt (SP-SM): Light brown, slightly moist, loose, fine- to coarse-grained, some gravel, 35% cobbles and boulders.					4.7	102.6	
		SAND (SP): Light brown, slightly moist, loose, fine- to coarse-grained, some gravel, 45% cobbles and boulders.					5.5	94.6	
5							5.0	105.0	
10		Total Depth = 10' No groundwater encountered Slight caving from 6-10' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project: East Highland Ranch		Boring No.:	TP-7
Location: Highland		Elevation:	1445±
Job No.: 24-156	Client: Diversified Pacific Communities	Date:	3/26/24
Drill Method: Backhoe	Driving Weight: N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to coarse-grained, some gravel, 25% cobbles.					3.0	105.0	
		SAND with Silt (SP-SM): Light brown to gray, slightly moist, loose, fine- to coarse-grained, some gravel, 45% cobbles and boulders.					3.0	101.3	
5						■	4.0	110.8	
		Total Depth = 7' No groundwater encountered Slight caving from 5-7' Test Pit converted to percolation well P-1 Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

PLATE A-7

Petra Geosciences, Inc.

TEST PIT LOG

Project:	East Highland Ranch		Boring No.:	TP-8
Location:	Highland		Elevation:	1448±
Job No.:	24-156	Client: Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight: N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to medium-grained, some gravel, few cobbles.							
		SAND (SP): Light brown to gray, slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles.				■	3.4	110.3	
		35% cobbles and boulders.					4.2	108.8	
5							4.3	101.9	
		Total Depth = 6.5' No groundwater encountered Slight caving from 5-6.5' Test Pit converted to percolation well P-2 Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

PLATE A-8

TEST PIT LOG

Project: **East Highland Ranch**			Boring No.: **TP-9**
Location: **Highland**			Elevation: **1458±**
Job No.: **24-156**	Client: **Diversified Pacific Communities**		Date: **3/26/24**
Drill Method: **Backhoe**	Driving Weight: **N/A**		Logged By: **SS**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to coarse-grained, some gravel, 15% cobbles. brown to dark yellow, slightly moist. brown to dark brown, 25% cobbles.					8.6	96.6	
							15.6	88.1	
5						■	33.9	71.9	pH, RES, S04, CL
		Total Depth = 6' No groundwater encountered Slight caving from 5-6' Test Pit converted to percolation well P-3 Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

PLATE A-9

Petra Geosciences, Inc.

TEST PIT LOG

Project: **East Highland Ranch**			Boring No.: **TP-10**
Location: **Highland**			Elevation: **1461±**
Job No.: **24-156**	Client: **Diversified Pacific Communities**		Date: **3/26/24**
Drill Method: **Backhoe**	Driving Weight: **N/A**		Logged By: **SS**

Depth (Feet)	Lith- ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to coarse-grained, numerous gravel. Brown to dark brown, slightly moist, 25% cobbles and boulders.				■	6.7	104.9	
							6.2	102.0	
5									
		SAND (SP): Light brown to brown, slightly moist, loose, fine- to coarse-grained.					13.0	92.2	
		Total Depth = 7' No groundwater encountered Slight caving from 5-7' Test Pit converted to percolation well P-4 Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project: **East Highland Ranch**		Boring No.:	**TP-11**
Location: **Highland**		Elevation:	**1462±**
Job No.: **24-156**	Client: **Diversified Pacific Communities**	Date:	**3/26/24**
Drill Method: **Backhoe**	Driving Weight: **N/A**	Logged By:	**SS**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown, dry, loose, fine- to coarse-grained, some gravel, 25% cobbles. Brown to dark brown, slightly moist.					9.0	93.8	
							11.1	89.5	
5		SAND (SP): Light brown, slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles, trace boulders.				■	5.4	95.4	
		Total Depth = 7' No groundwater encountered Slight caving from 5-7' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

PLATE A-11

Petra Geosciences, Inc.

TEST PIT LOG

Project:	East Highland Ranch		Boring No.:	TP-12
Location:	Highland		Elevation:	1457±
Job No.:	24-156	Client: Diversified Pacific Communities	Date:	3/26/24
Drill Method:	Backhoe	Driving Weight: N/A	Logged By:	SS

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty SAND (SM): Light brown to brown, dry, loose, fine- to coarse-grained, some gravel, 15% cobbles. Dark brown to brown, slightly moist.							
2							9.2	93.5	
3–4						■			
4							8.2	79.1	
5		SAND (SP): Light brown, slightly moist, loose, fine- to coarse-grained, some gravel, 25% cobbles and boulders.							
6							6.0	103.8	
7		Total Depth = 7' No groundwater encountered Slight caving from 5-7' Test Pits backfilled with spoils Moisture and dry density reading taken on site with Nuke Gauge.							
10									
15									
20									
25									
30									
35									

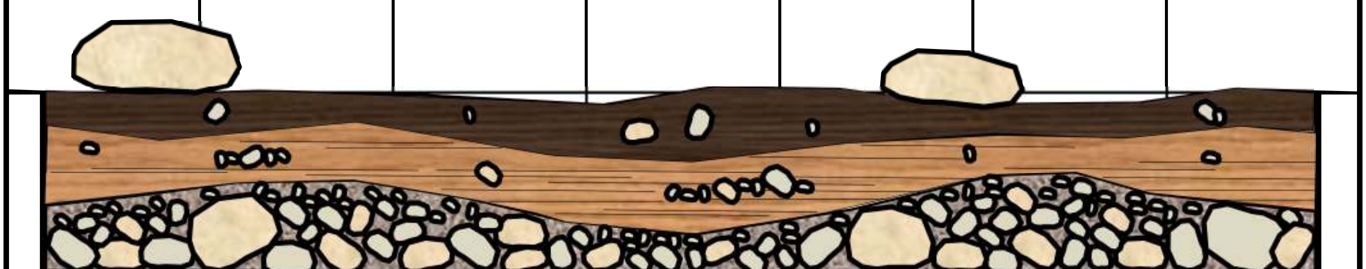
PLATE A-12

Log of Exploratory Trench

Project Name: East Highland Land	Trench Number: 1 Date: October 7, 2015
Project Number: 15-I27-0	Location: Highland, CA
Equipment: Backhoe - Williams Construction	Notes:
Logged By: ams Elevation: 1466 ft	

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with grass and sparse flowers, bushes, and small trees, sporadic boulders ≤ 6' diameter
SM		0-1.5': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent to approximately 2.5', mottled clay layers 0.5-6 cm thick, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
SW		1.5'-3.5': Light yellow brown, fine to coarse grained laminated to massively bedded sand, dry, sporadic subangular to rounded gravel with lenses of gravel and small cobbles, laminated silt-rich beds gray in color approximately 4-6 cm apart and less than 0.5 cm thick, wavy contact
GW		3.5-5': Light yellow brown, gravel, clasts, and boulders sourced primarily from diorite, granite, and other igneous rocks, dry, normally graded, clast supported with a medium to coarse sand martix

1 inch = 5 feet



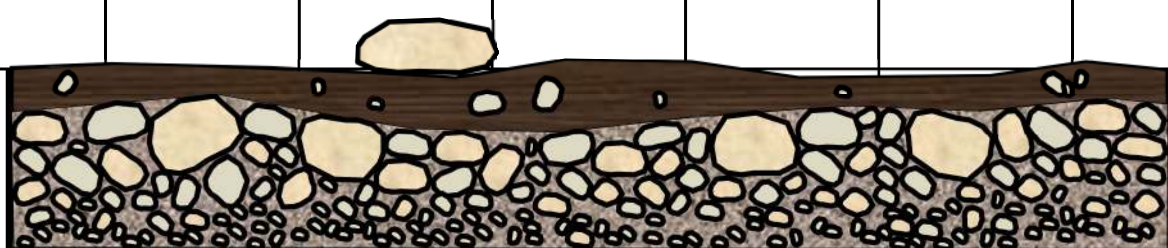
52% Sand
40% Gravel
5% Cobbles
3% Boulders

Log of Exploratory Trench

Project Name: East Highland Land
Trench Number: 2
Date: October 7, 2015
Project Number: 15-I27-0
Location: Highland, CA
Equipment: Backhoe - Williams Construction
Notes:
Logged By: ams
Elevation: 1466 ft

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with grass and sparse flowers, bushes, and small trees, sporadic boulders ≤ 6' diameter
SM		0-1.5': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent, mottled clay layers 0.5-6 cm thick, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
GW		1.5-5': Light yellow brown, gravel, clasts, and boulders sourced primarily from diorite, granite, and other igneous rocks, dry, reverse graded, clast supported with a medium to coarse sand martix

1 inch = 5 feet



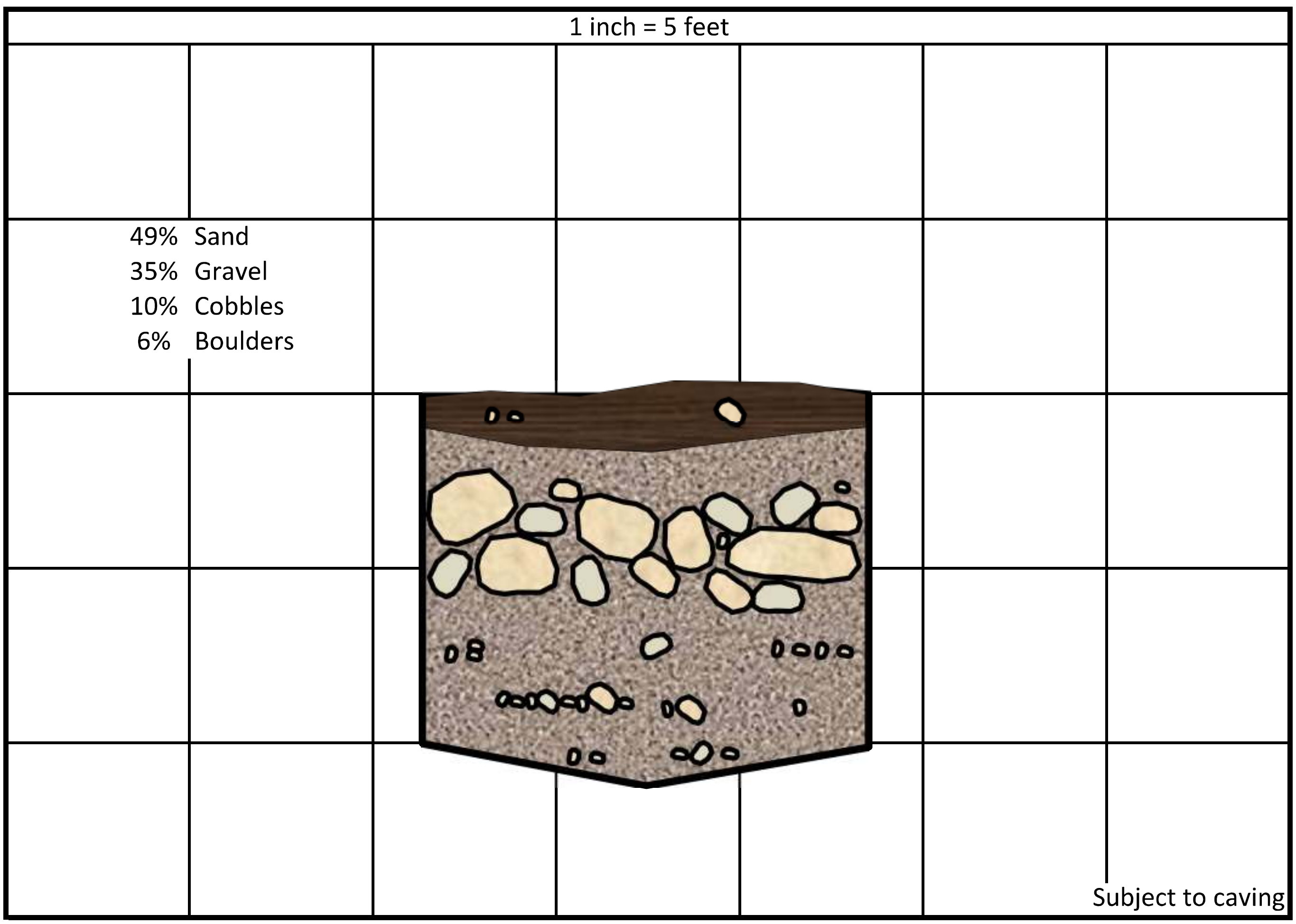
45% Sand
40% Gravel
10% Cobbles
5% Boulders

Log of Exploratory Trench

Project Name: East Highland Land
Project Number: 15-I27-0
Equipment: Backhoe - Williams Construction
Logged By: ams Elevation: 1466 ft

Trench Number: 3 Date: October 7, 2015
Location: Highland, CA
Notes:

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with grass, shrubs, and small trees, sporadic boulders ≤ 4' diameter
SM		0-1': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets to approximately 2 feet prevalent, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
SW		1'-2': White to tan medium to coarse grained clean sand, slightly moist, sproadic roots
GW		2-6': Tan brown sub angular to rounded gravel, cobbles, and boulders with medium to coarse grained sand matrix, dry
SW		6'-8': Yellow tan medium to coarse grained clean sand, dry, sporadic cobbles and gravel in lenses



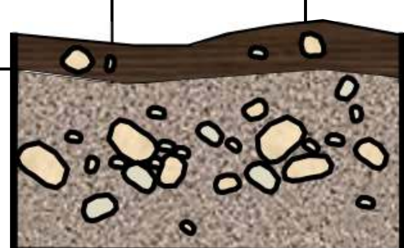
Log of Exploratory Trench

RMA GeoScience

Project Name: East Highland Land
Trench Number: 4
Date: October 7, 2015
Project Number: 15-I27-0
Location: Highland, CA
Equipment: Backhoe - Williams Construction
Notes:
Logged By: ams
Elevation: 1466 ft

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with grasses, sporadic boulders ≤ 4' diameter
SM		0-1.5': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
GW		1.5-6': Light yellow brown fine to coarse sand, gravel, clasts, and boulders sourced primarily from diorite, granite, and other igneous rocks, dry, matrix supported, with lenses of thicker clast supported regions

1 inch = 5 feet



86% Sand
10% Gravel
3% Cobbles
1% Boulders

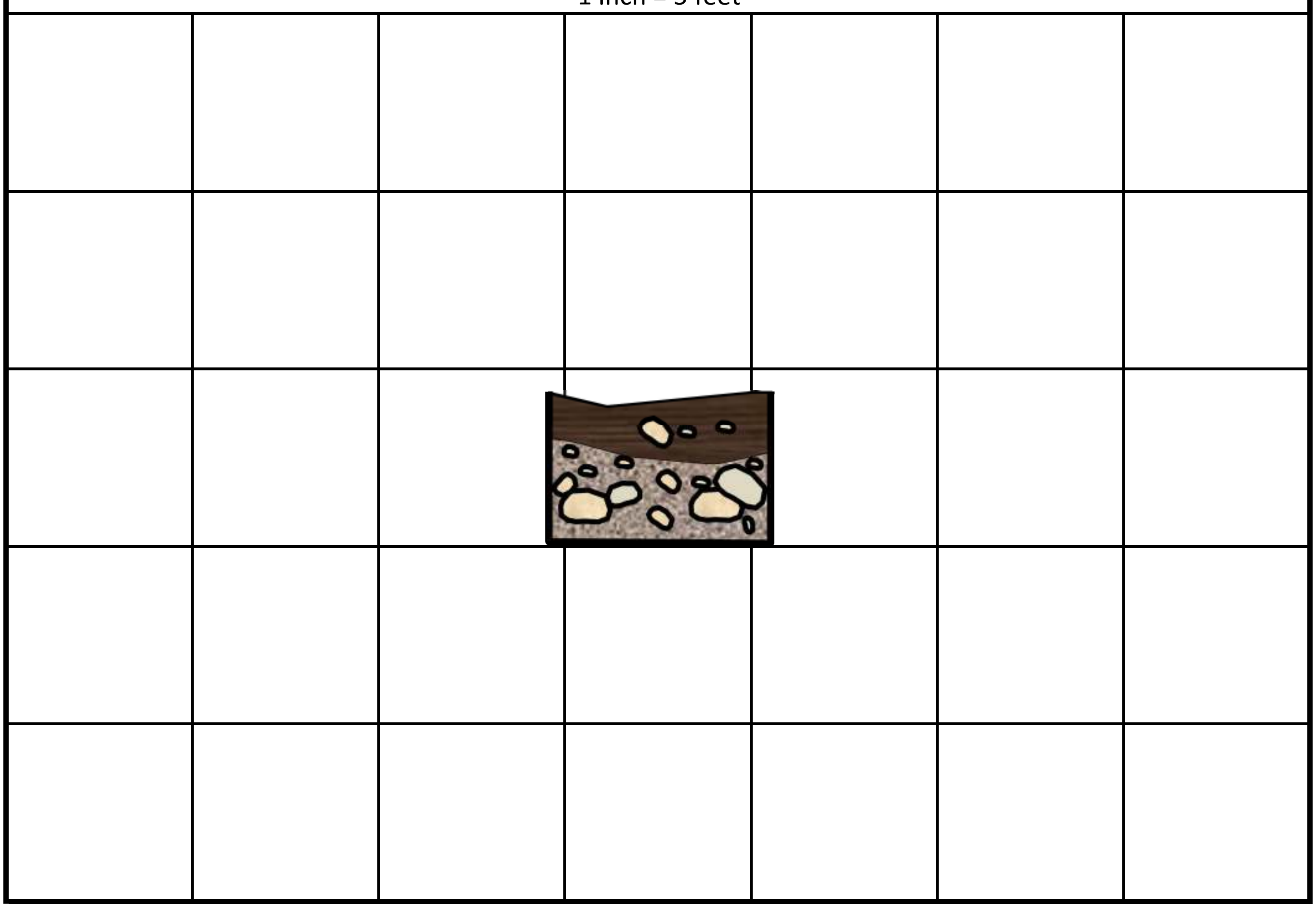
Subject to caving

Log of Exploratory Trench

Project Name: East Highland Land
Trench Number: 5 Date: October 7, 2015
Project Number: 15-I27-0
Location: Highland, CA
Equipment: Backhoe - Williams Construction
Notes:
Logged By: ams Elevation: 1466 ft

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with shrubs and small trees, sporadic boulders ≤ 4' diameter
SM		0-1.5': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
SW		1.5-5': Light yellow brown fine to coarse sand, gravel, clasts, and a few small boulders ,matrix supported, with lenses of thicker clast supported regions

1 inch = 5 feet



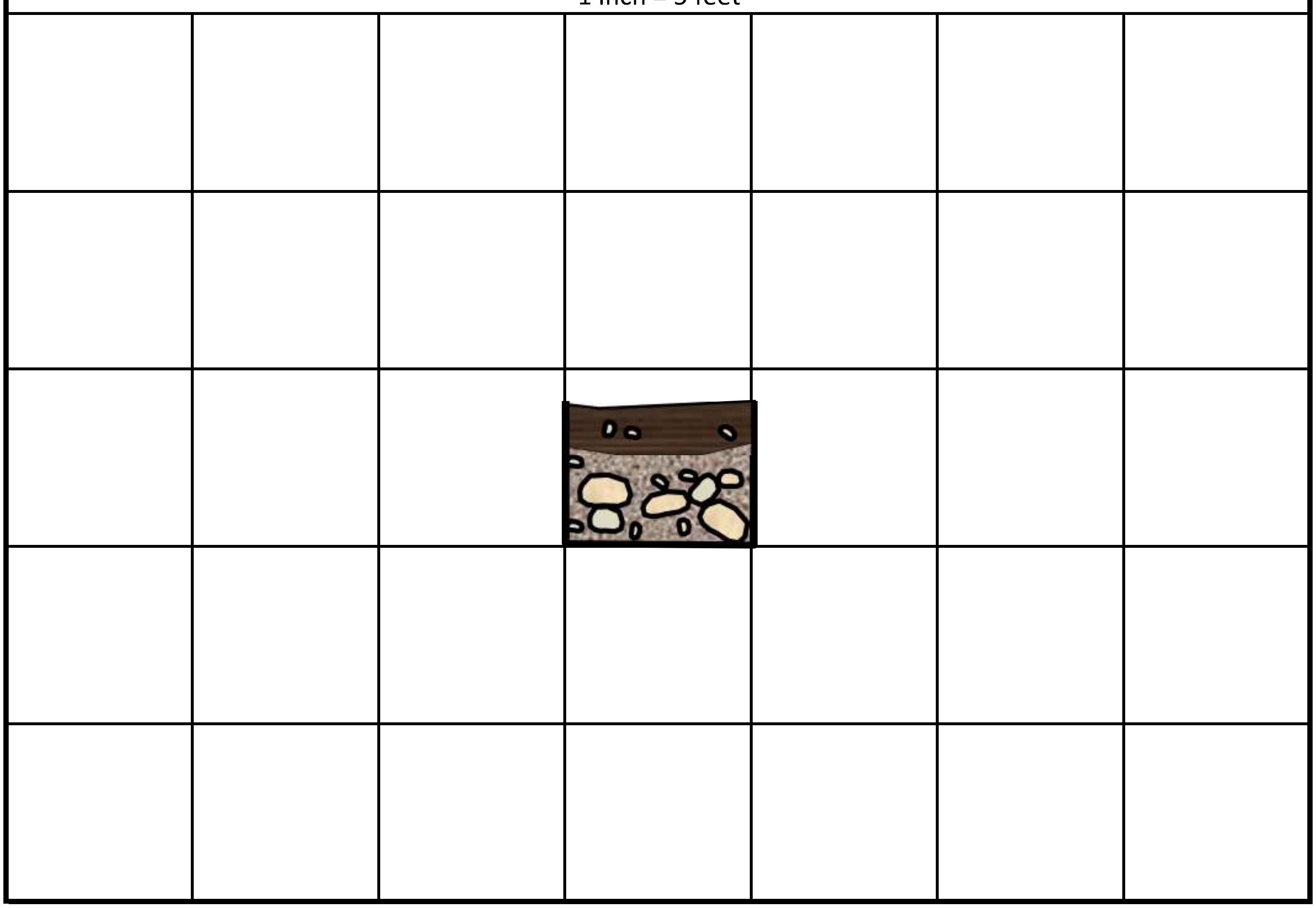
Log of Exploratory Trench

RMA GeoScience

Project Name: East Highland Land
Trench Number: 6
Date: October 7, 2015
Project Number: 15-I27-0
Location: Highland, CA
Equipment: Backhoe - Williams Construction
Notes:
Logged By: ams
Elevation: 1466 ft

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with shrubs and small trees, sporadic boulders ≤ 4' diameter
SM		0-2': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
SW		2-4': Tan to light brown fine to coarse sand, gravel, clasts, and a few small boulders, matrix supported

1 inch = 5 feet



Log of Exploratory Trench

RMA GeoScience

Project Name: East Highland Land
Trench Number: 7 Date: October 7, 2015
Project Number: 15-I27-0
Location: Highland, CA
Equipment: Backhoe - Williams Construction
Notes:
Logged By: ams Elevation: 1466 ft

USCS Classification	Density (PCF)	Material Description
-	-	Surface: vegetated with shrubs and small trees, sporadic boulders ≤ 4' diameter
SM		0-1': Dark brown, silty fine to coarse grained sand, slightly moist, roots and rootlets prevalent, subangular to rounded coarse gravel and small cobbles, porous, wavy gradational contact
SW		1-4': Light yellow brown fine to coarse sand, gravel, clasts, and a few small boulders matrix supported

1 inch = 5 feet

Subject to caving

APPENDIX B

LABORATORY TEST PROCEDURES

LABORATORY DATA SUMMARY (PETRA, 2024; RMA, 2015)

LABORATORY TEST PROCEDURES

Soil Classification

Soils encountered within the exploration borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2488). The samples were re-examined in the laboratory and the classifications reviewed and then revised where appropriate.

Laboratory Maximum Dry Density and Optimum Moisture Content

The maximum dry unit weight and optimum moisture content of various on-site soil types were determined for selected bulk samples in accordance with current version of Method A of ASTM D 1557. The results of these tests are presented on Plate B-1.

Expansion Index

Expansion index tests were performed on selected samples of soil in accordance with ASTM D 4829. The expansion potential classification was determined from 2016 CBC Section 1802.3.2 on the basis of the expansion index value. The test results and expansion potential are presented on Plate B-1.

Soil Corrosivity

Chemical analyses were performed on a selected sample of soil to determine concentrations of soluble sulfate and chloride, as well as pH and resistivity. These tests were performed in accordance with California Test Method Nos. 417 (sulfate), 422 (chloride) and 643 (pH and resistivity). Test results are included on Plate B-1.

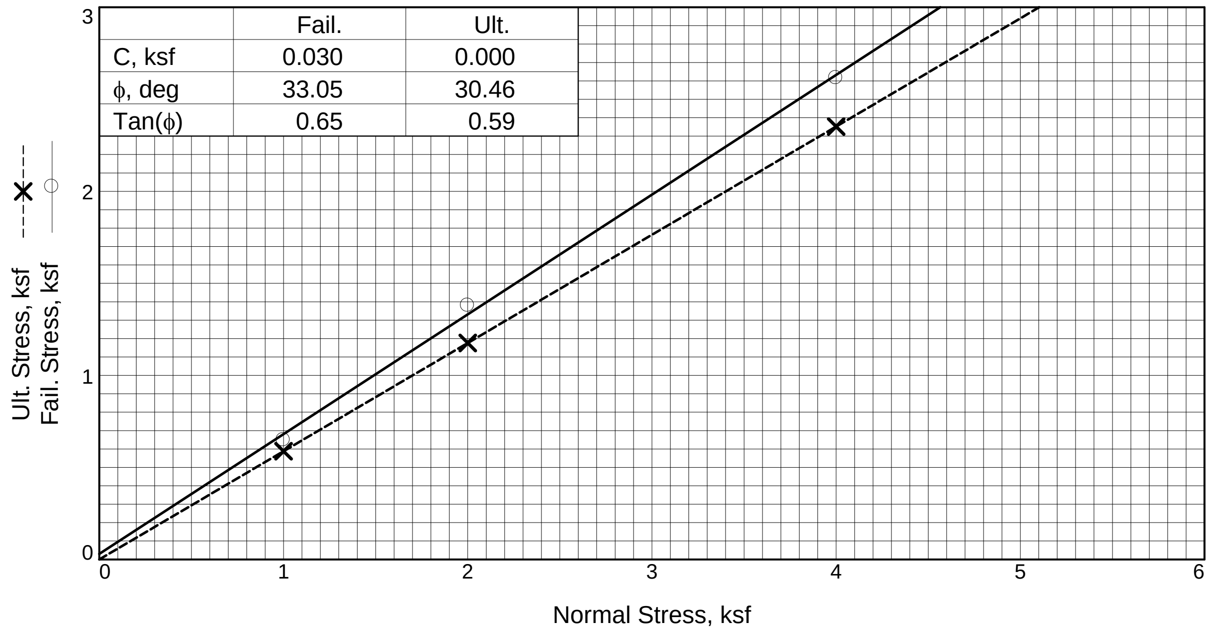
Direct Shear-Remolded

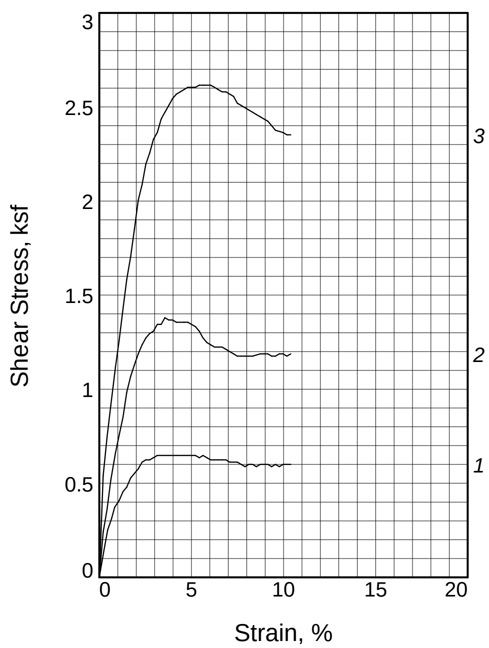
The Coulomb shear strength parameters, angle of internal friction and cohesion, were determined for undisturbed and disturbed (bulk) samples remolded to approximately 90 percent of maximum dry density. These tests were performed in general accordance with ASTM D 3080. Three specimens were prepared for each test. The test specimens were artificially saturated, and then sheared under varied normal loads at a maximum constant rate of strain of 0.05 inches per minute. Results are graphically depicted on Plate B-2.

LABORATORY DATA SUMMARY													
Test Pit Number	**Sample Depth (ft)**	**Soil Description**	**Compaction[1]**		**Expansion[2]**		**Atterberg Limits[3]**			**Soluble Sulfate Content[4] (%)**	**Chloride Content[5] (ppm)**	**pH[6]**	**Minimum Resistivity[6] (Ohm-cm)**
			Max. Dry Density (pcf)	**Optimum Moisture (%)**	**Index**	**Potential**	**LL**	**PL**	**PI**				
3	3-5	Sand with Gravel/Cobbles	120.5	9.5	-	-	-	-	-	-	-	-	-
6	1	Sand with Gravel/Cobbles	-	-	0	Non Expansive	-	-	-	-	-	-	-
9	4	Sand with Gravel/Cobble some Silt	-	-	-	-	-	-	-	0.0030	315	6.4	3,200

Test Procedures:

[1] Per ASTM Test Method ASTM D 1557
[2] Per ASTM Test Method ASTM D 4829
[3] Per ASTM Test Method ASTM D 4318
[4] Per California Test Method CTM 417
[5] Per California Test Method CTM 422
[6] Per California Test Method CTM 643





Sample No.		1	2	3
Initial	Water Content, %	10.5	10.5	10.5
	Dry Density, pcf	103.6	103.9	104.3
	Saturation, %	46.6	47.0	47.5
	Void Ratio	0.5969	0.5921	0.5859
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.017	1.014	1.010
At Test	Water Content, %	20.8	20.6	19.6
	Dry Density, pcf	104.8	106.4	108.0
	Saturation, %	95.4	98.6	97.8
	Void Ratio	0.5790	0.5545	0.5315
	Diameter, in.	2.416	2.416	2.416
	Height, in.	1.006	0.990	0.975
Normal Stress, ksf		1.000	2.000	4.000
Fail. Stress, ksf		0.648	1.380	2.616
Strain, %		4.0	3.6	6.0
Ult. Stress, ksf		0.588	1.176	2.352
Strain, %		9.8	7.5	10.4
Strain rate, in./min.		0.040	0.040	0.040

Sample Type: Remolded

Description: Brown Fine to Coarse Sand with Gravel

Specific Gravity= 2.65

Remarks:

Figure ________

Client: Diversified Pacific

Project: East Highland Ranch

Source of Sample: 24L052 **Depth:** 3-5

Sample Number: TP-4

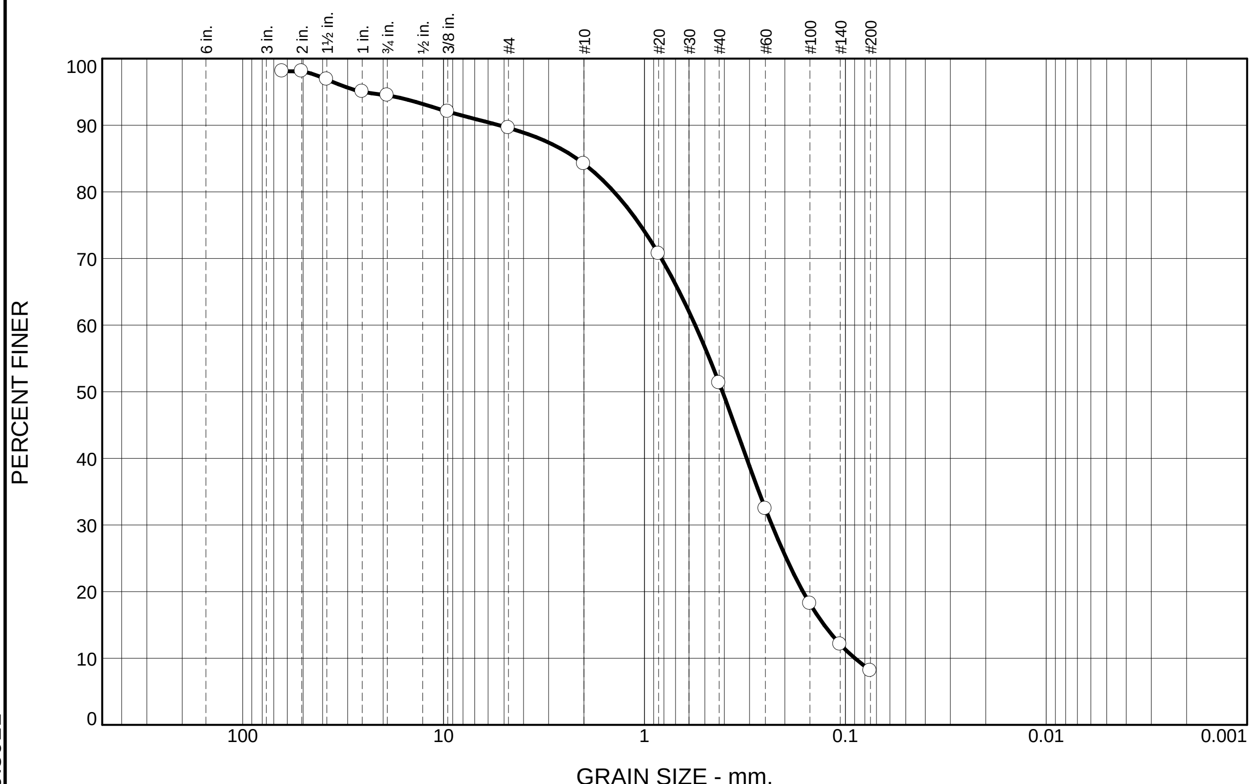
Proj. No.: 24-156 **Date Sampled:** 7/17/2024

PETRA GEOSCIENCES INC.

Laboratory:
1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

Tested By: DI

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
		4.9	5.4	32.9	43.2	8.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2.5	98.1		
2	98.1		
1.5	96.9		
1	95.0		
.75	94.5		
.375	92.1		
#4	89.6		
#10	84.2		
#20	70.7		
#40	51.3		
#60	32.4		
#100	18.2		
#140	12.1		
#200	8.1		

* (no specification provided)

Soil Description

Brown Fine to Coarse Sand with Gravel

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.3040 D_{85}= 2.1732 D_{60}= 0.5589

D_{50}= 0.4089 D_{30}= 0.2321 D_{15}= 0.1276

D_{10}= 0.0896 C_u= 6.24 C_c= 1.08

Classification

USCS= AASHTO=

Remarks

Source of Sample: 24L052 **Depth:** 3-5

Sample Number: TP-4

Date: 7/17/2024

PETRA GEOSCIENCES INC.

Client: Diversified Pacific

Project: East Highland Ranch

Project No: 24-156 **Figure**

Laboratory: 1251 West Pomona Road, Unit #103, Corona, Ca 92882 Phone #. 714.549.8921

Tested By: DI

APPENDIX B

B-1.00 LABORATORY TESTS

B-1.01 Maximum Density

Maximum density - optimum moisture relationships for the major soil types encountered during the field exploration were performed in the laboratory using the standard procedures of ASTM D1557.

B-1.02 Test Results

Test results for all laboratory tests performed on the subject project are presented in this appendix. For a sample-by-sample description, see the Trench Logs presented in Appendix A.

MAXIMUM DENSITY - OPTIMUM MOISTURE
(Test Method: ASTM D1557)

Sample Number	Optimum Moisture (Percent)	Maximum Density (lbs/ft^3)
T-2 at 0-2 ft	9.8	123.7
T-3 at 1-3 ft	___	___

APPENDIX C

PERCOLATION TEST PROCEDURES / RESULTS

<u>Preliminary Percolation Tests Results</u>

Percolation testing was performed to evaluate infiltration rates of the site soils, consisting of alluvial deposits, to aid in the design of proposed stormwater basins.

<u>Test Method</u>

Methodology included drilling four borings to depths between 7 and 8 feet below the existing ground surface, to the bottom elevation of the proposed basins. We subsequently performed falling head percolation tests in each of the four borings. The depths and locations of the percolation tests were provided by Kimley Horn. The locations of the percolation boreholes are shown in Figure 2.

Percolation tests to evaluate site infiltration rates were performed in conformance with Design Handbook for Low Impact Development, Best Management Practices, by Riverside County Flood Control and Water Conservation District, dated September 2011 (Handbook). Log and field-classify soil materials encountered in each boring in accordance with the visual-manual procedures outlined in the Unified Soil Classification System and the American Society for Testing and Materials (ASTM) Procedure D 2488-90. All field activities were performed by or under the direct observation of a State of California Certified Engineering Geologist.

<u>Test Description and Results</u>

The falling head percolation testing method was used in accordance with the above-referenced Handbook. The borings for the percolation tests were advanced using an 8-inch diameter hollow-stem auger to depths of approximately 7 to 8 feet below the existing ground surface. Percolation testing was performed in the bottom one foot of the boreholes, within the alluvial deposits. The locations of the percolation test borings are shown on Figure 2. Logs of percolation test borings are provided in Appendix A. A grain size analysis was performed on a representative soil sample. Laboratory results are presented in Appendix B.

Following a presoaking period, field testing was conducted in a perforated pipe lowered into the borehole, with ¾-inch gravel surrounding the pipe. Tests were conducted at 10-minute intervals for a period of approximately one hour. The falling-head percolation test data were utilized in determining the test infiltration rate, I_t, expressed in units of inches/hour, utilizing the Porchet Method (RCFCWCD, 2011). The infiltration rate, I_t, was calculated by determining the volumetric water flow rate through the wetted borehole surface area. The un-factored test results are summarized in the following table, Table 1. It should be noted that infiltration rates were higher than measurable in accordance the Handbook, as such, the time to record a drop of 12 inches was used in the time interval column on the percolation test sheets.

TABLE 1

Un-Factored Infiltration Test Results

Test No.	Borehole Total Depth (feet)	Approx. Test Zone (feet below existing grade)	Geologic Unit / Soil Description	Infiltration Test Rate, I_t (in/hr)
P-1	8	7-8	Qal Poorly Graded Silty SAND with Gravel (SP-SM)	29.38
P-2	7.5	6.5-7.5	Qal Poorly Graded SAND (SP)	29.48
P-3	7	6-7	Qal Silty SAND (SM)	29.48
P-4	8	7-8	Qal Poorly Graded SAND (SP)	29.48

The test data indicates the alluvial deposits at the depths evaluated are considered permeable. It is our professional opinion that the infiltration rates measured 7 to 8 feet below ground surface, as well as the material descriptions, are indicative of sufficient permeability to be suitable for the intended infiltration purposes.

Discussion

Suitability Assessment

In view of the test data, certain jurisdictions consider such factors as infiltration assessment method, soil texture, site soils variability, and depth to groundwater/impervious layer to assign a Suitability Assessment Safety Factor that should be applied to the infiltration rates.

To perform such an evaluation, we have adopted a procedure provided by Santa Ana Regional Water Quality Control Board (SARWQCB) in their Technical Guidance Document (TGD) for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Plans (WQMPs), with Appendices, For Santa Ana Regional Board consideration, dated December 20, 2013 (SARWQCB, 2013). Based on Appendix D of this document, using Table VII.3: Suitability Assessment Related Considerations for Infiltration Facility Safety Factors, and Worksheet H: Factor of Safety and Design Infiltration Rate and Worksheet, of the Orange County BMP Design Manual, the following is presented.

TABLE 2

Site Suitability Reduction Factor (Category A) for Infiltration Rate

Considerations		Concern		Reduction Factor
Description	**Weight**	**Level**	**Safety Factor**	**Weight x Safety Factor**
Soil Assessment Method	0.25	Low	1.0	0.25
Predominant Soil Texture	0.25	Low	1.0	0.25
Site Soil Variability	0.50	Medium	1.0	0.50
Depth to Groundwater/Impervious Layer	0.25	Low	1.0	0.25
Reduction Factor (sum of individual Reduction Factors)				**1.25**

Based on the information provided in Table 2, a Reduction Factor of 1.25 should be applied to the values of Infiltration Rate, I_t, provided in Table 1, above, for Site Suitability considerations.

Construction Procedure

The infiltration rates provided herein are considered representative of the native soils in the vicinity of the percolation test locations. Care should be taken to minimize disturbance of the exposed bottom surface of the basins as fill placement or any compaction effort applied to the area will have a detrimental effect on the anticipated infiltration rate of the proposed infiltration areas.

Environmental Impact

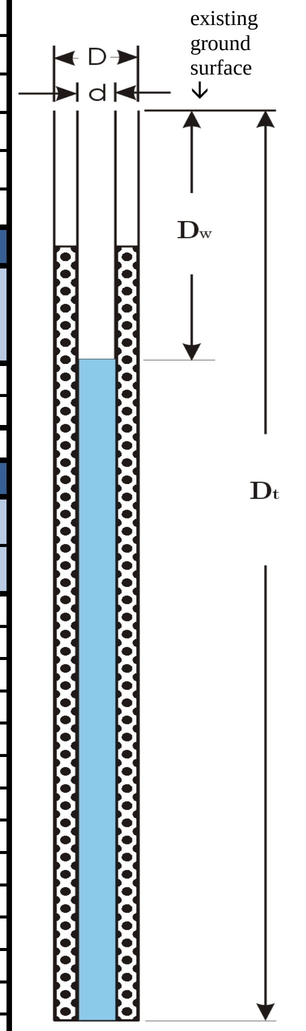
It should be noted that clean, potable water was used for the test. Surface runoff usually carries with it debris and fine particles that are typically expected to reduce the calculated infiltration rate.

Factor of Safety

The values of infiltration rate provided in Table 1 are raw test values. As discussed above, these values should be corrected for site suitability considerations by applying a Reduction factor as provided in Table 2. Further, the project civil engineer needs to consider a Design Safety Factor, which incorporates such items as tributary area size, level of pretreatment/expected sediment load, redundancy/contingency plan, and compaction during construction, in combination with the Suitability Assessment Safety/Reduction Factor for the design of the system.

Boring/Test Number: P-1

Total Depth of Boring, D_T (ft):	8	**Test Date:**	3/27/2024
Diameter of Hole, D (in):	6	**Tested By:**	SS
Diameter of Casing, d (in):	2	**USCS Soil Type:**	SP-SM
Depth of Slotted Casing (ft):	3 to 8	**Depth to Groundwater (ft):**	
Porosity of Annulus Material, *n* :	0.44	**Ground Elevation (msl ft):**	1445
Depth from Existing Ground Surface to Bottom of Prop. Infiltration System (ft):			



SANDY SOIL CRITERIA TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w Initial, D_o (ft.)	Final, D_f (ft.)	Change in Water Level ΔD (in.)	Change in Height of Water Greater Than or Equal to 6"? (Yes/No)*
1	25	6.90	8.04	13.68	yes
2	25	6.90	8.04	13.68	yes

Standard Time Interval Between Readings (min.), [* if yes = 10, if no = 30]: 10

PERCOLATION TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w Initial, D_o (ft.)	Final, D_f (ft.)	Change in Water Level ΔH (in.)	Percolation Rate (min/in.)	Percolation Rate (gal/day/ft^2)
1	2.07	6.90	7.90	12.00	0.17	450.60
2	2.53	6.90	7.90	12.00	0.21	368.67
3	2.67	6.90	7.90	12.00	0.22	349.34
4	2.83	6.90	7.90	12.00	0.24	329.59
5	2.83	6.90	7.90	12.00	0.24	329.59
6	2.83	6.90	7.90	12.00	0.24	329.59

TEST RESULTS**

Infiltration Rate [Porchet Method]# (inches/hour)	Percolation Rate (min/in.)	Percolation Rate (gal/day/ft^2)
29.38	**0.24**	**329.59**

**Raw Results. Does Not Include a Factor of Safety

FACTOR OF SAFETY

Testing Option	Testing Requirements	Factor of Safety per Reference
Option 2	**4 tests minimum with at least two borings per basin**	**3**

Where Infiltration Rate, $I_t = \Delta H\,(60r) / \Delta t\,(r + 2H_{avg})$

$r = D / 2$

$H_o = D_T - D_o$

$H_f = D_T - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

Reference:
RCFCWCD, Design Handbook for LID, dated September, 2011

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COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO

PERCOLATION TEST SUMMARY

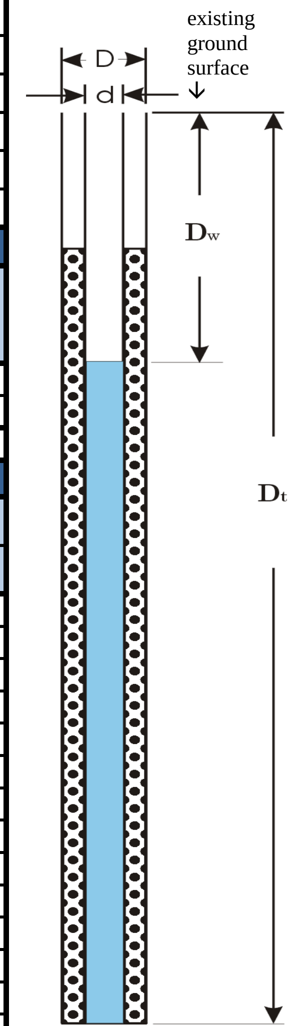
Highland Ranch
Highland, CA

DATE: August, 2024
J.N.: 24-156

Appendix C

Boring/Test Number: P-2

Total Depth of Boring, D_T (ft):	7.5	**Test Date:**	3/27/2024
Diameter of Hole, D (in):	6	**Tested By:**	SS
Diameter of Casing, d (in):	2	**USCS Soil Type:**	SP
Depth of Slotted Casing (ft):	2.5 to 7.5	**Depth to Groundwater (ft):**	
Porosity of Annulus Material, *n* :	0.44	**Ground Elevation (msl ft):**	1448
Depth from Existing Ground Surface to Bottom of Prop. Infiltration System (ft):			



SANDY SOIL CRITERIA TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔD (in.)	Change in Height of Water Greater Than or Equal to 6"? (Yes/No)*
		Initial, D_o (ft.)	Final, D_f (ft.)		
1	25	6.40	7.45	12.6	yes
2	25	6.40	7.48	12.96	yes

Standard Time Interval Between Readings (min.), [* if yes = 10, if no = 30]: 10

PERCOLATION TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔH (in.)	Percolation Rate	
		Initial, D_o (ft.)	Final, D_f (ft.)		(min/in.)	(gal/day/ft^2)
1	3.33	6.40	7.40	12.00	0.28	280.10
2	3.75	6.40	7.40	12.00	0.31	248.73
3	3.93	6.40	7.40	12.00	0.33	237.34
4	3.98	6.40	7.40	12.00	0.33	234.36
5	4.20	6.40	7.40	12.00	0.35	222.08
6	4.13	6.40	7.40	12.00	0.34	225.85
7	4.25	6.40	7.40	12.00	0.35	219.47
8	4.23	6.40	7.40	12.00	0.35	220.51
9	4.25	6.40	7.40	12.00	0.35	219.47
10	4.25	6.40	7.40	12.00	0.35	219.47

TEST RESULTS**

Infiltration Rate [Porchet Method]# (inches/hour)	Percolation Rate	
	(min/in.)	(gal/day/ft^2)
20.13	**0.34**	**225.85**

**Raw Results. Does Not Include a Factor of Safety

FACTOR OF SAFETY

Testing Option	Testing Requirements	Factor of Safety per Reference
Option 2	**4 tests minimum with at least two borings per basin**	**3**

Where Infiltration Rate, $I_t = \Delta H (60r) / \Delta t (r + 2H_{avg})$

$r = D / 2$

$H_o = D_T - D_o$

$H_f = D_T - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

Reference:
RCFCWCD, Design Handbook for LID, dated September, 2011

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COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO

PERCOLATION TEST SUMMARY

Highland Ranch
Highland, CA

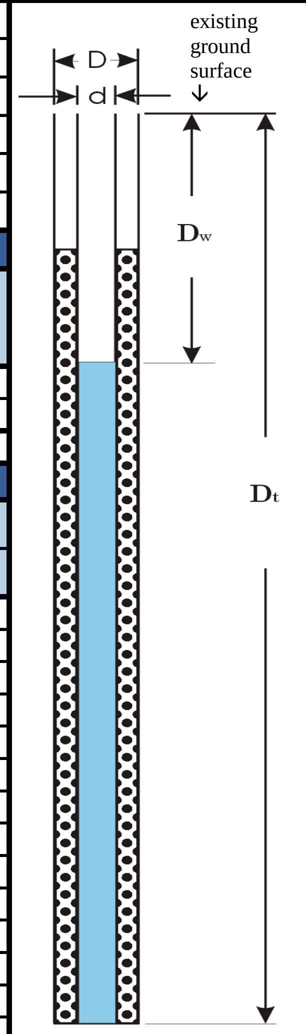
PETRA GEOSCIENCES INC.

DATE: August, 2024
J.N.: 24-156

Appendix C

Boring/Test Number: P-3

Total Depth of Boring, D_T (ft):	7	**Test Date:**	3/27/2024
Diameter of Hole, D (in):	6	**Tested By:**	SS
Diameter of Casing, d (in):	2	**USCS Soil Type:**	SM
Depth of Slotted Casing (ft):	2 to 7	**Depth to Groundwater (ft):**	
Porosity of Annulus Material, *n* :	0.44	**Ground Elevation (msl ft):**	1458
Depth from Existing Ground Surface to Bottom of Prop. Infiltration System (ft):			



SANDY SOIL CRITERIA TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔD (in.)	Change in Height of Water Greater Than or Equal to 6"? (Yes/No)*
		Initial, D_o (ft.)	Final, D_f (ft.)		
1	25	5.90	7.18	15.36	yes
2	25	5.90	7.19	15.48	yes

Standard Time Interval Between Readings (min.), [* if yes = 10, if no = 30]: 10

PERCOLATION TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔH (in.)	Percolation Rate	
		Initial, D_o (ft.)	Final, D_f (ft.)		(min/in.)	(gal/day/ft^2)
1	2.52	5.90	6.90	12.00	0.21	370.14
2	2.73	5.90	6.90	12.00	0.23	341.66
3	2.82	5.90	6.90	12.00	0.24	330.76
4	2.80	5.90	6.90	12.00	0.23	333.12
5	2.80	5.90	6.90	12.00	0.23	333.12
6	2.82	5.90	6.90	12.00	0.24	330.76

TEST RESULTS**

Infiltration Rate [Porchet Method]# (inches/hour)	Percolation Rate	
	(min/in.)	(gal/day/ft^2)
29.48	**0.24**	**330.76**

**Raw Results. Does Not Include a Factor of Safety

FACTOR OF SAFETY

Testing Option	Testing Requirements	Factor of Safety per Reference
Option 2	**4 tests minimum with at least two borings per basin**	**3**

Where Infiltration Rate, It = $\Delta H (60r) / \Delta t (r + 2H_{avg})$

$r = D / 2$

$H_o = D_T - D_o$

$H_f = D_T - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

Reference:
RCFCWCD, Design Handbook for LID, dated September, 2011

PETRA GEOSCIENCES, INC.
3186 Airway Avenue, Suite K
Costa Mesa, California 92626
PHONE: (714) 549-8921
COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO

PERCOLATION TEST SUMMARY

Highland Ranch
Highland, CA

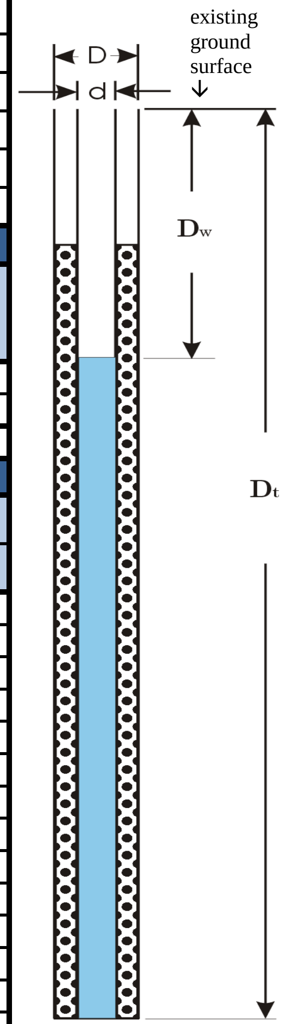
PETRA GEOSCIENCES

DATE: August, 2024
J.N.: 24-156

Appendix C

Boring/Test Number: P-4

Total Depth of Boring, D_T (ft):	8	**Test Date:**	3/27/2024
Diameter of Hole, D (in):	6	**Tested By:**	SS
Diameter of Casing, d (in):	2	**USCS Soil Type:**	SP
Depth of Slotted Casing (ft):	3 to 8	**Depth to Groundwater (ft):**	
Porosity of Annulus Material, *n* :	0.44	**Ground Elevation (msl ft):**	1461
Depth from Existing Ground Surface to Bottom of Prop. Infiltration System (ft):			



SANDY SOIL CRITERIA TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w Initial, D_o (ft.)	Depth to Water, D_w Final, D_f (ft.)	Change in Water Level ΔD (in.)	Change in Height of Water Greater Than or Equal to 6"? (Yes/No)*
1	25	6.90	7.98	12.96	yes
2	25	6.90	7.98	12.96	yes

Standard Time Interval Between Readings (min.), [* if yes = 10, if no = 30]: 10

PERCOLATION TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w Initial, D_o (ft.)	Depth to Water, D_w Final, D_f (ft.)	Change in Water Level ΔH (in.)	Percolation Rate (min/in.)	Percolation Rate (gal/day/ft^2)
1	2.52	6.90	7.90	12.00	0.21	370.14
2	2.73	6.90	7.90	12.00	0.23	341.66
3	2.82	6.90	7.90	12.00	0.24	330.76
4	2.80	6.90	7.90	12.00	0.23	333.12
5	2.80	6.90	7.90	12.00	0.23	333.12
6	2.82	6.90	7.90	12.00	0.24	330.76

TEST RESULTS**

Infiltration Rate [Porchet Method]# (inches/hour)	Percolation Rate (min/in.)	Percolation Rate (gal/day/ft^2)
29.48	**0.24**	**330.76**

**Raw Results. Does Not Include a Factor of Safety

FACTOR OF SAFETY

Testing Option	Testing Requirements	Factor of Safety per Reference
Option 2	**4 tests minimum with at least two borings per basin**	**3**

Where Infiltration Rate, It = ΔH (60r) / Δt (r + 2Havg)

$r = D / 2$

$H_o = D_T - D_o$

$H_f = D_T - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

Reference:
RCFCWCD, Design Handbook for LID, dated September, 2011

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PERCOLATION TEST SUMMARY

Highland Ranch
Highland, CA

PETRA GEOSCIENCES INC.

DATE: August, 2024
J.N.: 24-156

Appendix C

APPENDIX D

STANDARD GRADING SPECIFICATIONS

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for projects on which Petra Geosciences, Inc. (Petra) is the geotechnical consultant. No deviation from these specifications will be allowed, except where specifically superseded in the preliminary geology and soils report, or in other written communication signed by the Soils Engineer and Engineering Geologist of record (Geotechnical Consultant).

I. GENERAL

A. The Geotechnical Consultant is the Owner's or Builder's representative on the project. For the purpose of these specifications, participation by the Geotechnical Consultant includes that observation performed by any person or persons employed by, and responsible to, the licensed Soils Engineer and Engineering Geologist signing the soils report.

B. The contractor should prepare and submit to the Owner and Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" and the estimated quantities of daily earthwork to be performed prior to the commencement of grading. This work plan should be reviewed by the Geotechnical Consultant to schedule personnel to perform the appropriate level of observation, mapping, and compaction testing as necessary.

C. All clearing, site preparation, or earthwork performed on the project shall be conducted by the Contractor in accordance with the recommendations presented in the geotechnical report and under the observation of the Geotechnical Consultant.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Consultant and to place, spread, mix, water, and compact the fill in accordance with the specifications of the Geotechnical Consultant. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Consultant.

E. It is the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction to project specifications. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement, and time of year.

F. After completion of grading a report will be submitted by the Geotechnical Consultant.

II. SITE PREPARATION

A. Clearing and Grubbing

1. All vegetation such as trees, brush, grass, roots, and deleterious material shall be disposed of offsite. This removal shall be concluded prior to placing fill.

2. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines, etc., are to be removed or treated in a manner prescribed by the Geotechnical Consultant.

III. FILL AREA PREPARATION

A. Remedial Removals/Overexcavations

1. Remedial removals, as well as overexcavation for remedial purposes, shall be evaluated by the Geotechnical Consultant. Remedial removal depths presented in the geotechnical report and shown on the geotechnical plans are estimates only. The actual extent of removal should be determined by the Geotechnical Consultant based on the conditions exposed during grading. All soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as determined by the Geotechnical Consultant.

2. Soil, alluvium, or bedrock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as a part of a compacted fill must be approved by the Geotechnical Consultant.

3. Should potentially hazardous materials be encountered, the Contractor should stop work in the affected area. An environmental consultant specializing in hazardous materials should be notified immediately for evaluation and handling of these materials prior to continuing work in the affected area.

B. Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide sufficient survey control for determining locations and elevations of processed areas, keys, and benches.

C. Processing

After the ground surface to receive fill has been declared satisfactory for support of fill by the Geotechnical Consultant, it shall be scarified to a minimum depth of 6 inches and until the ground surface is uniform and free from ruts, hollows, hummocks, or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted to a minimum relative compaction of 90 percent.

D. Subdrains

Subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, and/or with the recommendations of the Geotechnical Consultant. (Typical Canyon Subdrain details are given on Plate SG-1).

E. Cut/Fill & Deep Fill/Shallow Fill Transitions

In order to provide uniform bearing conditions in cut/fill and deep fill/shallow fill transition lots, the cut and shallow fill portions of the lot should be overexcavated to the depths and the horizontal limits discussed in the approved geotechnical report and replaced with compacted fill. (Typical details are given on Plate SG-7.)

IV. COMPACTED FILL MATERIAL

A. General

Materials excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Consultant. Material to be used for fill shall be essentially free of organic material and other deleterious substances. Roots, tree branches, and other matter missed during clearing shall be removed from the fill as recommended by the Geotechnical Consultant. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

B. Oversize Materials

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches in diameter, shall be taken offsite or placed in accordance with the recommendations of the Geotechnical Consultant in areas designated as suitable for rock disposal (Typical details for Rock Disposal are given on Plate SG-4).

Rock fragments less than 12 inches in diameter may be utilized in the fill provided, they are not nested or placed in concentrated pockets; they are surrounded by compacted fine grained soil material and the distribution of rocks is approved by the Geotechnical Consultant.

C. Laboratory Testing

Representative samples of materials to be utilized as compacted fill shall be analyzed by the laboratory of the Geotechnical Consultant to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Consultant as soon as possible.

D. Import

If importing of fill material is required for grading, proposed import material should meet the requirements of the previous section. The import source shall be given to the Geotechnical Consultant at least 2 working days prior to importing so that appropriate tests can be performed and its suitability determined.

V. FILL PLACEMENT AND COMPACTION

A. Fill Layers

Material used in the compacting process shall be evenly spread, watered, processed, and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Consultant.

B. Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly above optimum moisture content.

C. Compaction

Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency. (In general, ASTM D 1557-02, will be used.)

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soils condition, the area to received fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soils report.

D. Failing Areas

If the moisture content or relative density varies from that required by the Geotechnical Consultant, the Contractor shall rework the fill until it is approved by the Geotechnical Consultant.

E. Benching

All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of 5 horizontal to 1 vertical, in accordance with the recommendations of the Geotechnical Consultant.

VI. SLOPES

A. Fill Slopes

The contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses, and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure that produces the required compaction.

B. Side Hill Fills

The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report. (See detail on Plate SG-5.)

C. Fill-Over-Cut Slopes

Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials, and the transition shall be stripped of all soils prior to placing fill. (see detail on Plate SG-6).

D. Landscaping

All fill slopes should be planted or protected from erosion by other methods specified in the soils report.

E. Cut Slopes

1. The Geotechnical Consultant should observe all cut slopes at vertical intervals not exceeding 10 feet.

2. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be evaluated by the Geotechnical Consultant, and recommendations shall be made to treat these problems (Typical details for stabilization of a portion of a cut slope are given in Plates SG-2 and SG-3.).

3. Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erodible interceptor swale placed at the top of the slope.

4. Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

5. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Consultant.

VII. GRADING OBSERVATION

A. General

All cleanouts, processed ground to receive fill, key excavations, subdrains, and rock disposals must be observed and approved by the Geotechnical Consultant prior to placing any fill. It shall be the Contractor's responsibility to notify the Geotechnical Consultant when such areas are ready.

B. Compaction Testing

Observation of the fill placement shall be provided by the Geotechnical Consultant during the progress of grading. Location and frequency of tests shall be at the Consultants discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations may be selected to verify adequacy of compaction levels in areas that are judged to be susceptible to inadequate compaction.

C. Frequency of Compaction Testing

In general, density tests should be made at intervals not exceeding 2 feet of fill height or every 1000 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

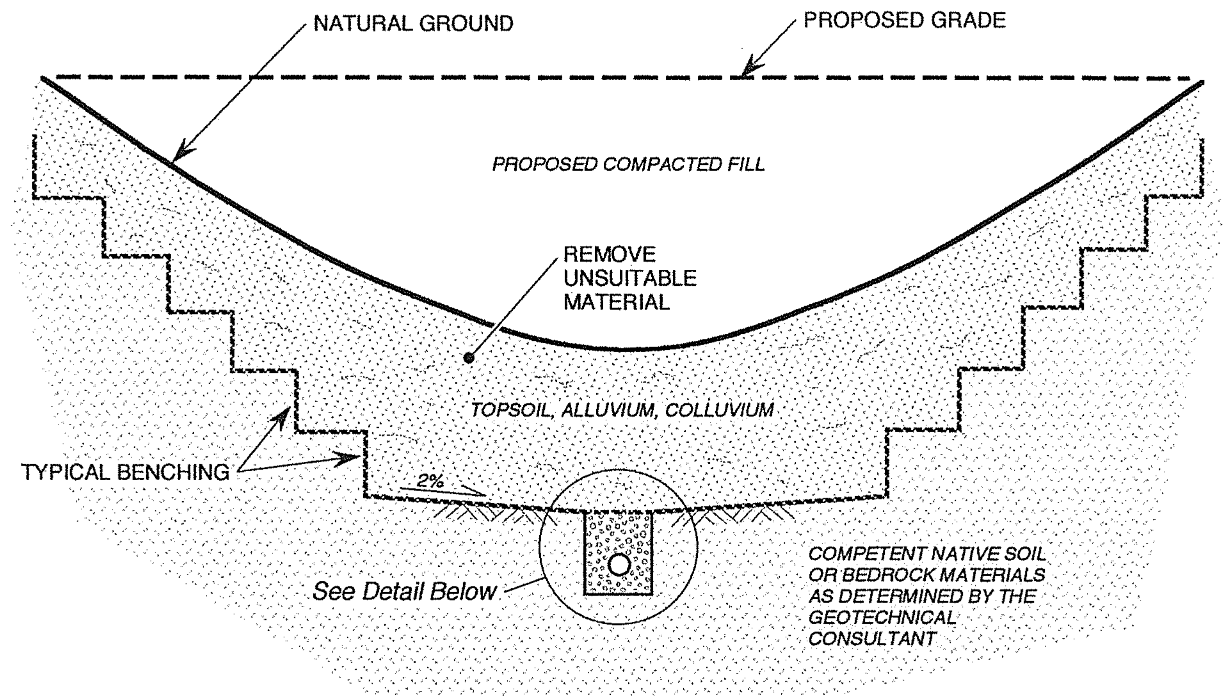
VIII. CONSTRUCTION CONSIDERATIONS

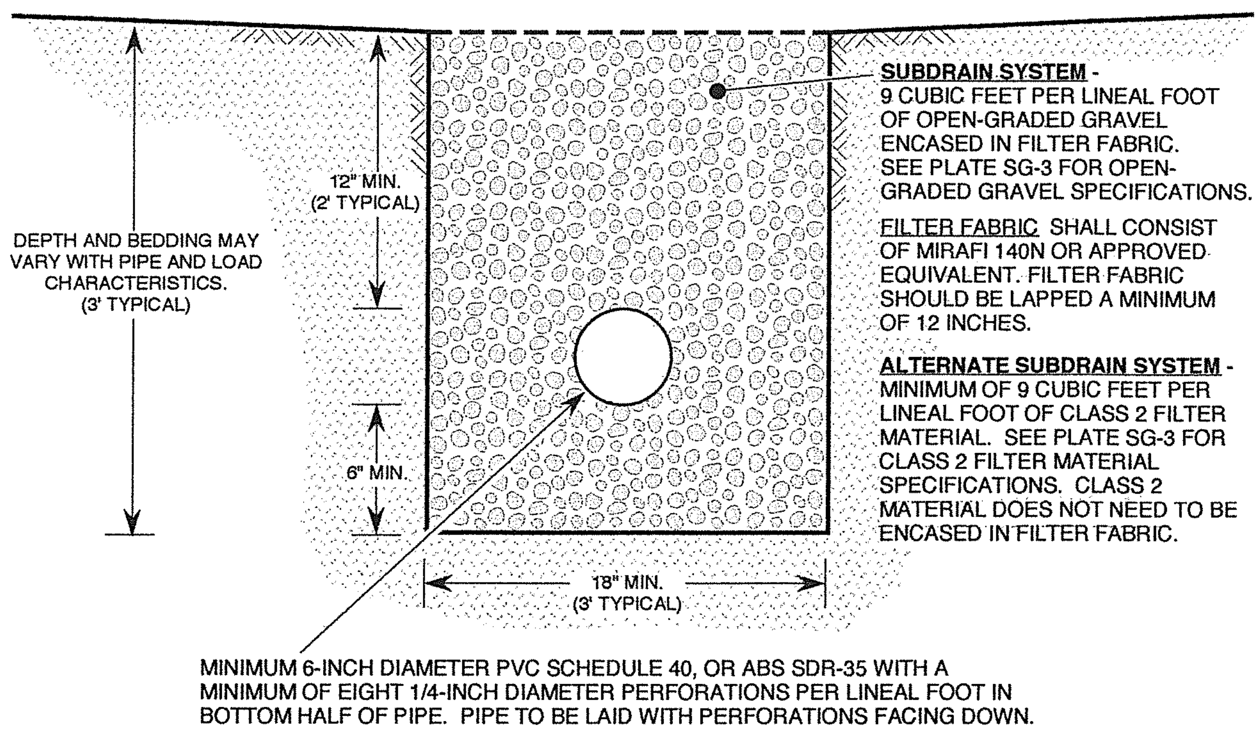
A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of observations by the Geotechnical Consultant, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Consultant.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of permanent nature on or adjacent to the property.

S:\!BOILERS-WORK\REPORT INSERTS\STANDARD GRADING SPECS

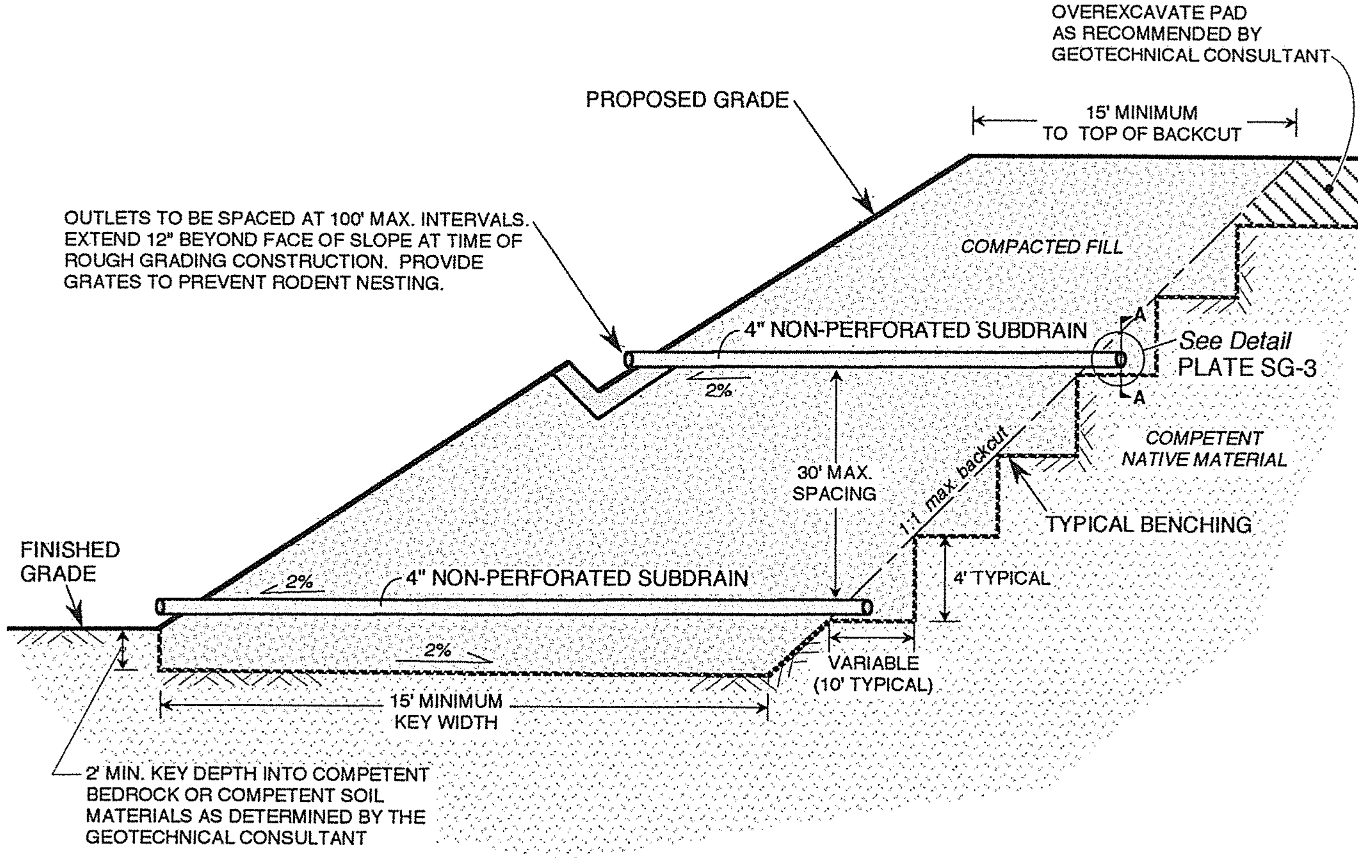




NOTES:

1. FOR CONTINUOUS RUNS IN EXCESS OF 500 FEET USE 8-INCH DIAMETER PIPE.
2. FINAL 20 FEET OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL.

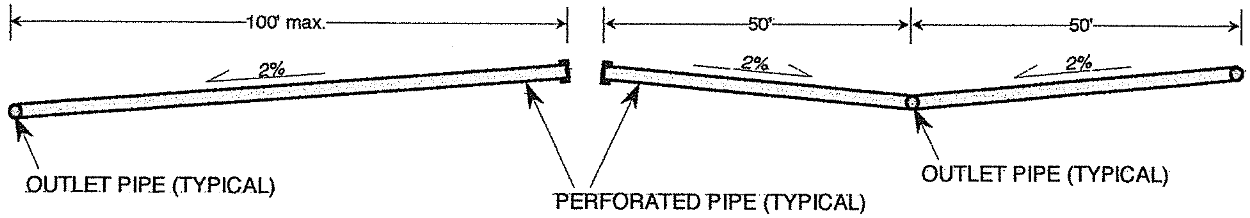
PETRA	CANYON SUBDRAIN DETAIL	PLATE SG-1



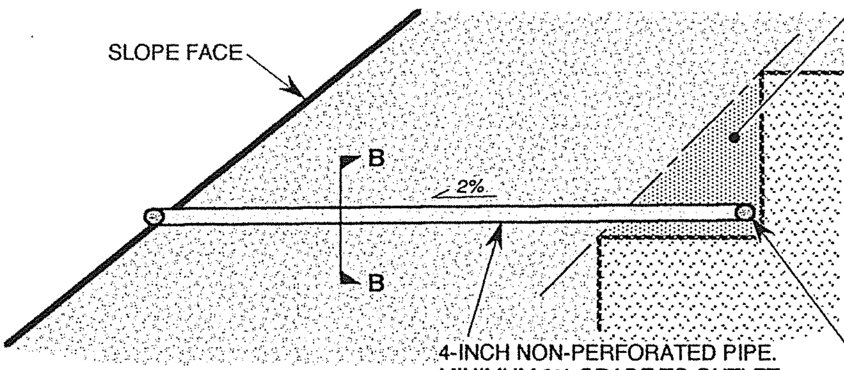
NOTES:

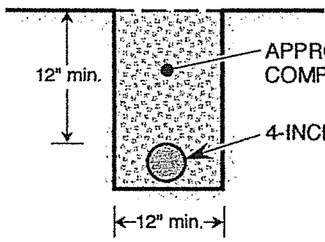
1. 30' MAXIMUM VERTICAL SPACING BETWEEN SUBDRAIN SYSTEMS.
2. 100' MAXIMUM HORIZONTAL DISTANCE BETWEEN NON-PERFORATED OUTLET PIPES. *(See Below)*
3. MINIMUM GRADIENT OF 2% FOR ALL PERFORATED AND NON-PERFORATED PIPE.

SECTION A-A (PERFORATED PIPE PROFILE)



PETRA	BUTTRESS OR STABILIZATION FILL DETAIL	PLATE SG-2





SECTION B-B (OUTLET PIPE)

PIPE SPECIFICATIONS:

1. 4-INCH MINIMUM DIAMETER, PVC SCHEDULE 40 OR ABS SDR-35.
2. FOR PERFORATED PIPE, MINIMUM 8 PERFORATIONS PER FOOT ON BOTTOM HALF OF PIPE.

FILTER MATERIAL/FABRIC SPECIFICATIONS:

OPEN-GRADED GRAVEL ENCASED IN FILTER FABRIC.
(MIRAFI 140N OR EQUIVALENT)

OPEN-GRADED GRAVEL

SIEVE SIZE	PERCENT PASSING
1 1/2-INCH	88 - 100
1-INCH	5 - 40
3/4-INCH	0 - 17
3/8-INCH	0 - 7
No. 200	0 - 3

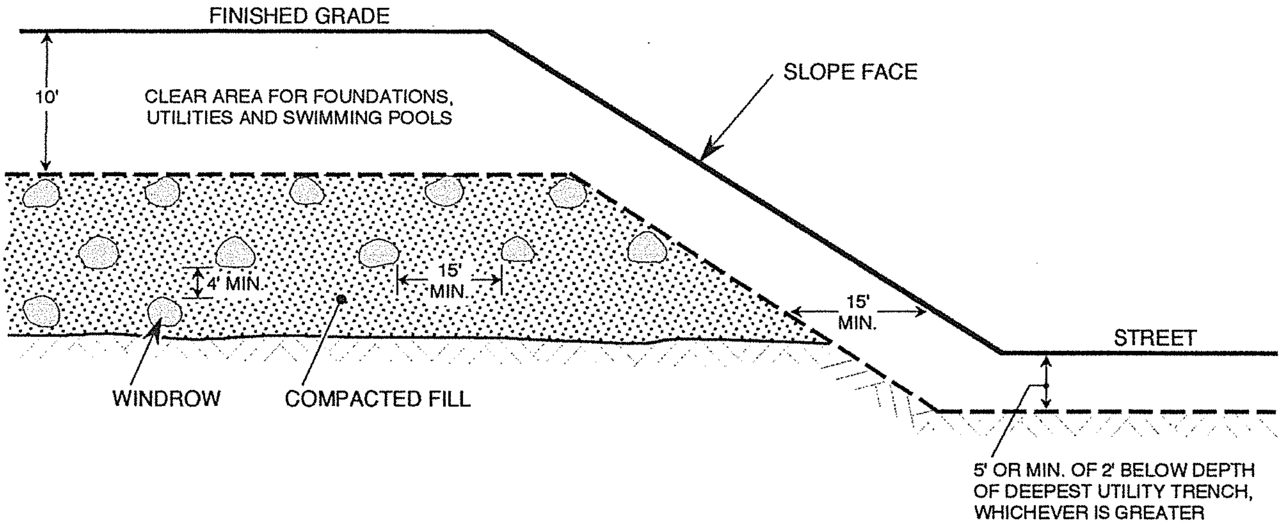
ALTERNATE:

CLASS 2 PERMEABLE FILTER MATERIAL PER CALTRANS STANDARD SPECIFICATION 68-1.025.

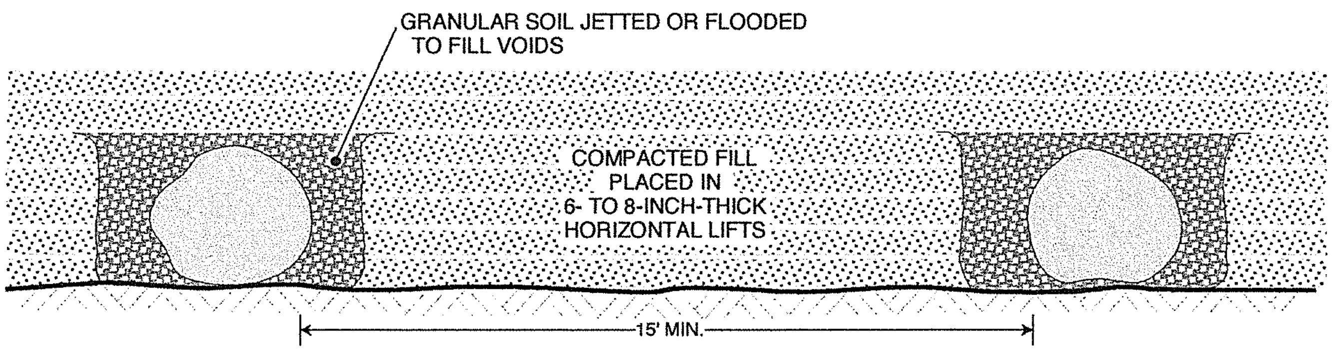
CLASS 2 FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
1-INCH	100
3/4-INCH	90 - 100
3/8-INCH	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. -30	5 - 15
No. -50	0 - 7
No. 200	0 - 3

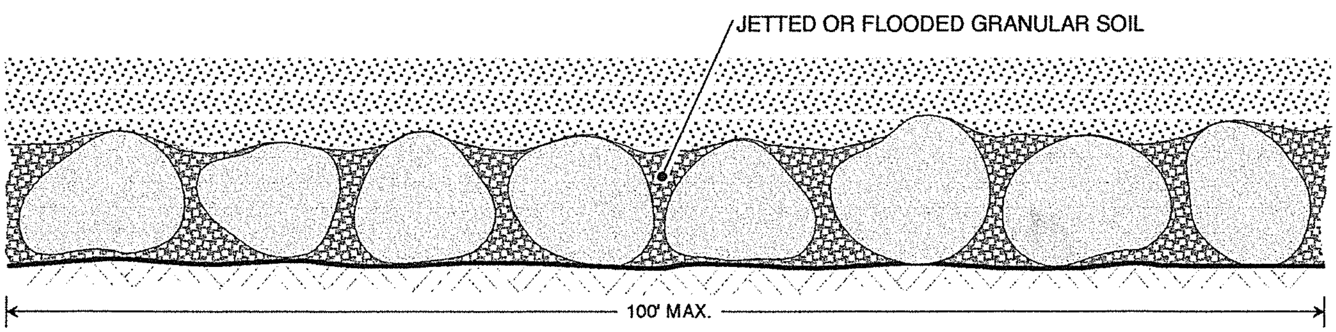
PETRA | BUTTRESS OR STABILIZATION FILL SUBDRAIN | PLATE SG-3



TYPICAL WINDROW DETAIL (END VIEW)

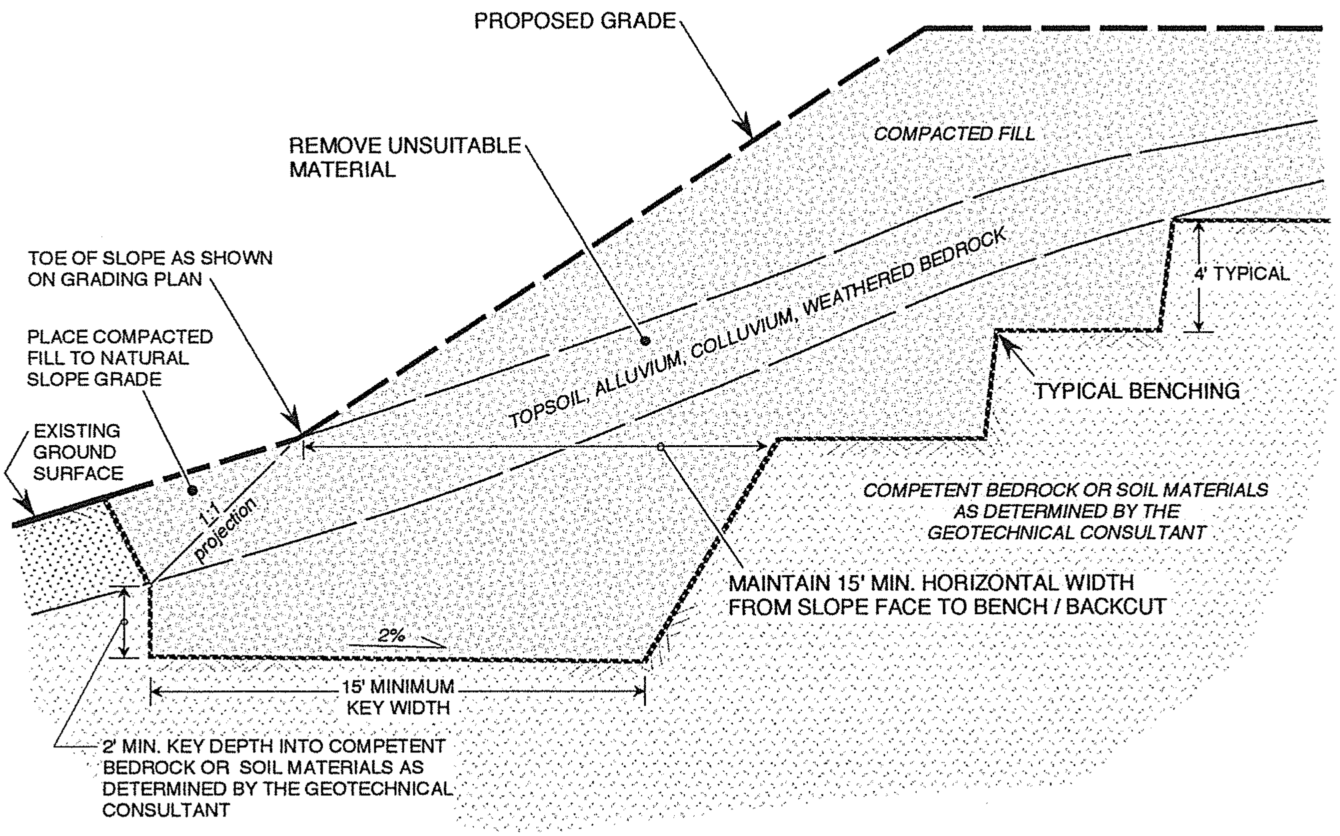


TYPICAL WINDROW DETAIL (PROFILE VIEW)



NOTE: OVERSIZE ROCK IS DEFINED AS CLASTS HAVING A MAXIMUM DIMENSION OF 12" OR LARGER

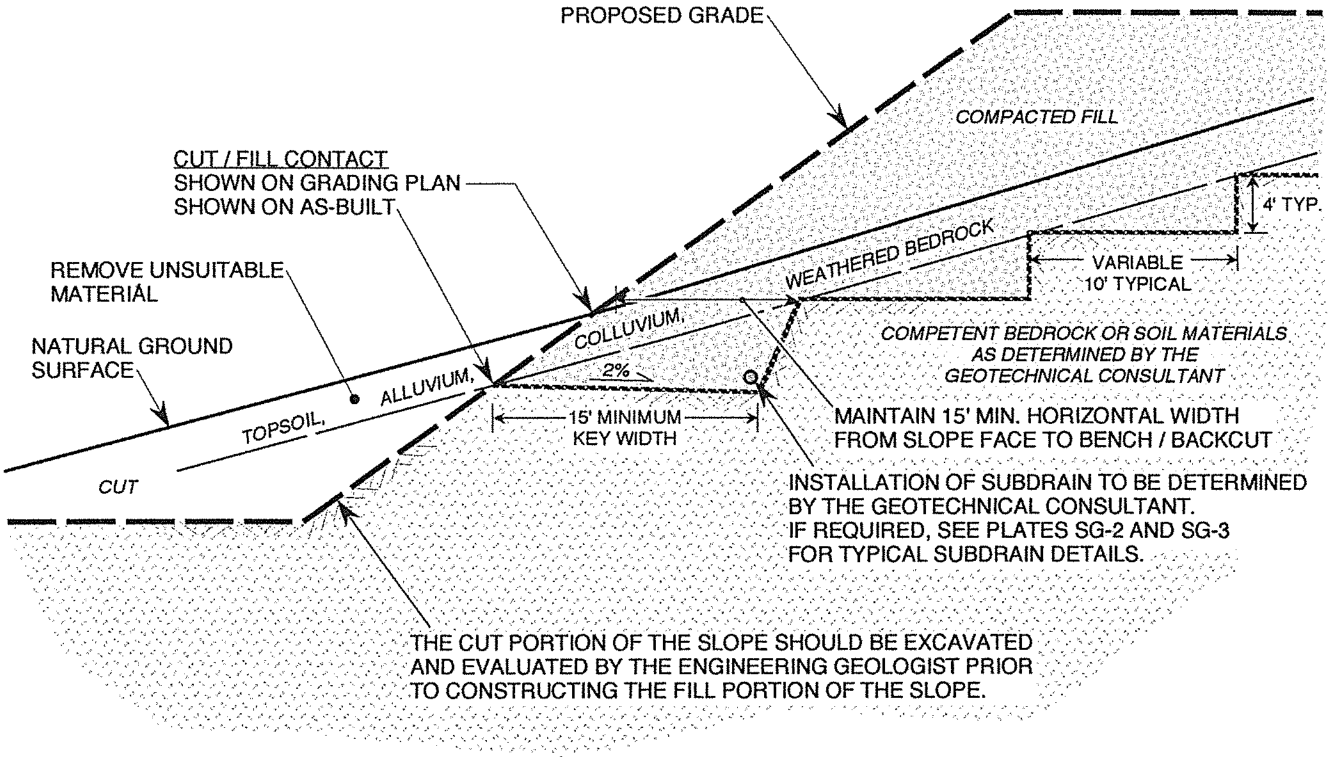
PETRA	TYPICAL ROCK DISPOSAL DETAIL	PLATE SG-4



NOTES:

1. WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, BENCHING IS NOT NECESSARY; HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.
2. SOILS ENGINEER TO DETERMINE IF SUBDRAIN IS REQUIRED.

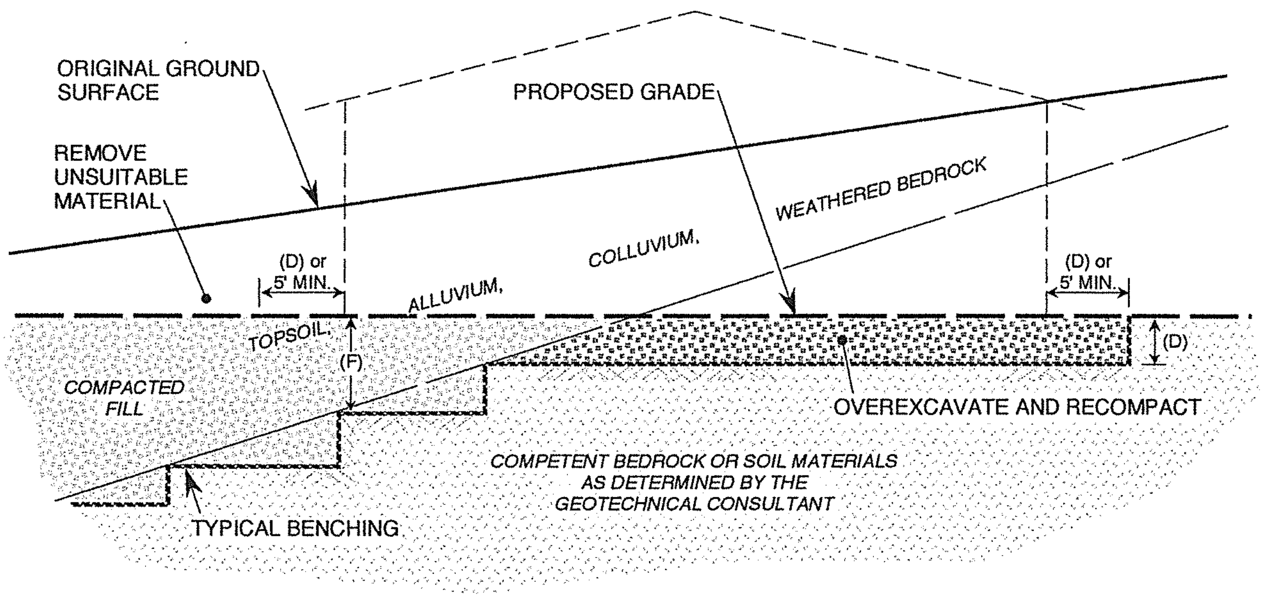
PETRA	FILL SLOPE ABOVE NATURAL SLOPE	PLATE SG-5



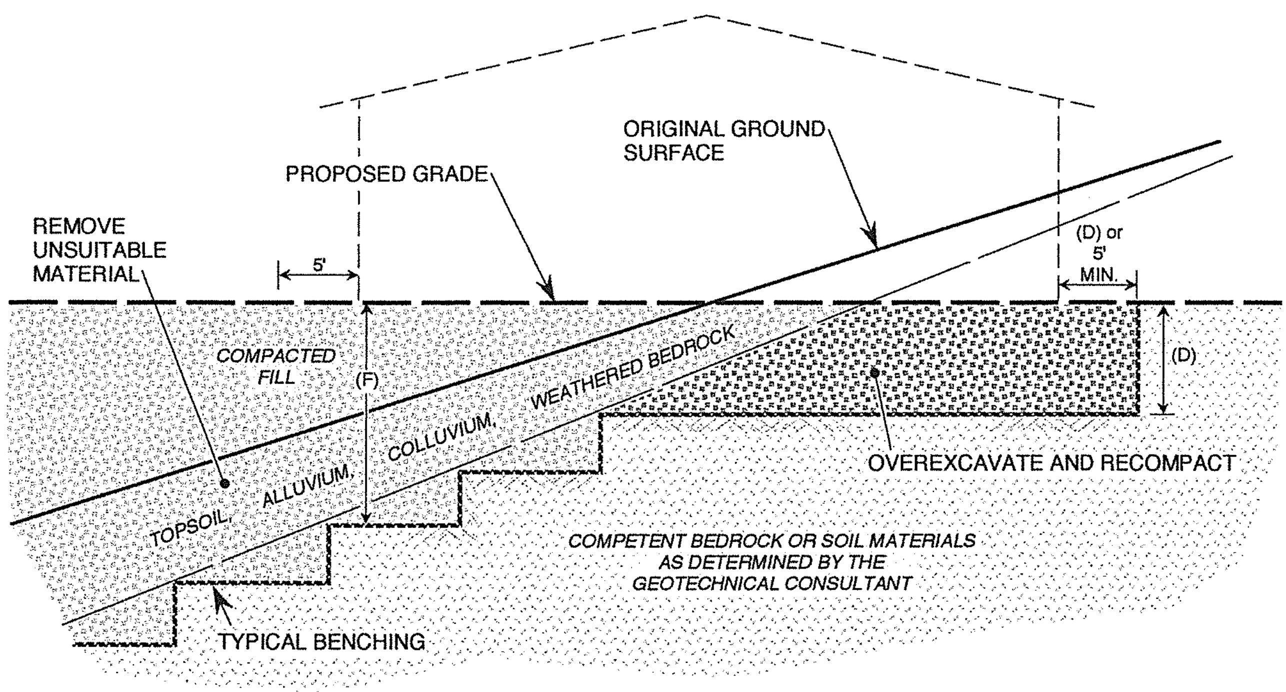
PETRA	FILL SLOPE ABOVE CUT SLOPE	PLATE SG-6

CUT LOT

UNSUITABLE MATERIAL EXPOSED IN PORTION OF CUT PAD



CUT-FILL TRANSITION LOT

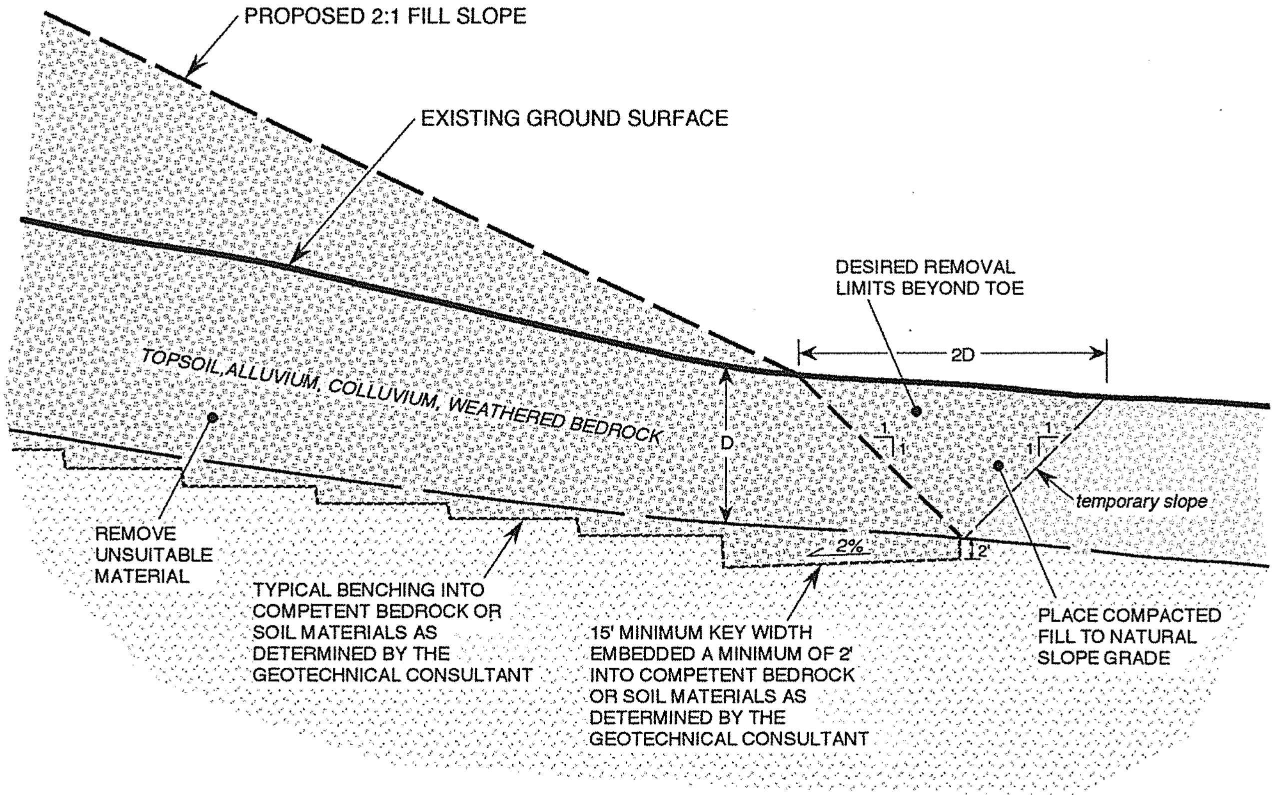


MAXIMUM FILL THICKNESS (F)	DEPTH OF OVEREXCAVATION (D)
FOOTING DEPTH TO 3 FEET	EQUAL DEPTH
3 TO 6 FEET	3 FEET
GREATER THAN 6 FEET	1/2 THE THICKNESS OF DEEPEST FILL PLACED WITHIN THE "FILL" PORTION (F) TO 15 FEET MAXIMUM

PETRA

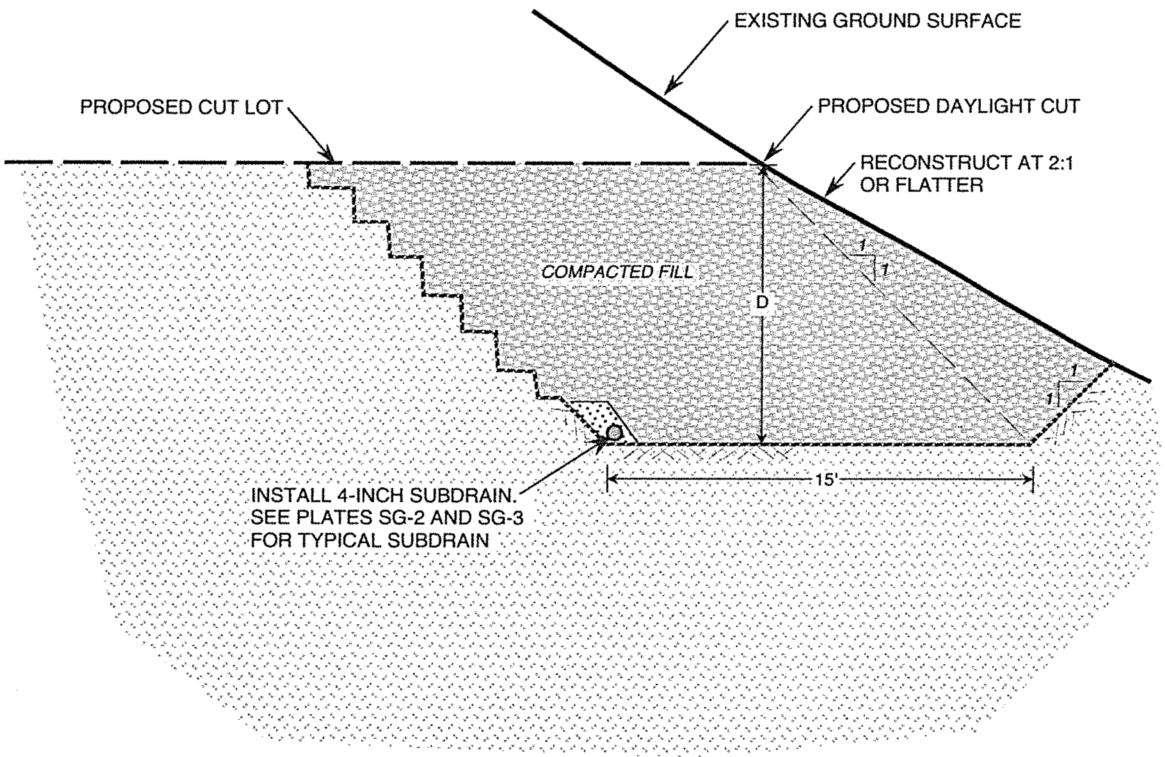
CUT LOTS AND CUT-FILL TRANSITION LOTS

PLATE SG-7



D = RECOMMENDED DEPTH OF REMOVAL PER GEOTECHNICAL REPORT

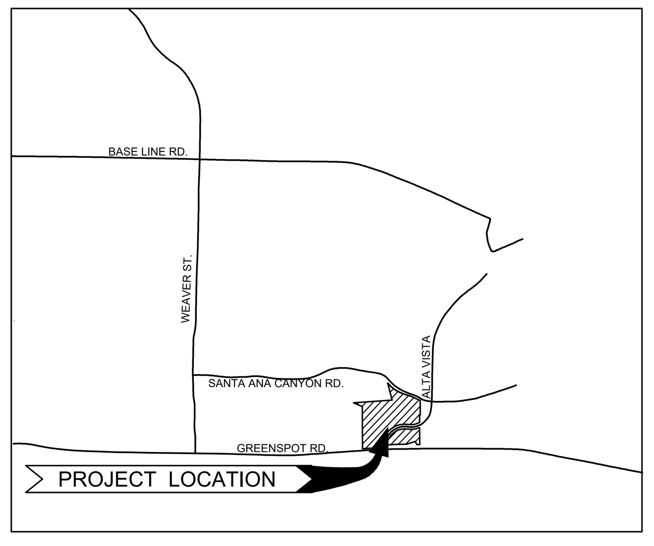
PETRA	TYPICAL REMOVALS BEYOND TOE OF PROPOSED FILL SLOPE	PLATE SG-8



NOTE:

1. "D" SHALL BE 10 FEET MINIMUM OR AS DETERMINED BY SOILS ENGINEER.

PETRA	SHEAR KEY ON DAYLIGHT CUT LOTS	PLATE SG-9



VICINITY MAP

NOT TO SCALE

LEGEND

TRACT BOUNDARY	
RIGHT OF WAY	
EX PARCEL LINE	
STREET CENTERLINE	
EX CONTOUR	1400
PROP MAJOR CONTOUR	1400
PROP MINOR CONTOUR	1400
LOT LINE	
EASEMENT LINE	
BUILDING SETBACK LINE	
BUILDING FOOTPRINT	
EX FENCE	
PROP RET. WALL	
PROP SEWER	S
PROP STORM DRAIN	SD
PROP WATER	W
PROP FIRE HYDRANT	
FLOWLINE	
SLOPE DIRECTION	
EX CURB	
PROP CURB	

SETBACKS

FRONT YARD ---------------------------3FT
SIDE SETBACK--------------------------5FT
REAR SETBACK--------------------------10FT

EARTHWORK QUANTITIES

RAW NUMBERS:

CUT = 7,000 CY
FILL = 30,500 CY
NET = 23,500 CY OF FILL

SHEET INDEX

1 – TITLE SHEET & PRELIMINARY GRADING PLAN
2 – SECTIONS
3 – PLOT PLAN

AREA SUMMARY

TOTAL GROSS AREA: 11.98± ACRES
NUMBERED LOTS: 113 – AREA: 7.01± ACRES
STREET AREA: 2.28± ACRES
OPEN SPACE AREA: 2.70± ACRES

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100

SCALE: 1" = 50' WHEN PRINTED AT FULL SIZE (30" X 42")

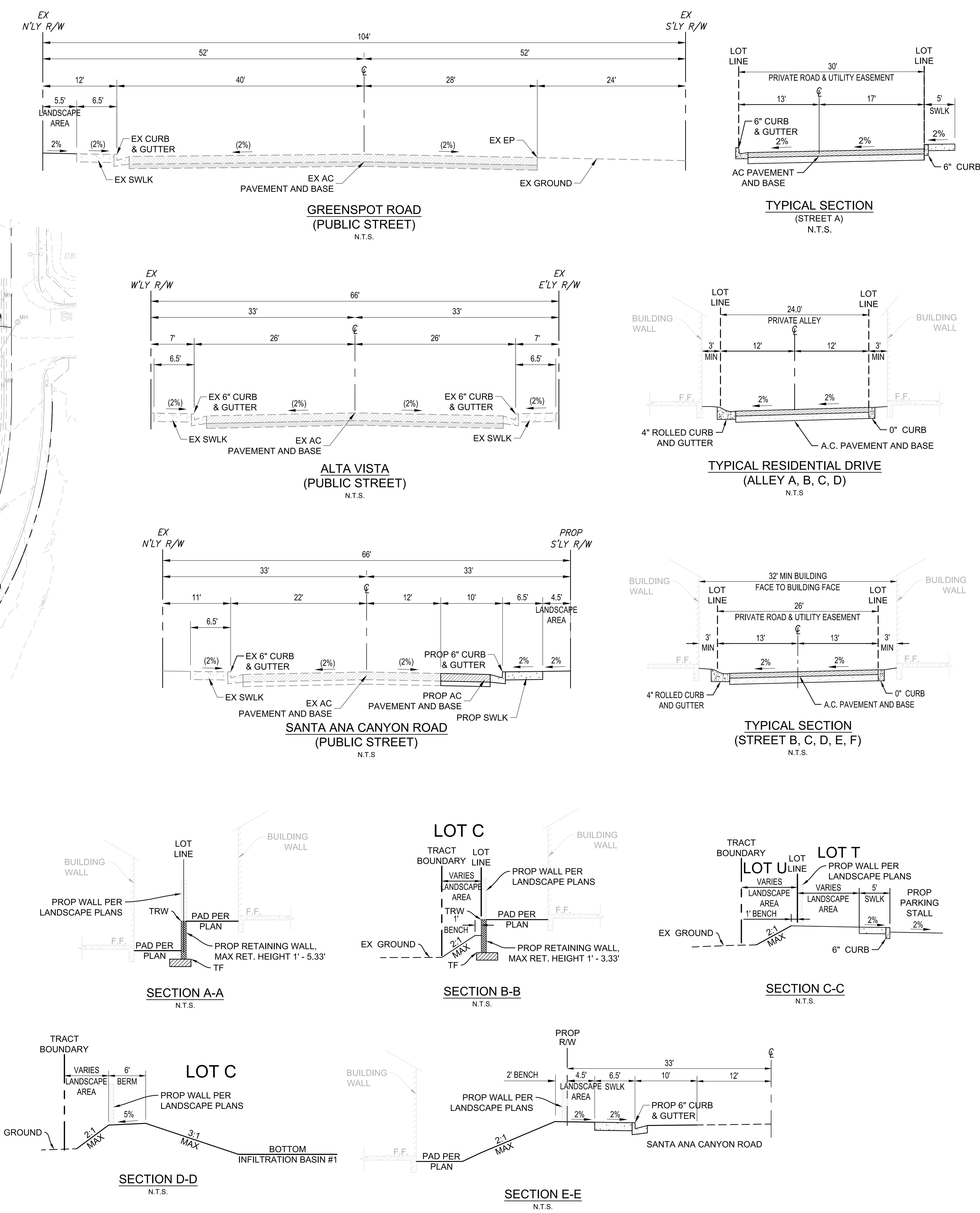
ABBREVIATIONS

BLDG	–	BUILDING
BSL	–	BUILDING SETBACK LINE
BTM	–	BOTTOM
BW	–	BACK OF SIDEWALK
C&G	–	CURB & GUTTER
℄	–	CENTERLINE
CONC	–	CONCRETE
EP	–	EDGE OF PAVEMENT
EX	–	EXISTING
FG	–	FINISHED GROUND
FL	–	FLOWLINE
FS	–	FINISHED SURFACE
FH	–	FIRE HYDRANT
N.T.S	–	NOT TO SCALE
PE	–	PAD ELEVATION
PROP	–	PROPOSED
PIP	–	PROTECT IN PLACE
PVMT	–	PAVEMENT
RET.	–	RETAINING
R/W	–	RIGHT OF WAY
SD	–	STORM DRAIN
SWLK	–	SIDEWALK
TYP	–	TYPICAL
TC	–	TOP OF CURB

IN THE CITY OF HIGHLAND, STATE OF CALIFORNIA

TENTATIVE TRACT MAP NO. 20721

ALL THAT PORTION OF THE NORTH HALF OF THE SOUTHWEST QUARTER OF SECTION 1, TOWNSHIP 1 SOUTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.



GENERAL NOTES

1. ASSESSOR'S PARCEL NUMBERS: 1210–371–16 & 1210–371–14
2. EXISTING ZONING: R1–10,000 SINGLE FAMILY RES. 10,000, INCLUDING PROPERTIES TO THE EAST, WEST, AND NORTH. THE PROPERTY TO THE SOUTH IS A/EQ – AGRICULTURAL/EQUESTRIAN RES.
3. PROPOSED ZONING: PD–PLANNED DEVELOPMENT
4. THERE ARE 113 RESIDENTIAL LOTS PROPOSED WITHIN THIS TRACT BOUNDARY WHICH CONTAINS 12 GROSS ACRES FOR AN OVERALL RESIDENTIAL LOT DENSITY OF 9.42 LOTS PER GROSS ACRE.
5. THERE ARE 22 LETTERED LOTS THAT WILL BE PRIVATELY OWNED.
6. THERE IS APPROXIMATELY 4,180 LINEAL FEET OF NEW STREET PROPOSED WITHIN THIS DEVELOPMENT.
7. THIS TENTATIVE MAP SHOWS ENTIRE CONTIGUOUS OWNERSHIP.
8. THE LETTERED LOTS "A" & "B" ARE PRIVATE STREETS.
9. NO REGULATED TREES EXIST ON SITE.
10. ONE PHASE AND ONE FINAL MAP IS PLANNED.
11. CONTOUR INTERVAL = 2 FEET
12. ALL SLOPES SHALL BE 2:1 OR FLATTER.
13. LOT DIMENSIONS SHOWN HEREON ARE APPROXIMATE.
14. BOUNDARY SURVEY PROVIDED BY DAWSON SURVEYS.
15. THE LOCATION OF EXISTING UTILITIES SHOWN ON THIS MAP ARE APPROXIMATE AND WERE OBTAINED FROM APPROVED PLANS & UTILITY COMPANY MAPS.
16. SANTA ANA CANYON ROAD FOR PUBLIC ROAD DEDICATION.
17. HOMEOWNER'S ASSOCIATION TO MAINTAIN WQMP SYSTEMS & ALL LETTERED LOTS.

LEGAL DESCRIPTION

APN: 1210–371–16 & 1210–371–14
THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA AND IS DESCRIBED AS FOLLOWS:
PARCEL 1:
ALL THAT PORTION OF THE NORTH HALF OF THE SOUTHWEST QUARTER OF SECTION 1, TOWNSHIP 1 SOUTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT OF SAID LAND FILED IN THE DISTRICT LAND OFFICE FEBRUARY 24, 1869, DESCRIBED AS FOLLOWS:
COMMENCING AT A POINT FOUND IN THE FOLLOWING MANNER:
BEGINNING AT THE CENTER OF SAID SECTION 1; THENCE RUNNING SOUTH 88 DEGREES 17' WEST 676 FEET; THENCE SOUTH 1 DEGREES WEST 635 FEET TO A STAKE, WHICH IS THE POINT IN THE BOUNDARY LINE OF THE LAND HEREBY, DESCRIBED AT WHICH THE DESCRIBED THEREON IS TO BEGIN, TO WIT:
BEGINNING AT SAID STAKE AND RUNNING THENCE NORTH 60° 12' WEST 557 FEET; THENCE SOUTH 13° 55' EAST 363.5 FEET; THENCE SOUTH 58° 33' EAST 298 FEET; THENCE EAST 143 FEET; THENCE NORTH 230 FEET TO THE POINT OF BEGINNING.

PARCEL 2:
ALL THAT PORTION OF THE NORTH ½ OF THE SOUTHWEST ¼ OF SECTION 1, TOWNSHIP 1 SOUTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN, IN THE CITY OF HIGHLAND, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF DESCRIBED AS FOLLOWS:
BEGINNING AT A POINT ON THE COUNTY ROAD, 515 FEET EAST AND 243 FEET SOUTH OF THE QUARTER SECTION CORNER OF THE WEST LINE OF SECTION 1, TOWNSHIP 1 SOUTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN; THENCE RUNNING NORTH 71° 00' EAST, 303 FEET; THENCE SOUTH 78° 57' EAST, 539 FEET; THENCE SOUTH 60° 12' EAST, 787 FEET; THENCE SOUTH 655 FEET; THENCE WEST 1498 FEET; THENCE NORTH 1077 FEET TO THE POINT OF BEGINNING.
EXCEPTING THEREFROM THE PROPERTY DESCRIBED IN A DEED FROM ADOLPH F. H. CORNELIUS AND WIFE, TO ROBERTA T. GREEPE, RECORDED IN BOOK 464, PAGE 126, OF DEEDS AS FOLLOWS:
A PORTION OF THE NORTH ½ OF THE SOUTHWEST ¼ OF SECTION 1, TOWNSHIP 1 SOUTH, RANGE 3 WEST, SAN BERNARDINO BASE AND MERIDIAN, DESCRIBED AS FOLLOWS:

COMMENCING AT A POINT FOUND IN THE FOLLOWING MANNER:
BEGINNING AT THE CENTER OF SAID SECTION 1; THENCE SOUTH 88° 17' WEST, 676 FEET; THENCE SOUTH 1 WEST, 635 FEET TO A STAKE WHICH IS THE POINT IN THE BOUNDARY LINE OF LAND CONVEYED, AT WHICH DESCRIPTION IS TO BEGIN TO–WIT:
BEGINNING AT SAID STAKE; THENCE NORTH 60° 12' WEST, 557 FEET; THENCE SOUTH 13° 55' EAST, 363.5 FEET; THENCE SOUTH 58° 33' EAST 298 FEET; THENCE EAST 143 FEET; THENCE NORTH 230 FEET TO BEGINNING;ALSO EXCEPTING THAT PORTION CONVEYED TO ALBERT O'HOUNSIN RECORDED MARCH 26, 1953, IN BOOK 3134, PAGE 560 OF OFFICIAL RECORDS; ALSO EXCEPTING THAT PORTION CONVEYED TO SOUTHWEST BROADCASTING COMPANY, INC. BY DEED RECORDED FEBRUARY 23, 1962, IN BOOK 5651, PAGE 48 OF OFFICIAL RECORDS; ALSO EXCEPTING THAT PORTION CONVEYED TO JOE ARREDONDO ET AL. BY DEED RECORDED AUGUST 4, 1967, IN BOOK 6867, PAGE 697 OF OFFICIAL RECORDS.
ALSO EXCEPTING THEREFROM THAT PORTION CONVEYED TO THE CITY OF HIGHLAND, A MUNICIPAL CORPORATION BY DEED RECORDED JULY 22, 1994 AS INSTRUMENT NO. 94–315824 OF OFFICIAL RECORDS.

UTILITY PROVIDERS

WATER/SEWER:
EAST VALLEY WATER DISTRICT
31111 GREENSPOT ROAD
HIGHLAND, CA 92346
PH: (909) 889–9501

POWER:
SOUTERN CALIFORNIA EDISON
287 TENNESSEE STREET
REDLANDS, CA 92373
PH: (909) 307–6749

GAS:
SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
REDLANDS, CA92374–9796
PH: (909)335–7772

TELEPHONE:
VERIZON
19800 ORANGE TREE LN. STE 100
REDLAND, CA 92374–7880
PH: (909) 748–6649

EXISTING EASEMENTS

THE FOLLOWING MATTERS AFFECT PARCEL 1:

1. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO AS SET FORTH IN A DOCUMENT:

   PURPOSE: EXISTING DITCH, WATER PIPELINES
   RECORDING DATE: SEPTEMBER 12, 1961
   RECORDING NO.: BOOK 5532, PAGE 454, OF OFFICIAL RECORDS

2. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

   GRANTED TO: CITY OF HIGHLAND, A MUNICIPAL CORPORATION
   PURPOSE: ROADS, DRAINAGE AND PUBLIC UTILITY
   RECORDING DATE: APRIL 18, 2022
   RECORDING NO.: 2022–143198, OF OFFICIAL RECORDS
   AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

THE FOLLOWING MATTERS AFFECT PARCEL 2:

3. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

   GRANTED TO: SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION
   PURPOSE: PUBLIC UTILITIES
   RECORDING DATE: DECEMBER 22, 1960
   RECORDING NO.: BOOK 5311, PAGE 211, OF OFFICIAL RECORDS
   AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

4. EASEMENT(S) FOR THE PURPOSE(S) SHOWN BELOW AND RIGHTS INCIDENTAL THERETO, AS GRANTED IN A DOCUMENT:

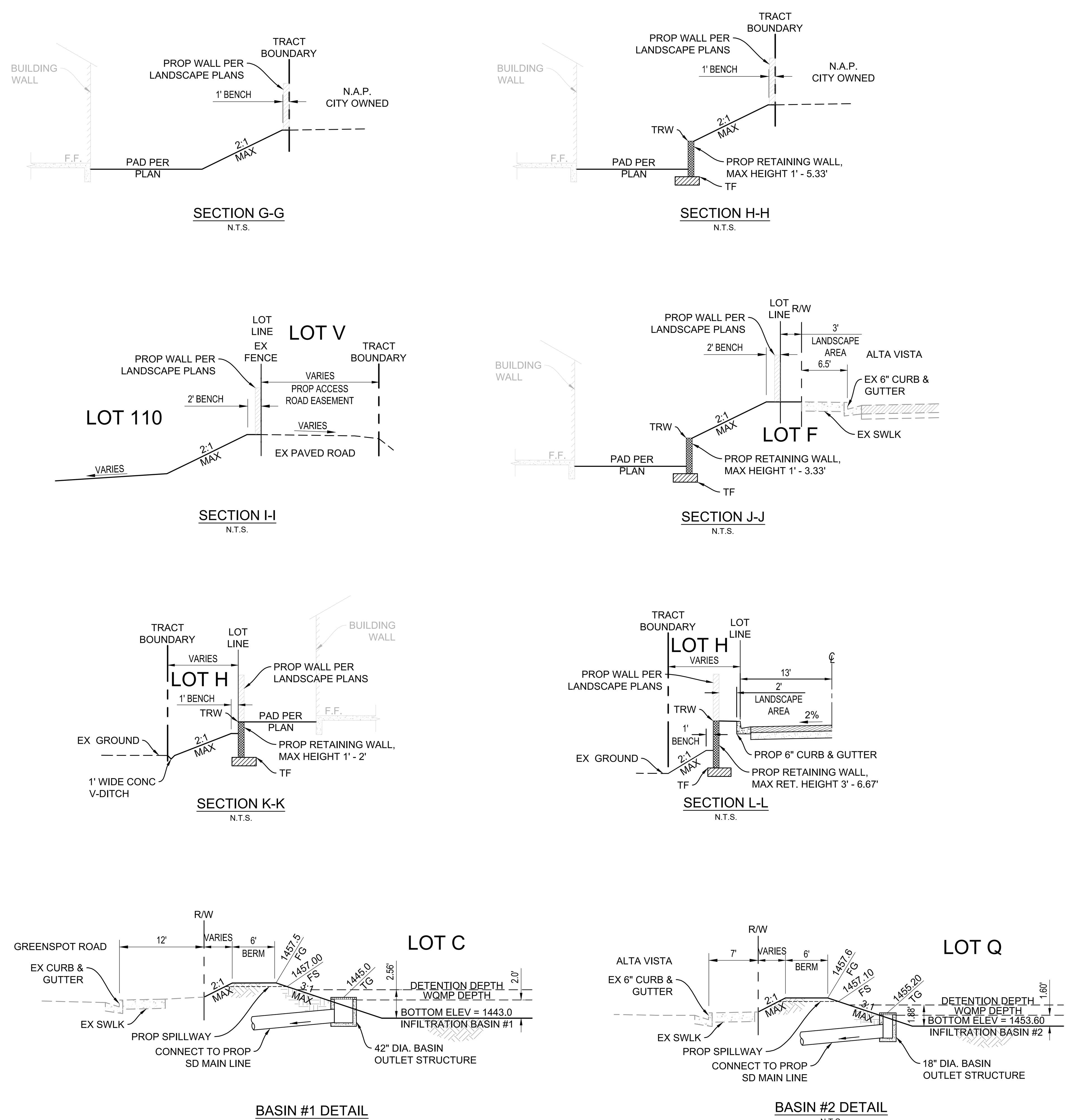
   GRANTED TO: SAN BERNARDINO VALLEY MUNICIPAL WATER DISTRICT
   PURPOSE: PUBLIC UTILITIES
   RECORDING DATE: SEPTEMBER 28, 1973
   RECORDING NO.: BOOK 8277, PAGE 252, OF OFFICIAL RECORDS
   AFFECTS: SAID LAND MORE PARTICULARLY DESCRIBED THEREIN

PRELIMINARY
NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
ROBERT R. OTTE
No. 44120
CIVIL
STATE OF CALIFORNIA

TITLE SHEET & PRELIMINARY GRADING PLAN	
ASSESSOR'S PARCEL NO.: 1210-371-16 & 1210-371-14	
TRACT NO.: 20721	
APPLICANT INFORMATION:	EAST HIGHLAND LAND, LLC. C/O JAKE SOWDER DIVERSIFIED PACIFIC 10621 CIVIC CENTER DRIVE RANCHO CUCAMONGA, CA 91730 D: (909) 373-2637 M: (714) 329-5438
ENGINEER INFORMATION:	ROBERT R. OTTE, PE 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 D: (951) 534-5630 M: (909) 953-6070
MAP PREPARED BY:	Kimley»Horn 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 PHONE: (951) 543-9868 WWW.KIMLEY-HORN.COM
MAP PREPARED ON: DECEMBER 17, 2024	SHEET 1 OF 3

SCALE: 1" = 50' WHEN PRINTED AT FULL SIZE (30" X 42")



LOT SUMMARY

LOT NUMBER	LOT AREA (SF)	PAD AREA (SF)	PLAN TYPE	ELEVATION
1	4,531	3,544	P3	FARMHOUSE
2	3,172	2,749	P1	COTTAGE
3	2,939	2,439	P2	SPANISH
4	2,621	2,159	P3	COTTAGE
5	2,500	2,190	P2	FARMHOUSE
6	2,339	1,947	P1	SPANISH
7	3,019	2,388	P2	COTTAGE
8	4,140	3,464	P1	FARMHOUSE
9	2,200	2,200	P3	COTTAGE
10	2,901	2,882	P2	SPANISH
11	2,202	2,202	P3	SPANISH
12	2,000	1,987	P1	COTTAGE
13	3,468	3,424	P1	FARMHOUSE
14	3,095	3,060	P3	SPANISH
15	2,250	2,235	P2	COTTAGE
16	2,302	2,302	P3	FARMHOUSE
17	2,200	2,200	P3	SPANISH
18	2,250	2,200	P2	FARMHOUSE
19	2,250	2,250	P3	COTTAGE
20	3,422	3,396	P2	SPANISH
21	3,077	2,441	P1	COTTAGE
22	2,163	1,981	P1	SPANISH
23	2,565	2,556	P2	FARMHOUSE
24	2,289	2,003	P1	COTTAGE
25	2,000	1,987	P1	SPANISH
26	2,250	2,235	P2	FARMHOUSE
27	2,360	2,341	P1	SPANISH
28	2,205	2,175	P3	FARMHOUSE
29	1,960	1,933	P1	COTTAGE
30	2,205	2,175	P2	FARMHOUSE
31	2,214	2,183	P3	SPANISH
32	2,325	2,290	P2	COTTAGE
33	2,196	2,166	P3	FARMHOUSE
34	2,205	2,175	P2	SPANISH
35	3,444	3,541	P2	FARMHOUSE
36	2,040	2,013	P1	COTTAGE
37	2,295	2,265	P2	SPANISH
38	2,040	2,013	P1	COTTAGE
39	2,295	2,265	P2	FARMHOUSE
40	2,295	2,265	P3	SPANISH

LOT NUMBER	LOT AREA (SF)	PAD AREA (SF)	PLAN TYPE	ELEVATION
41	2,295	2,295	P2	COTTAGE
42	2,295	2,295	P3	SPANISH
43	2,295	2,295	P2	FARMHOUSE
44	2,711	2,711	P3	COTTAGE
45	3,237	3,148	P2	COTTAGE
46	2,796	2,796	P3	FARMHOUSE
47	2,432	2,432	P2	SPANISH
48	2,760	2,760	P3	COTTAGE
49	2,490	2,490	P2	FARMHOUSE
50	2,663	2,334	P1	FARMHOUSE
51	3,428	3,090	P3	SPANISH
52	3,341	3,004	P2	COTTAGE
53	2,568	2,275	P3	FARMHOUSE
54	2,588	2,588	P1	SPANISH
55	2,250	2,250	P2	COTTAGE
56	2,670	2,670	P1	SPANISH
57	3,423	3,102	P2	SPANISH
58	1,920	1,920	P1	COTTAGE
59	2,643	2,430	P1	FARMHOUSE
60	3,257	3,032	P3	COTTAGE
61	2,181	2,181	P3	FARMHOUSE
62	3,297	3,185	P3	COTTAGE
63	2,726	2,570	P2	SPANISH
64	2,329	2,164	P1	FARMHOUSE
65	2,759	2,521	P2	COTTAGE
66	2,617	2,402	P1	SPANISH
67	3,067	2,694	P3	FARMHOUSE
68	2,659	2,289	P1	COTTAGE
69	2,250	2,220	P2	SPANISH
70	2,207	2,132	P1	FARMHOUSE
71	2,606	2,457	P2	COTTAGE
72	2,322	2,094	P1	SPANISH
73	2,666	2,298	P2	FARMHOUSE
74	4,134	3,207	P1	COTTAGE
75	3,044	2,596	P2	FARMHOUSE
76	2,691	2,302	P1	SPANISH
77	3,155	2,690	P3	COTTAGE
78	2,970	2,565	P2	FARMHOUSE
79	2,640	2,287	P1	SPANISH
80	3,008	2,624	P2	FARMHOUSE

LOT NUMBER	LOT AREA (SF)	PAD AREA (SF)	PLAN TYPE	ELEVATION
81	2,874	2,555	P1	COTTAGE
82	4,604	3,764	P3	FARMHOUSE
83	2,735	2,513	P3	SPANISH
84	2,250	2,235	P2	COTTAGE
85	2,250	2,235	P3	FARMHOUSE
86	2,250	2,250	P2	SPANISH
87	2,203	2,203	P1	FARMHOUSE
88	2,536	2,516	P3	FARMHOUSE
89	2,250	2,235	P2	SPANISH
90	2,000	2,000	P1	COTTAGE
91	2,000	2,000	P1	FARMHOUSE
92	2,250	2,235	P2	COTTAGE
93	3,015	2,995	P3	SPANISH
94	4,009	3,983	P3	FARMHOUSE
95	2,250	2,235	P2	SPANISH
96	2,000	1,987	P1	COTTAGE
97	2,000	1,987	P1	SPANISH
98	2,250	2,235	P2	FARMHOUSE
99	2,141	2,128	P1	SPANISH
100	3,927	3,452	P2	COTTAGE
101	2,810	2,513	P3	FARMHOUSE
102	2,819	2,819	P3	FARMHOUSE
103	2,344	2,344	P2	SPANISH
104	3,485	3,264	P3	COTTAGE
105	2,932	2,707	P2	FARMHOUSE
106	2,217	2,017	P1	SPANISH
107	2,848	2,557	P2	FARMHOUSE
108	2,478	2,253	P3	COTTAGE
109	2,475	2,250	P2	SPANISH
110	5,186	3,109	P1	COTTAGE
111	4,046	4,046	P3	FARMHOUSE
112	4,105	4,105	P2	COTTAGE
113	4,163	4,163	P3	SPANISH
TOTAL AREA (SF)	305,316			
TOTAL AREA (AC)	7.01			
AVERAGE LOT(SF)	2,702			

LETTERED LOT SUMMARY

LOT LETTER	LOT AREA (SF)
LOT A	105,173
LOT B	16,462
LOT C	25,005
LOT D	1,636
LOT E	490
LOT F	948
LOT G	2,476
LOT H	10,214
LOT I	505
LOT J	459
LOT K	641
LOT L	13,072
LOT M	1,234
LOT N	1,234
LOT O	942
LOT P	8,291
LOT Q	254
LOT R	22,071
LOT S	2,290
LOT T	2,664
LOT U	3,616
LOT V	1,089
TOTAL STREETS AREA (SF)	2.70
TOTAL OPEN SPACE AREA (SF)	2.28

PRELIMINARY
NOT FOR CONSTRUCTION

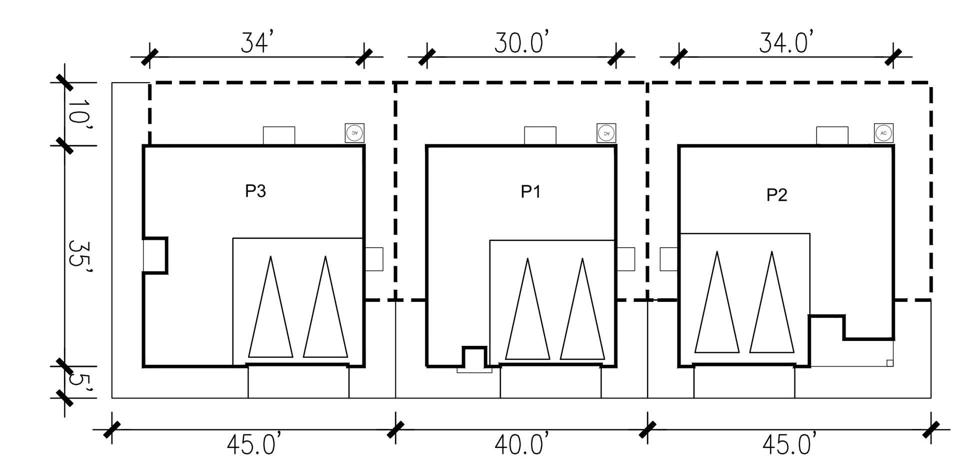
REGISTERED PROFESSIONAL ENGINEER
ROBERT R. OTTE
No. 44120
CIVIL
STATE OF CALIFORNIA

SECTIONS	
ASSESSOR'S PARCEL NO.: 1210-371-16 & 1210-371-14	
TRACT NO.: 20721	
APPLICANT INFORMATION:	EAST HIGHLAND LAND, LLC. C/O JAKE SOWDER DIVERSIFIED PACIFIC 10621 CIVIC CENTER DRIVE RANCHO CUCAMONGA, CA 91730 D: (909) 373-2637 M: (714) 329-5438
ENGINEER INFORMATION:	ROBERT R. OTTE, PE 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 D: (951) 534-5630 M: (909) 953-6070
MAP PREPARED BY:	Kimley»Horn 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 PHONE: (951) 543-9868 WWW.KIMLEY-HORN.COM
MAP PREPARED ON: DECEMBER 17, 2024	SHEET 2 OF 3

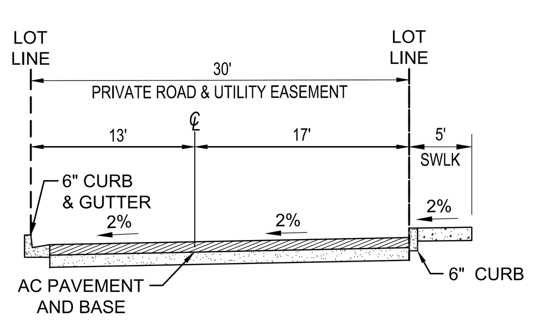
PROJECT SUMMARY

Unit Mix			
P1	35	31%	
P2	43	38%	
P3	35	31%	
Total	113	100%	
Parking			
Required			
2+BD	113x2/du		226 spaces
Guest	113x0.5/du		57 spaces
Total			283 spaces
Provided			
Garage	113x2/du		226 spaces
Guest			59 spaces
Parallel Street			8 spaces
Total			293 spaces

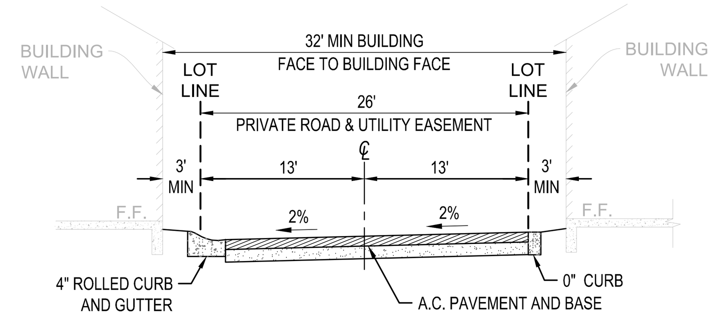
TYPICAL MINIMUM BUILDING FOOTPRINT DIAGRAM



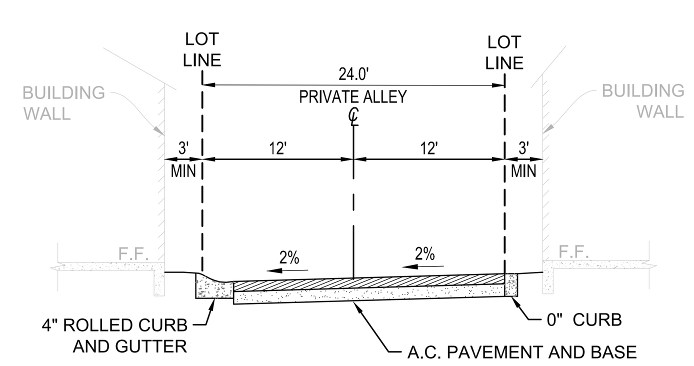
NTS



TYPICAL SECTION
(STREET A)
N.T.S.



TYPICAL SECTION
(STREET B, C, D, E, F)
N.T.S.



TYPICAL RESIDENTIAL DRIVE
(ALLEY A, B, C, D)
N.T.S.

NORTH

GRAPHIC SCALE IN FEET
0 25 50 100
SCALE: 1"=50'
(WHEN PRINTED AT 24"X36")

PRELIMINARY
NOT FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER
ROBERT R. OTTE
No. 44120
CIVIL
STATE OF CALIFORNIA

PLOT PLAN	
ASSESSOR'S PARCEL NO.: 1210-371-16 & 1210-371-14	
TRACT NO.: 20721	
APPLICANT INFORMATION:	EAST HIGHLAND LAND, LLC. C/O JAKE SOWDER DIVERSIFIED PACIFIC 10621 CIVIC CENTER DRIVE RANCHO CUCAMONGA, CA 91730 D: (909) 373-2637 M: (714) 329-5438
ENGINEER INFORMATION:	ROBERT R. OTTE, PE 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 D: (951) 534-5630 M: (909) 953-6070
MAP PREPARED BY:	Kimley»Horn 3801 UNIVERSITY AVENUE, SUITE 300, RIVERSIDE, CA 92501 PHONE: (951) 543-9868 WWW.KIMLEY-HORN.COM
MAP PREPARED ON: DECEMBER 17, 2024	SHEET 3 OF 3