Preliminary Water Quality Management Plan

For:

CAJON AND JUNE INDUSTRIAL SOUTH

APN 0267012090000

WQMP-2023-00132

Prepared for:

DUNLEER GROUP

269 S. BEVERLY DRIVE #1674

BEVERLY HILLS, CA 90212

818.299.0494

Prepared by:

raSmith

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Irvine, CA 92618

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Submittal Date: 06/12/2023
Revision Date: 02/28/2024
Revision Date: 04/19/2024
Revision Date: 05/15/2024
Revision Date: 07/29/2025

Approval Date:______________________

Project Owner's Certification

This Water Quality Management Plan (PWQMP) has been prepared for Dunleer by raSmith. The PWQMP is intended to comply with the requirements of the San Bernardino County and the NPDES Areawide Stormwater Program requiring the preparation of a PWQMP. 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 PWQMP. A copy of the approved PWQMP 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 PWQMP have been accepted and that the plan will be transferred to future successors."

.

Project Data			
Permit/Application Number(s):	PROJ 2023-00107 WQMP-2023-00132	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	N/A	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0267012090000

Owner's Signature			
Owner Name: JACK LUU			
Title	Principle		
Company	DUNLEER GROUP		
Address	269 S. Beverly Drive # 1674		
Email	JACK@DUNLEERGROUP.COM		
Telephone #	818-299-0494		
Signature		Date	7/29/2025

Preparer's Certification

Project Data			
Permit/Application Number(s):	PROJ-2023-00107 WQMP-2023-00132	Grading Permit Number(s):	TBD
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CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			0267012090000

"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: Eric A. Robles		PE Stamp Below
Title	Project Engineer	
Company	raSmith	
Address	8911 Research Drive, Irvine, CA 92618	
Email	Eric.robles@rasmith.com	
Telephone #	949-242-8044	
Signature		
Date	07/29/2025	

REGISTERED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP. 06/30/27
CIVIL
STATE OF CALIFORNIA

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Forms

Additional Materials

- PWQMP Exhibit Existing
- PWQMP Exhibit Proposed
- June Springs PGP set
- TOPO MAP
- HCOC Exemption Map
- NOAA Depth Precipitation
- Soils Map
- Soil Infiltration Study
- Geotech Report
- BMP Educational Materials: Not Provided in PWQMP
- Map showing Drainage Easement TMP 20798
- Tc Nomograph
- Worksheet H - Infiltration Rate safety factor Worksheet
- Civil D output Existing
- Civil D Output Proposed CJWW, DA-N-1
- Civil D Output Proposed CJWE, DA-N-2
- PULS Output DA-N-1
- PULS Output DA-N-2
- Employee Training Educational Materials
- Picture of Existing Conditions

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">Cajon and June Industrial North</td></tr>
<tr><td colspan="2">Project Owner Contact Name:</td><td colspan="4">Mr. Jack Luu</td></tr>
<tr><td>Mailing Address:</td><td>269 S. Beverly Drive #1674, Beverly Hills CA, 90212</td><td>E-mail Address:</td><td>JACK@DUNLEERGROUP.COM</td><td>Telephone:</td><td>818-299-0494</td></tr>
<tr><td colspan="2">Permit/Application Number(s):</td><td>PROJ-2023-00107
WQMP-2023-00132</td><td>Tract/Parcel Map Number(s):</td><td colspan="2">N/A</td></tr>
<tr><td colspan="2">Additional Information/ Comments:</td><td colspan="4">APN # 0267012090000
This report is for the southern 2 Drainage areas. The northern 2 areas will be part of a separate report.</td></tr>
<tr><td colspan="2">Description of Project:</td><td colspan="4">This project proposes the construction of a warehouse building and associated parking on a vacant lot. The site covers 1.81 acres of space.
The existing site is 1.81 acres of 100% pervious open space. It drains from the Northwest corner of the site to the southeast corner of the site toward the existing drainage easement along the south lot line.
The proposed site is divided into 2 Stormwater Drainage Areas (DAs), DA-S-1 is the northern portion of the site and DA-S-2 covers the southern portion of the project. DA-S-1 is 1.01 acres and consists of 0.50ac (50%) building roof, 043ac (43%) parking areas and 0.08 (8%) ac landscaping areas. The proposed DA-S-1 site flows from north to south and enters the treatment system by an inlet along the south edge of the parking area It is treated with an underground stormwater retention/infiltration Chamber System and hydrodynamic gravity separator pretreatment unit. DA-S-2 is 0.81 acres and consists of 0.35ac (43%) building roof, 0.37ac (46%) parking areas and 0.09ac (12%) landscaping areas. The proposed DA-S-2 site flows from north to south and enters the treatment system by an inlet along the south edge of the parking area. It is treated with an underground stormwater retention/infiltration Chamber System and hydrodynamic gravity separator pretreatment unit. The proposed BMPS have been designed to fully infiltrate the 2 yr design storm. The site will be subdivided into two parcels. Each will have 2 DA’s totaling 4 Da’s. The WQMP’s will be broken up into 2 separate WQMP’s labeled North and South to represent the parcel split.</td></tr>
</table>

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

Section 2 Project Description

2.1 Project Information

This section of the PWQMP should provide the information listed below. The information provided for Conceptual/ Preliminary PWQMP 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 PWQMP 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.

<table>
<tr><th colspan="6">Form 2.1-1 Description of Proposed Project</th></tr>
<tr><td colspan="6">1 Development Category (Select all that apply):</td></tr>
<tr><td colspan="2">☐ Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site</td><td>☒ New development involving the creation of 10,000 ft² or more of impervious surface collectively over entire site</td><td>☐ Automotive repair shops with standard industrial classification (SIC) codes 5013, 5014, 5541, 7532- 7534, 7536-7539</td><td colspan="2">☐ Restaurants (with SIC code 5812) where the land area of development is 5,000 ft² or more</td></tr>
<tr><td colspan="2">☐ 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</td><td>☐ 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.</td><td>☒ Parking lots of 5,000 ft² or more exposed to storm water</td><td colspan="2">☐ 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</td></tr>
<tr><td colspan="6">☐ Non-Priority / Non-Category Project May require source control LID BMPs and other LIP requirements. Please consult with local jurisdiction on specific requirements.</td></tr>
<tr><td>2 Project Area (ft2):</td><td>79,224</td><td>3 Number of Dwelling Units:</td><td>N/A</td><td>4 SIC Code:</td><td>4225</td></tr>
<tr><td colspan="6">5 Is Project going to be phased? Yes ☐ No ☒ If yes, ensure that the PWQMP evaluates each phase as a distinct DA, requiring LID BMPs to address runoff at time of completion.</td></tr>
<tr><td colspan="6">6 Does Project include roads? Yes ☐ No ☒ If yes, ensure that applicable requirements for transportation projects are addressed (see Appendix A of TGD for PWQMP)</td></tr>
</table>

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 owner of the property is DUnleer Group. The owner will be solely responsible for all maintenance of WQMP features. Should ownership change, Dunleer Group will relinquish all ownership responsibilities and transfer the responsibility of water quality management feature maintenance over to the new owner of the property. No infrastructure will be transferred as a part of this project. Jack Luu Princilple Dunleer Group 269 S. Beverly Drive # 1674 Email jack@dunleergroup.com 818-299-0494

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 ☐	Expected due to pavement runoff.
Nutrients - Phosphorous	E ☒	N ☐	Landscaping proposed onsite, therefore expected
Nutrients - Nitrogen	E ☒	N ☐	Landscaping proposed onsite, therefore expected
Noxious Aquatic Plants	E ☒	N ☒	Landscaping proposed onsite, therefore expected
Sediment	E ☒	N ☐	Landscaping proposed onsite, therefore expected
Metals	E ☒	N ☐	Vehicles could potentially contribute, therefor expected
Oil and Grease	E ☒	N ☐	Expected due to petroleum hydrocarbons from idling cars, pavement runoff
Trash/Debris	E ☒	N ☐	Proposed warehouse, therefore expected.
Pesticides / Herbicides	E ☒	N ☐	Landscaping proposed onsite, therefore expected.
Organic Compounds	E ☒	N ☐	Expected due to landscaping, solvents, and petroleum hydrocarbons.
Other:	E ☐	N ☐	
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 % N/A *(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

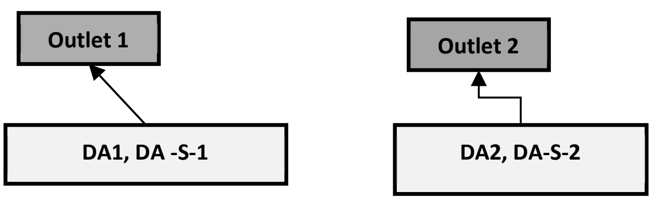
Describe the project site conditions that will facilitate the selection of BMP through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (and sub-watershed DAs) 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 34.168629	Longitude -117.346825	Thomas Bros Map page

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 DAs and hydrologic feature connecting DAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DA and flow routing may be attached*



Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DA
DA1, DA-S-1 flows to Outlet 1	Site area will drain into an infiltration chamber with overflow stormwater runoff running to the drainage easement along the south edge of the property. Matching existing conditions.
DA2, DA-S-2 flows to Outlet 2	Site area will drain into an infiltration chamber with overflow stormwater runoff running to the drainage easement along the south edge of the property. Matching existing conditions.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DA, provide the following characteristics	DA-S-1	DA-S-2		
1 DA drainage area (ft^2)	44,035	35,189		
2 Existing site impervious area (ft^2)	0	0		
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC II	AMC II		
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*	A	A		
5 Longest flowpath length (ft)	236	269		
6 Longest flowpath slope (ft/ft)	0.024	0.022		
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	**Grass**	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	Fair		

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DA w/in DA 1)				
For Drainage Area 1's sub-watershed DA, provide the following characteristics	DA E	DA F	DA G	DA H
1 DA drainage area (ft^2)				
2 Existing site impervious area (ft^2)				
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*				
4 Hydrologic soil group *Refer to Watershed Mapping Tool – http://permitrack.sbcounty.gov/wap/*				
5 Longest flowpath length (ft)				
6 Longest flowpath slope (ft/ft)				
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*				
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*				

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*	Cajon Creek Lytle Creek Warm Creek Santa Ana River Reach 4 Santa Ana River Reach 3 Santa Ana River Reach 2 Santa Ana River Reach 1 Pacific Ocean
Applicable TMDLs *Refer to Local Implementation Plan*	Santa Ana River, Reach 3 – Indicator Bacteria
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*	Warm Creek: Indicator Bacteria Santa Ana River, Reach 4: Indicator Bacteria Santa Ana River, Reach 3: Copper, Lead, Indicator Bacteria Santa Ana River, Reach 2: Indicator Bacteria,
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	NONE
Unlined Downstream Water Bodies *Refer to Watershed Mapping Tool –* *http://permitrack.sbcounty.gov/wap/*	Santa Ana, Reach 3
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	☒	☐	Owner shall familiarize himself with the contents of this WQMP and shall educate tenants of stormwater BMPs proposed using education materials provided.
N2	Activity Restrictions	☒	☐	Owner to educate tenants of the following activity restrictions set forth in Lease Agreements: The dumping of waste into any area of the site is prohibited The blowing or sweeping of debris such as grass clippings, plant trimmings, dead leaves, etc. into the drainage areas is prohibited. The discharge of fertilizer or pesticides into drainage areas is prohibited Maintenance or repair is prohibited. There are no facilities for these activities. All pesticide applications shall be done by a licensed professional.
N3	Landscape Management BMPs	☒	☐	Drought tolerant plants will be used along with efficient irrigation in order to reduce excess irrigation runoff, promote surface filtration, and adhere to County landscape design standards. Landscaping shall be maintained monthly or as required by maintenance personnel, and waste disposed and/or recycled in appropriate bins per County requirements. Fertilizers and amendments shall be applied only per manufacturers specifications.
N4	BMP Maintenance	☒	☐	BMPs proposed require maintenance as shown on this WQMP on Form 5-1, Page 5-1.
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waste proposed onsite

Form 4.1-1 Non-Structural Source Control BMPs				
N6	Local Water Quality Ordinances	☒	☐	The local water quality ordinance shall be complied with throughout the implementation of this WQMP.
N7	Spill Contingency Plan	☒	☐	This site will have absorbent materials on site for potential vehicle leaks
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks proposed. No hazardous materials proposed onsite
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials stored onsite.

Form 4.1-1 Non-Structural Source Control BMPs				
Identifier	Name	Check One		Describe BMP Implementation OR, if not applicable, state reason
		Included	Not Applicable	
N10	Uniform Fire Code Implementation	☐	☐	PROJECT SITE TO COMPLY WITH ALL FIRE CODE REQUIREMENTS. BUILDING TO BE FULLY SPRINKLERED, PLEASE REFER TO FIRE SPRINKLER AND ALARM PLANS PREPARED BY OTHERS."
N11	Litter/Debris Control Program	☒	☐	The Owner and his contractors shall ensure the site is maintained free of litter/debris at all times through regular sweeping and litter/trash collection & removal and as part of landscape maintenance.
N12	Employee Training	☒	☐	The project owner shall provide regular Stormwater BMP training to all site occupants, including contractors, working on the site, using BMP Educational Materials in Section 6.4 of this document

N13	Housekeeping of Loading Docks	☒	☐	Maintenance of proposed loading docks west of the building by cleaning up spills immediately. Proper inspection of containment after area has been cleaned thoroughly.
N14	Catch Basin Inspection Program	☒	☐	The Owner shall inspect all inlet catch basins to make sure they are clean and there is no evidence of illegal/illicit discharges into these drains.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	All paved areas of the site shall be vacuum swept by the owner's contractor to remove trash/litter and sediment.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project
N17	Comply with all other applicable NPDES permits	☐	☐	Prior to and during the entire construction phase, the owner shall apply for coverage under the statewide Construction General Permit by filing an NOI and SWPPP with the CA State Water Board and any tenant required to obtain coverage under the CA General Industrial Stormwater Permit shall file for coverage under that permit, prior to occupying the building.

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
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	The Site Owner shall initially apply a "No Dumping - Drains To River" stenciled message onto all onsite catch basin inlets and shall maintain the legibility of these messages on an annual basis.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	The Owner shall prohibit any outdoor material storage onsite
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☒	The Trash Enclosure shall be constructed with a solid roof to prevent rainfall exposure. Runoff will be diverted away from the trash enclosure to prevent stormwater flows from entering the enclosure, and the owner shall require dumpster lids to be closed at all times and regular sweeping/cleaning of the enclosure.
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)	☒	☐	Efficient irrigation proposed at site, please refer to landscape plans for additional information re: valves, controllers, and timers. The owner shall perform maintenance of this system to minimize irrigation runoff and ensure system operates as designed.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	All landscaped areas shall be finish graded at least 1" below top-of-curb or pavement and the owner shall maintain this design to conserve runoff.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	All sloped areas shall be stabilized with pavement, rock, vegetation, bark, or other stabilizing materials to prevent erosion.
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Docks proposed onsite with dock-high rollup doors so all loading/unloading is performed inside the building.
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Maintenance or repair is prohibited.

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash onsite
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No processing onsite

Form 4.1-2 Structural Source Control BMPs

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

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: Proposed BMP will utilize the natural infiltration capacity as much as possible by providing landscaping to all areas not needed for operation of the site. S-1 Impervious = 92%, Pervious = 08%; N-2 Impervious = 89%, Pervious = 11%;
Maximize natural infiltration capacity: Yes ☒ No ☐ Explanation:
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Proposed drainage pattern intended for infiltration as opposed to offsite drainage. The addition of the infiltration chambers will increase the time of concentration
Disconnect impervious areas: Yes ☒ No ☐ Explanation: All impervious areas flow into onsite retention/infiltration systems before overflowing into the MS4.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: Very little existing vegetation onsite currently and the site is being mass graded, landscaping proposed.
Re-vegetate disturbed areas: Yes ☒ No ☐ Explanation: Disturbed areas not covered by impervious areas are landscaped.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The underground infiltration system shall be compacted per manufacturers specifications.
Utilize vegetated drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation No above ground vegetated drainage swales utilized. Given the limited space for each BMP underground infiltration chambers were chosen. Vegetated lined earthen swales upstream of these units is undesirable due to the potential of clogging if the vegetation should fail to hold the soil in place. The site does discharge to an unlined swale
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: Landscape areas will be staked

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.

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1; DA-S-1)		
1 Project area DA-S-1 (ft^2): 44,035	2 Imperviousness after applying preventative site design practices (Imp%): 92.3%	3 Runoff Coefficient (Rc): 0.7646 *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 $P_{2yr\text{-}1hr}$ (in): 0.708 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
5 Compute P_6, Mean 6-hr Precipitation (inches): 1.05 *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): 5,783.1 *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 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1; DA-S-2)

1 Project area DA 1 (ft^2): 35,189	2 Imperviousness after applying preventative site design practices (Imp%): 89%	3 Runoff Coefficient (Rc): 0.7159 *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 $P_{2yr\text{-}1hr}$ (in): 0.708 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

5 Compute P_6, Mean 6-hr Precipitation (inches): 1.05

*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): 4,327.0

*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) DA-S-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 Entire Existing site 0.0419 ac/ft = 1,825 cf *Form 4.2-3 Item 12*	2 11.5 min *Form 4.2-4 Item 13*	3 Entire Existing site 1.73 *Form 4.2-5 Item 10*
Post-developed	4 0 *Form 4.2-3 Item 13*	5 7 min *Form 4.2-4 Item 14*	6 0 *Form 4.2-5 Item 14*
Difference	7 *-1,825* *Item 4 – Item 1*	8 *4.5* *Item 2 – Item 5*	9 *- 1.73cfs* *Item 6 – Item 3*
Difference (as % of pre-developed)	10 *-%* *Item 7 / Item 1*	11 39% *Item 8 / Item 2*	12 *-%* *Item 9 / Item 3*

Form 4.2-2 Summary of HCOC Assessment (DA 1) DA-S-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** Entire Existing site 0.0419 ac/ft = 1,825 cf *Form 4.2-3 Item 12*	**2** 11.5 min *Form 4.2-4 Item 13*	**3** Entire Existing site 1.73 *Form 4.2-5 Item 10*
Post-developed	**4** 0 *Form 4.2-3 Item 13*	**5** 6 min *Form 4.2-4 Item 14*	**6** 0 cfs *Form 4.2-5 Item 14*
Difference	**7** *-1,825* *Item 4 – Item 1*	**8** *5.5 min* *Item 2 – Item 5*	**9** *-1.73 cfs* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** -*%* *Item 7 / Item 1*	**11** 48 *%* *Item 8 / Item 2*	**12** -*%* *Item 9 / Item 3*

For Peak runoff H&H report was conducted using Civil D software and PULS spreadsheet to calculate pre and post runoff conditions.

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1) DA-S-1

Weighted Curve Number Determination for: **Pre**-developed DA	DA-S-1		DA C	DA D	DA E	DA F	DA G	DA H
1a Land Cover type	GRASS FAIR							
2a Hydrologic Soil Group (HSG)	A							
3a DA Area, ft^2 *sum of areas of DA should equal area of DA*	44,035							
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	50							
Weighted Curve Number Determination for: Post-developed DA	DA-S-1		DA C	DA D	DA E	DA F	DA G	DA H
1b Land Cover type	COMMERCIAL							
2b Hydrologic Soil Group (HSG)	A							
3b DA Area, ft^2 *sum of areas of DA should equal area of DA*	44,035							
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*	90							

5 Pre-Developed area-weighted CN: 50	**7** Pre-developed soil storage capacity, S (in): 10.00 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 2.000 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.222 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 3.23
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 1,825 CF, FOR ALL OF DA-1
*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): 0
*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): 0
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Lines 12,13,14 Updated with Civil D and PULS spreadsheet outputs.

Form 4.2-3 HCOC Assessment for Runoff Volume (DA 1) DA-S-2

Weighted Curve Number Determination for: <u>Pre</u>-developed DA		DA-S-2	DA C	DA D	DA E	DA F	DA G	DA H
1a Land Cover type		GRASS FAIR						
2a Hydrologic Soil Group (HSG)		A						
3a DA Area, ft^2 *sum of areas of DA should equal area of DA*		35,189						
4a Curve Number (CN) *use Items 1 and 2 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*		50						
Weighted Curve Number Determination for: <u>Post</u>-developed DA		DA-S-2	DA C	DA D	DA E	DA F	DA G	DA H
1b Land Cover type		COMMERCIAL						
2b Hydrologic Soil Group (HSG)		A						
3b DA Area, ft^2 *sum of areas of DA should equal area of DA*		35,189						
4b Curve Number (CN) *use Items 5 and 6 to select the appropriate CN from Appendix C-2 of the TGD for WQMP*		90						

5 Pre-Developed area-weighted CN: 50	**7** Pre-developed soil storage capacity, S (in): 10.00 *S = (1000 / Item 5) - 10*	**9** Initial abstraction, I_a (in): 2.000 *I_a = 0.2 * Item 7*
6 Post-Developed area-weighted CN: 90	**8** Post-developed soil storage capacity, S (in): 1.11 *S = (1000 / Item 6) - 10*	**10** Initial abstraction, I_a (in): 0.222 *I_a = 0.2 * Item 8*

11 Precipitation for 2 yr, 24 hr storm (in): 3.23
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

12 Pre-developed Volume (ft^3): 1,825 CF, FOR ALL OF DA-1
*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): 0
*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): 0
*V_{HCOC} = (Item 13 * 0.95) – Item 12*

Lines 12,13,14 Updated with Civil D and PULS spreadsheet outputs.

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 DA*				Post-developed DA1 *Use additional forms if there are more than 4 DA*			
	DA 1	DA B	DA C	DA D	DA S1	DA S2	DA C	DA D
1 Length of flowpath (ft) *Use Form 3-2 Item 5 for pre-developed condition*	313				224	240		
2 Change in elevation (ft)	6.9				0.86	1.28		
3 Slope (ft/ft), *S_o = Item 2 / Item 1*	0.022				0.004	0.005		
4 Land cover	Undevelo ped				paved	paved		
5 Initial DA Time of Concentration (min) *Appendix C-1 of the TGD for WQMP*	11.5				7	6		
6 Length of conveyance from DA outlet to project site outlet (ft) *May be zero if DA 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): 11.5 *Minimum of Item 12 pre-developed DA*

14 Post-developed time of concentration (min): N/A FLOW DOES NOT LEAVE SITE, FULLY INFILTRATED *Minimum of Item 12 post-developed DA*

15 Additional time of concentration needed to meet HCOC requirement (min): 0 *T_{C-HCOC} = (Item 13 * 0.95) – Item 14*

NOTE: The time of concentration nomograph from the San Bernardino County Hydrology Manual was used for initial Tc. Post development Tc to the property line is not possible due to all the runoff being captured and infiltrated.

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 DA)*			Post-developed DA to Project Outlet (*Use additional forms if more than 3 DA)*		
		DA 1	DA B	DA C	DA-S-1	DA-S-2	DA 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 DA (Acres) *For DA with outlet at project site outlet, include upstream DA (Using example schematic in Form 3-1, DA A will include drainage from DA C)*							
3 Ratio of pervious area to total area *For DA with outlet at project site outlet, include upstream DA (Using example schematic in Form 3-1, DA A will include drainage from DA 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 DA with outlet at project site outlet, include upstream DA (Using example schematic in Form 3-1, DA A will include drainage from DA C)*							
6 Peak Flow from DA (cfs) *Q_p =Item 2 * 0.9 * (Item 1 - Item 5)*							
7 Time of concentration adjustment factor for other DA to site discharge point *Form 4.2-4 Item 12 DA / Other DA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)*	DA A	*n/a*			*n/a*		
	DA B		*n/a*			*n/a*	
	DA C			*n/a*			*n/a*

8 Pre-developed Q_p at T_c for DA 1: 1.73 CFS *Q_p = Item 6_{DAA} + [Item 6_{DAB} * (Item 1_{DAA} - Item 5_{DAB})/(Item 1_{DAB} - Item 5_{DAB})* Item $7_{DAA/2}$] + [Item 6_{DAC} * (Item 1_{DAA} - Item 5_{DAC})/(Item 1_{DAC} - Item 5_{DAC})* Item $7_{DAA/3}$]*	**9** Pre-developed Q_p at T_c for DA B: *Q_p = Item 6_{DAB} + [Item 6_{DAA} * (Item 1_{DAB} - Item 5_{DAA})/(Item 1_{DAA} - Item 5_{DAA})* Item $7_{DAB/1}$] + [Item 6_{DAC} * (Item 1_{DAB} - Item 5_{DAC})/(Item 1_{DAC} - Item 5_{DAC})* Item $7_{DAB/3}$]*	**10** Pre-developed Q_p at T_c for DA C: *Q_p = Item 6_{DAC} + [Item 6_{DAA} * (Item 1_{DAC} - Item 5_{DAA})/(Item 1_{DAA} - Item 5_{DAA})* Item $7_{DAC/1}$] + [Item 6_{DAB} * (Item 1_{DAC} - Item 5_{DAB})/(Item 1_{DAB} - Item 5_{DAB})* Item $7_{DAC/2}$]*
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 DA-S-1: 0 CFS *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DA-S-2: 0 CFS *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DA C: *Same as Item 10 for post-developed values*
14 Peak runoff from post-developed condition confluence analysis (cfs): 0.0 CFS *Maximum of Item 11, 12, and 13 (including additional forms as needed)*		
15 Peak runoff reduction needed to meet HCOC Requirement (cfs): 0.0 CFS Q_{p-HCOC} *= (Item 14 * 0.95) – Item 10*		

Lines 8, 10, 11, 12 Updated with Civil D and PULS spreadsheet outputs.

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)
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 DA BMP Type	DA DA BMP Type	DA DA 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 DA BMP Type	DA DA BMP Type	DA DA 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 Site Design Hydrologic Source Control BMPs (DA 1)

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 DA BMP Type	DA DA BMP Type	DA DA 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 DA BMP Type	DA DA BMP Type	DA DA 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 DA BMP Type	DA DA BMP Type	DA DA 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): 10,110 *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 DA-S-1 BMP Type Infiltration Chamber	DA 1 DA-S-2 BMP Type Infiltration Chamber	DA DA 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*	21.0	19.8	
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3.375	3.375	
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	6.2 MAX, 5.87 USED	5.87	
For line 4 as an additional safety factor the lower design percolation rate was used 5.87 in/hr			
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	48	
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	23.48’	23.48’	
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	6.75	6.75	
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*	1,197.2	903.8	
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*			
10 Amended soil porosity			
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*	12” above 9” below	12” above 9” below	
12 Gravel porosity	40%	40%	
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	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))]*	0	0	
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer’s specifications and calculations*	7,264	5,766	
16 Total Retention Volume from LID Infiltration BMPs: 13,030 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*			
17 Fraction of DCV achieved with infiltration BMP: 100% *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): 0 *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 DA BMP Type	DA DA BMP Type	DA DA 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)

<table>
<tr><th colspan="6">Form 4.3-5 Selection and Evaluation of Biotreatment BMP (DA 1)</th></tr>
<tr><td colspan="3">1 Remaining LID DCV not met by site design HSC, infiltration, or harvest and use BMP for potential biotreatment (ft³): 0 Form 4.2-1 Item 7 - Form 4.3-2 Item 30 – Form 4.3-3 Item 16- Form 4.3-4 Item 9</td><td colspan="3">List pollutants of concern Copy from Form 2.3-1.</td></tr>
<tr><td rowspan="2">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)</td><td colspan="3">Volume-based biotreatment
Use Forms 4.3-6 and 4.3-7 to compute treated volume</td><td colspan="2">Flow-based biotreatment
Use Form 4.3-8 to compute treated volume</td></tr>
<tr><td colspan="3">☐ Bioretention with underdrain
☐ Planter box with underdrain
☐ Constructed wetlands
☐ Wet extended detention
☐ Dry extended detention</td><td colspan="2">☐ Vegetated swale
☐ Vegetated filter strip
☐ Proprietary biotreatment</td></tr>
<tr><td colspan="2">3 Volume biotreated in volume based biotreatment BMP (ft³): Form 4.3-6 Item 15 + Form 4.3-7 Item 13</td><td colspan="2">4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft³): Item 1 – Item 3</td><td colspan="2">5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % Item 4 / Item 1</td></tr>
<tr><td colspan="6">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)</td></tr>
<tr><td colspan="6">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.</td></tr>
</table>

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 DA BMP Type	DA DA BMP Type	DA DA 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 DA BMP Type		DA DA 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 DA BMP Type	DA DA BMP Type	DA DA 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 2^1.67 * Item 3^0.5)*			
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 2^2)*			
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 S1)
1 Total LID DCV for the Project DA-1 (ft^3):5,783.1 *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): 7,264 *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 S2)

1 Total LID DCV for the Project DA-1 (ft^3): 4,327.0 *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): 5,766 *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 S1)	
1 Volume reduction needed for HCOC performance criteria (ft^3): 7,164 *(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): 0.2257 ac/ft 9,831 cf per civil D and PULS *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): 0 *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 S2)

1 Volume reduction needed for HCOC performance criteria (ft^3): 5,635 *(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): 0.1775 ac/ft 7,732 cf per civil D and PULS *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): 0 *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
Inlets (Box grates and Trench grates) & Inlet Filters	Owner	Inspect the Inlets, Trench drains and Inlet Filters for obstructions/debris buildup and to ensure that they continue to function properly.	Yearly in November, before every rainy season
ADS Infiltration Chamber	Owner	Inspect surface area for debris, and trash Open Manholes and measure sediment buildup. Once sediment has reached a depth of 6" inches the system shall be cleaned	Bi-Annually, November and May, and monthly during rainy season
Vacuum Sweeping	Owner	Vacuum sweeping of private streets and parking lots	Biweekly at a minimum
Storm drain stencil	Owner	Inspect for legibility, repair as needed	Inspect yearly and as needed
Efficient Irrigation	Owner	Inspect for leaks, broken sprinkler heads, spray coverage and excess runoff and adjust the irrigation frequency and duration as needed.	weekly and as needed.
Landscape Finish Grade	Owner	Inspect for depressions and repair as needed.	Inspect yearly after every rainy season to ensure no erosion/deteriorati ng.

Barracuda Max-S6 Hydrodynamic Gravity Separator	Owner	Insert vacuum hose on the inlet side of the Oil Floatables Skimmer and Vacuum out all trash, sediment and standing water Open cover inspect for debris, trash, Remove as needed, Check for accumulated sediment, if exceeds 18” remove sediment by vacuum truck	Vacuum yearly, remove debris, trash and inspect for 18” of sediment monthly
Litter and Debris	Owner	Litter shall be picked up, trash enclosure areas shall be swept and cleaned, dumpsters shall be emptied.	Weekly
Loading Dock	Owner	Inspect the loading dock area daily for loose trash/litter and sweep biweekly. Any spills or broken containers shall be cleaned up immediately.	Inspected daily and cleaned as needed. Bi-Weekly sweeping at a minimum.
Catch Basin	Owner	Inspect the Catch Basin for obstructions/debris buildup and to ensure that they continue to function properly.	Quarterly (Minimum), Monthly during rainy season and after heavy storm event
Landscape	Owner	Landscape management will consist of trimming and replanting of vegetation, repair and maintenance of irrigation systems, and appropriate use of fertilizers and pesticides.	Weekly
Rip-rap	Owner	Check rip-rap for coverage and erosion at all outfalls to ensure that they continue to function properly.	Quarterly (Minimum), Monthly during rainy season and after heavy storm event

Section 6 WQMP 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

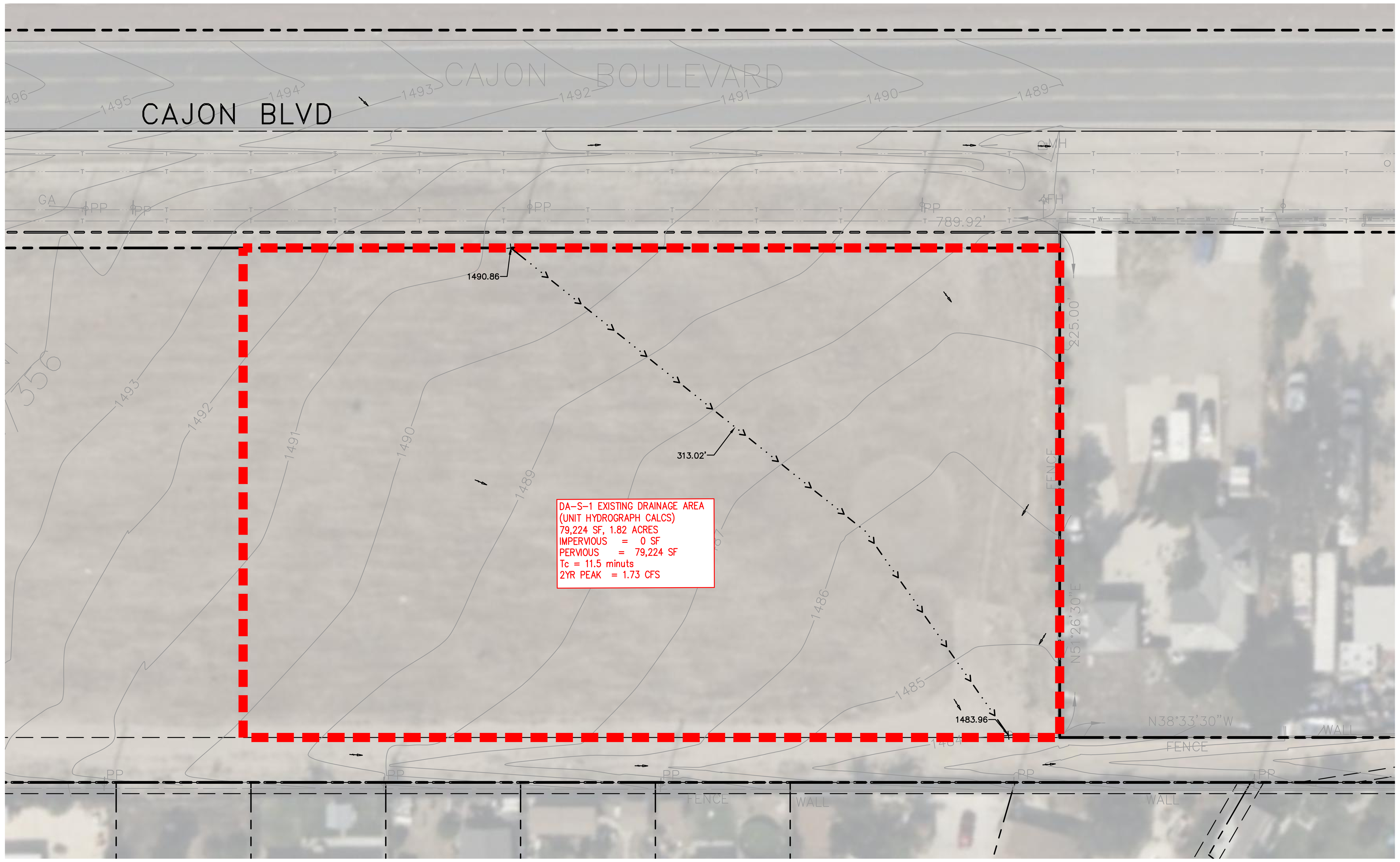
Minimum requirements include submittal of PDF exhibits in addition to hard copies. Format must not require specialized software to open. If the local jurisdiction requires specialized electronic document formats (as described in their Local Implementation Plan), this section will describe the contents (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. : Not Provided in PWQMP

6.4 Other Supporting Documentation

- PWQMP Exhibit Existing
- PWQMP Exhibit Proposed
- June Springs PGP set
- TOPO MAP
- HCOC Exemption Map
- NOAA Depth Precipitation
- Soils Map
- Soil Infiltration Study
- Geotech Report
- BMP Educational Materials: Not Provided in PWQMP
- Map showing Drainage Easement TMP 20798
- Tc Nomograph
- Worksheet H - Infiltration Rate safety factor Worksheet
- Civil D output Existing
- Civil D Output Proposed CJWW, DA-N-1
- Civil D Output Proposed CJWE, DA-N-2
- PULS Output DA-N-1
- PULS Output DA-N-2
- Employee Training Educational Materials
- Picture of Existing Conditions



GRAPHIC SCALE

15 0 7.5 15 30 60

(IN FEET)
1 inch = 30 ft.

LEGEND:

— - - —	PROPERTY LINE
▬ ▬ ▬	DRAINAGE AREA BOUNDARY
–<···–<···–	PR. DRAINAGE PATH
— 144 —	EXISTING CONTOURS
→	FLOW ARROWS

Know what's **below.**
Call before you dig.

DESCRIPTION

DATE

raSmith
CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

JUNE SPRINGS BUSINESS PARK
SOUTH EAST CORNER OF CAJON BLVD. & JUNE STREET
SAN BERNARDINO, CA

PWQMP SOUTH EX

LICENSED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP.6/30/25
CIVIL
STATE OF CALIFORNIA
DATE 02/28/24

DATE: 02/28/24

SCALE: 1"= 30'

JOB NO. 3230032

PROJECT MANAGER:
ERIC A. ROBLES

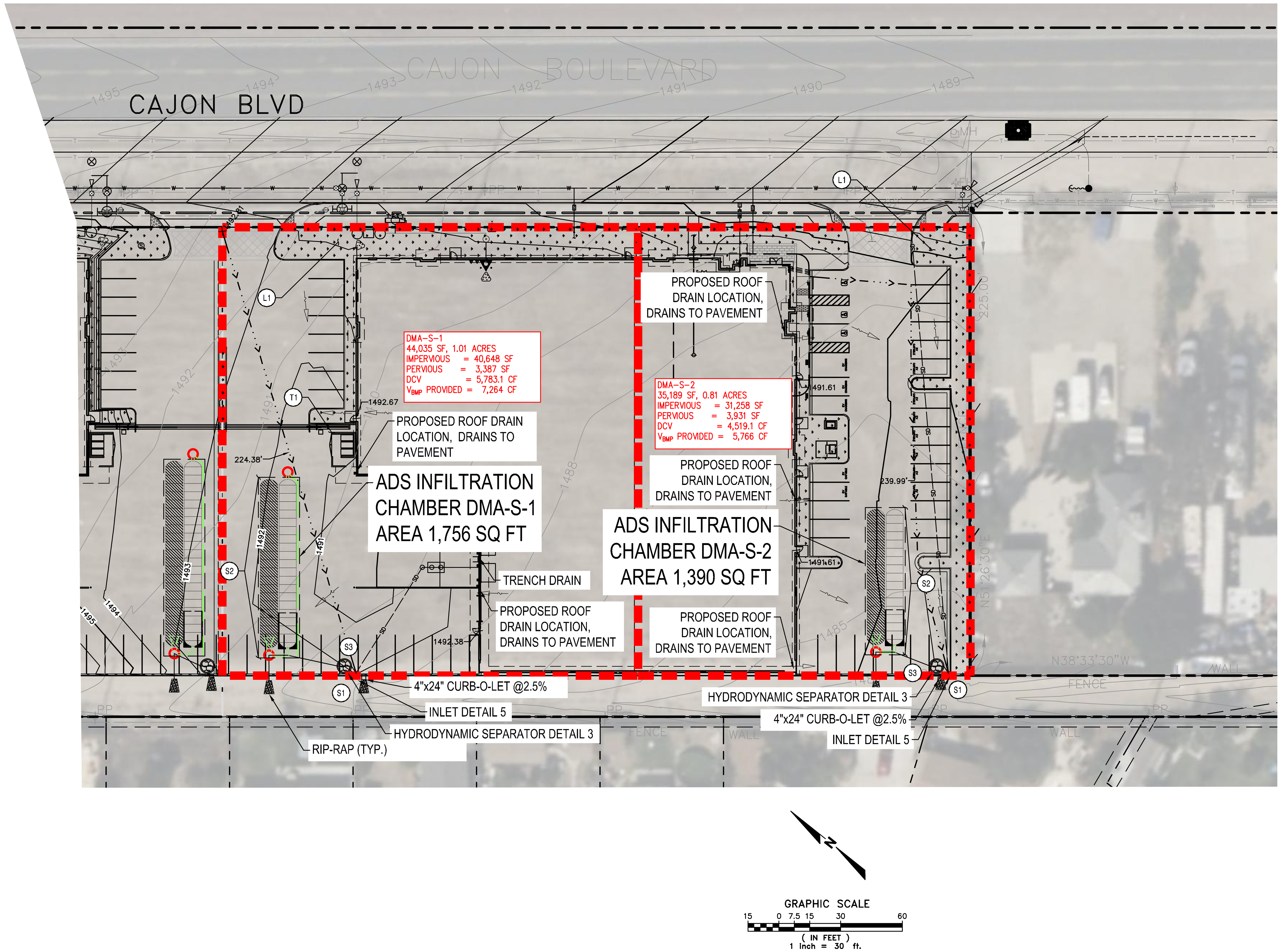
DESIGNED BY: JBM

CHECKED BY: EAR

SHEET NUMBER

PWQMP-S-1

Q:\3230032\Dwg\Exhibits\3230032 - PWQMP SOUTH EX.dwg, PWQMP SOUTH EX, 4/19/2024 4:29:50 PM, jbm



LEGEND:

- PROPERTY LINE
- DRAINAGE AREA BOUNDARY
- PROPOSED STORM DRAIN
- PR. DRAINAGE PATH
- EXISTING CONTOURS
- PROPOSED CONTOURS
- PROPOSED LANDSCAPING
- (T1) TRASH AND WASTE STORAGE WITH ROOF
- (L1) EFFICIENT IRRIGATION (NOT SHOWN, TYPICAL)
- (S1) STORM DRAIN GRATE INLET W/ STENCILING, TRENCH DRAIN GRATE INLET W/ STENCILING
- (S2) ADS INFILTRATION CHAMBER
- (S3) BARRACUDA S6 HYDRODYNAMIC SEPARATOR

SITE CONDITIONS SUMMARY:

PROJECT SITE = 1.81 ACRES (EXISTING)

INFILTRATION RATE DMA-S-1 = 21.0 IN/HR.
INFILTRATION RATE DMA-S-2 = 19.8 IN/HR.
INFILTRATION IS FEASIBLE

PROPOSED CONDITIONS AREA SUMMARY

SITE AREA:	1.81 AC
IMPERVIOUS AREA (%):	87.6%
SOIL TYPE:	FINE TO MEDIUM SAND
P6 STORM DEPTH:	1.05 INCHES
2YR STORM DEPTH:	3.23 INCHES

DMA-S-1

AREA:	1.01 AC
IMPERVIOUS AREA (%):	92%
DCV REQUIRED:	5,718.3 CF
HCOC VOLUME REDUCTION REQUIRED:	7,164.5 CF
BMP PROVIDED:	
INFILTRATION CHAMBER	7,264 CF
DRAWDOWN RATE:	48 HR

DMA-S-2

AREA:	0.81 AC
IMPERVIOUS AREA (%):	89%
DCV REQUIRED:	4,327.0 CF
HCOC VOLUME REDUCTION REQUIRED:	5,635
BMP PROVIDED:	
INFILTRATION CHAMBERS	5,766 CF
DRAWDOWN RATE:	48 HR

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DESCRIPTION	DATE

8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com
raSmith
CREATIVITY BEYOND ENGINEERING

JUNE SPRINGS BUSINESS PARK
SOUTH EAST CORNER OF CAJON BLVD. & JUNE STREET
SAN BERNARDINO, CA
PWQMP SOUTH

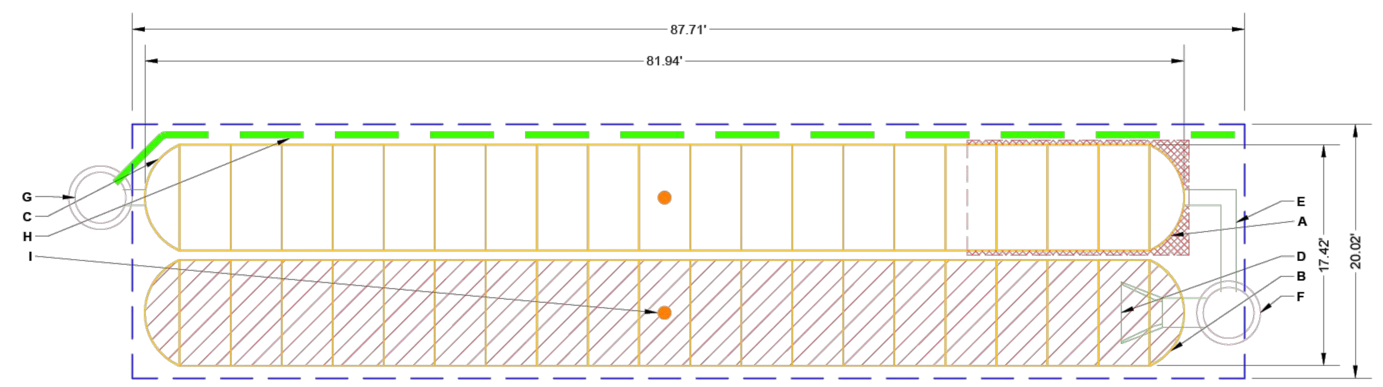
LICENSED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP.6/30/25
CIVIL
STATE OF CALIFORNIA
DATE 02/28/24

DATE: 02/28/24
SCALE: 1"= 30'
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JBM
CHECKED BY: EAR
SHEET NUMBER
PWQMP-S-1

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS:	
38	STORMTECH MC-4500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
4	STORMTECH MC-4500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
7264	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-4500 CHAMBER:	5.75
		12" x 12" TOP MANIFOLD INVERT:	3.72
		24" ISOLATOR ROW PLUS INVERT:	0.94
1756	SYSTEM AREA (SF)	12" BOTTOM CONNECTION INVERT:	0.88
215.5	SYSTEM PERIMETER (ft)	BOTTOM OF MC-4500 CHAMBER:	0.75
		UNDERDRAIN INVERT:	0.00
		BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
PREFABRICATED END CAP	C	12" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP12B / TYP OF ALL 12" BOTTOM CONNECTIONS	1.55"	
FLAMP	D	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	E	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN
CONCRETE STRUCTURE	G	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.0 CFS OUT
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		
INSPECTION PORT	I	4" SEE DETAIL (TYP 2 PLACES)		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

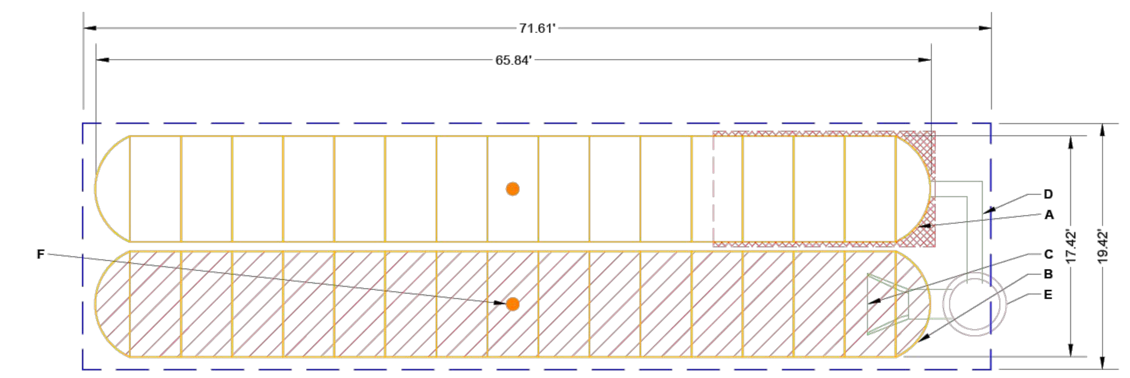
CAJUN & JUNE S-1
SAN BERNARDINO, CA, USA
DRAWN: JM
CHECKED: N/A
DATE:
PROJECT #:
DATE DRW CHK DESCRIPTION
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473
SHEET 2 OF 5

1 INFILTRATION CHAMBER DMA-S-1
N.T.S.

PROPOSED LAYOUT		CONCEPTUAL ELEVATIONS:	
30	STORMTECH MC-4500 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
4	STORMTECH MC-4500 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
5766	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	6.75
		TOP OF MC-4500 CHAMBER:	5.75
		12" x 12" TOP MANIFOLD INVERT:	3.72
		24" ISOLATOR ROW PLUS INVERT:	0.94
1390	SYSTEM AREA (SF)	BOTTOM OF MC-4500 CHAMBER:	0.75
182.1	SYSTEM PERIMETER (ft)	BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN
INSPECTION PORT	F	4" SEE DETAIL (TYP 2 PLACES)		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

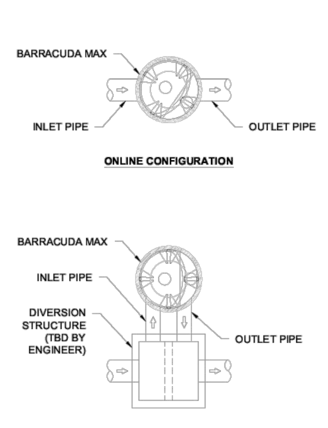
NOTES
- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

CAJUN & JUNE S-2
SAN BERNARDINO, CA, USA
DRAWN: JM
CHECKED: N/A
DATE:
PROJECT #:
DATE DRW CHK DESCRIPTION
StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473
SHEET 2 OF 5

2 INFILTRATION CHAMBER DMA-S-2
N.T.S.

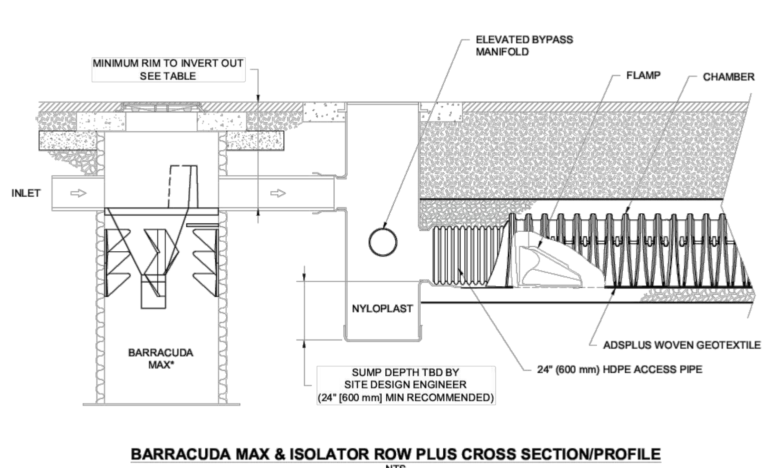
BARRACUDA MAX MINIMUM RIM TO INVERT OUT	
MODEL	INCH (MM)
S3	36 (914)
S4	36 (914)
S6	39 (991)
S8	41 (1041)

THE S3, S4, S6, AND S8 CAN BE INSTALLED IN A STANDARD 36" (900 mm), 48" (1200 mm), 72" (1800 mm), AND 96" (2400 mm) PRECAST MANHOLE, RESPECTIVELY. THE S3 AND S4 CAN BE PROVIDED FACTORY INSTALLED WITHIN A 36" (900 mm) AND 48" (1200 mm) ADS HP MANHOLE AND DELIVERED TO THE JOBSITE.

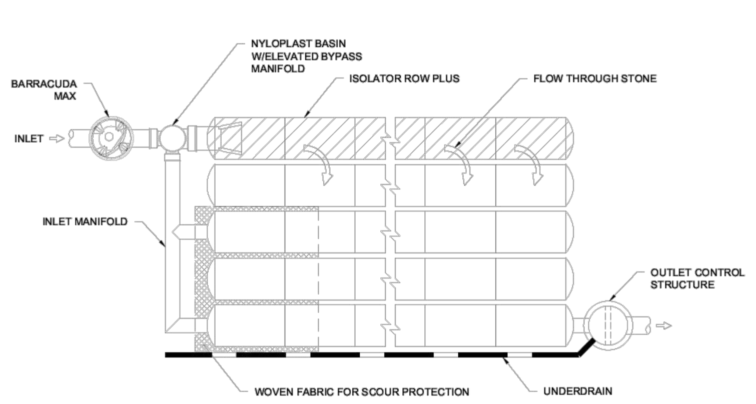


ONLINE CONFIGURATION

OFFLINE CONFIGURATION



BARRACUDA MAX & ISOLATOR ROW PLUS CROSS SECTION/PROFILE
NTS



BARRACUDA MAX & ISOLATOR ROW PLUS SCHEMATIC
NTS

ISOLATOR ROW PLUS FLOW RATES			
CHAMBER MODEL	SURFACE LOADING RATE GPM/FT² (L/S/m²)	EFFECTIVE FILTRATION TREATMENT AREA FT² (m²)	MTFR CFS (L/S)*
SC-160	4.13 (2.8)	11.45 (1.064)	0.11 (2.983)
SC-310	4.13 (2.8)	17.7 (1.644)	0.16 (4.612)
SC-740	4.13 (2.8)	27.8 (2.583)	0.26 (7.244)
DC-780	4.13 (2.8)	27.8 (2.583)	0.26 (7.244)
MC-3500	4.13 (2.8)	42.9 (3.986)	0.40 (11.178)
MC-4500	4.13 (2.8)	30.1 (2.796)	0.28 (7.843)
MC-7200	4.13 (2.8)	50.0 (4.645)	0.46 (13.028)

* PER CHAMBER LOADING RATES BASED ON NJCAT VERIFICATION TESTING OF THE STORMTECH SC-740 ISOLATOR ROW PLUS IN ACCORDANCE WITH NJDEP LABORATORY PROTOCOL TO ACCESS TOTAL SUSPENDED SOLIDS REMOVAL BY FILTRATION MANUFACTURED TREATMENT DEVICES, 2013.

KEY BENEFITS OF THE BARRACUDA MAX
- SINGLE MANHOLE DESIGN
- VARIABLE INLET/OUTLET ANGLE CONFIGURATIONS (NOT JUST 180 DEGREE ORIENTATION)
- INTERNAL BYPASS FOR INLINE INSTALLATION (WHERE APPLICABLE)
- ALL UNITS CAN BE INSTALLED INTO A STANDARD PRECAST MANHOLE
- 3' & 4' UNITS CAN BE FACTORY FABRICATED IN HP MANHOLES FOR QUICK DELIVERY WITH A LIGHT, EASY TO INSTALL STRUCTURE
- IN-STOCK COMPONENTS FOR QUICK DELIVERY
- NO ELEVATION LOSS BETWEEN THE INLET AND OUTLET
- SURFACE INSPECTION AND MAINTENANCE WITH NO CONFINED SPACE ENTRY
- DESIGNED FOR EASY MAINTENANCE USING A VACUUM TRUCK OR SIMILAR EQUIPMENT
- FIELD ENGINEERS AND INTERNAL ENGINEERING SERVICES DEPARTMENT TO ASSIST ENGINEERING WITH SIZING/DETAILS

BARRACUDA DESIGN TOOL
https://www.ads-pipe.com/water-quality-design-tool

BARRACUDA MAX TREATMENT FLOW (80% TSS)	
MODEL	CFS (L/s)
S3	0.85 (24.1)
S4	1.52 (43.0)
S6	3.40 (96.3)
S8	6.08 (172.2)

BARRACUDA MAX CAN BE CONFIGURED WITH AN OIL POUCH OR TRASH GUARD FOR ENHANCED TREATMENT.

KEY BENEFITS OF A BARRACUDA MAX & ISOLATOR PLUS DESIGN
- ENHANCED SEDIMENT REMOVAL BY COMBINING TWO INDUSTRY PROVEN DEVICES
- EXTENDED MAINTENANCE CYCLES
- EASY TO INSTALL AND CONFIGURE TO SPECIFIC SITE CONSTRAINTS
- ONLINE DESIGN TOOLS ALLOW DESIGNERS TO EASILY CREATE LAYOUTS AND DETAILS

KEY BENEFITS OF STORMTECH CHAMBERS
- LARGE FAMILY OF CHAMBERS TO FIT YOUR SITE
- EASILY CONFIGURABLE FOR IRREGULAR SHAPED BEDS
- MEETS PRODUCT REQUIREMENTS OF ASTM F2418 AND ASTM F2922 AND DESIGN REQUIREMENTS OF ASTM F2787
- EXCEED AASHTO LRFD DESIGN SPECIFICATIONS FOR HS-20 LIVE LOADS & DEEP BURIAL EARTH LOADS
- PATENTED ISOLATOR ROW PLUS FOR LESS FREQUENT MAINTENANCE, WATER QUALITY AND LONG-TERM PERFORMANCE
- THIRD PARTY VERIFIED PERFORMANCE
- FIELD ENGINEERS AND INTERNAL ENGINEERING SERVICES DEPARTMENT TO ASSIST ENGINEERING WITH LAYOUTS

STORMTECH DESIGN TOOL
https://designtool.ads-pipe.com/

STORMTECH® + WQ STD DETAIL
BARRACUDA®
& ISOLATOR ROW PLUS®
DATE: 2/10/22
DRAWN: KLJ
ADS Advanced Drainage Systems, Inc.
4640 TRUEMAN BLVD
HILLIARD, OH 43026
SHEET 1 OF 1

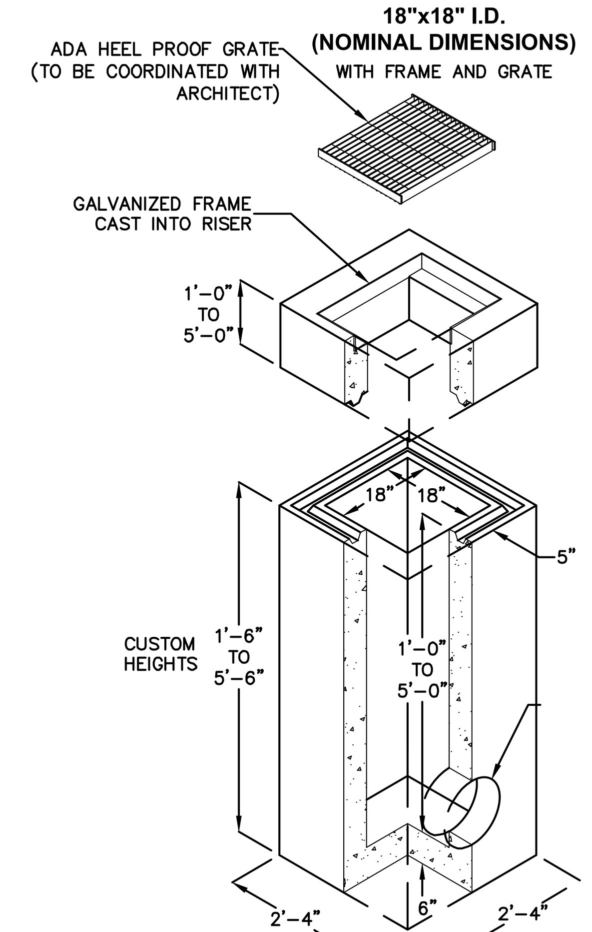
3 BARRACUDA HYDRO DYNAMIC SEPARATOR DMA-S-1, DMA-S-2
N.T.S.

NOTE:

ALL DRAIN INLETS THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN MUST BE LABELED TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS WITH THE STENCIL ABOVE IN A VISIBLE AREA. 2 COATS MINIMUM.

4 INLET STENCIL DETAIL
N.T.S.

DROP INLET
18"x18" I.D.
(NOMINAL DIMENSIONS)
WITH FRAME AND GRATE



NOTE:
1. FOR GRATE INLET SKIMMER BOX, USE PART #GISB 18-18-18

5 STORM DRAIN INLET DETAIL
N.T.S.

Know what's below. Call before you dig.
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DATE | DESCRIPTION

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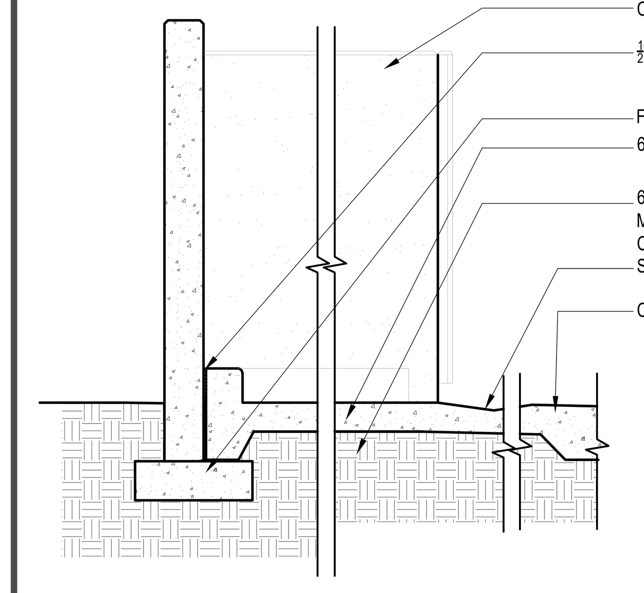
CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

JUNE SPRINGS BUSINESS PARK
SOUTH EAST CORNER OF CAJON BLVD. & JUNE STREET
SAN BERNARDINO, CA

PWQMP SOUTH DETAILS

LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
DATE 02/28/24

DATE: 02/28/24
SCALE: N/A
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JBM
CHECKED BY: EAR
SHEET NUMBER
PWQMP-S-2



CONCRETE TILT UP PANEL

1/2" EXPANSION JOINT MATERIAL

FOOTING PER STRUCTURAL

6"H CONCRETE CURB

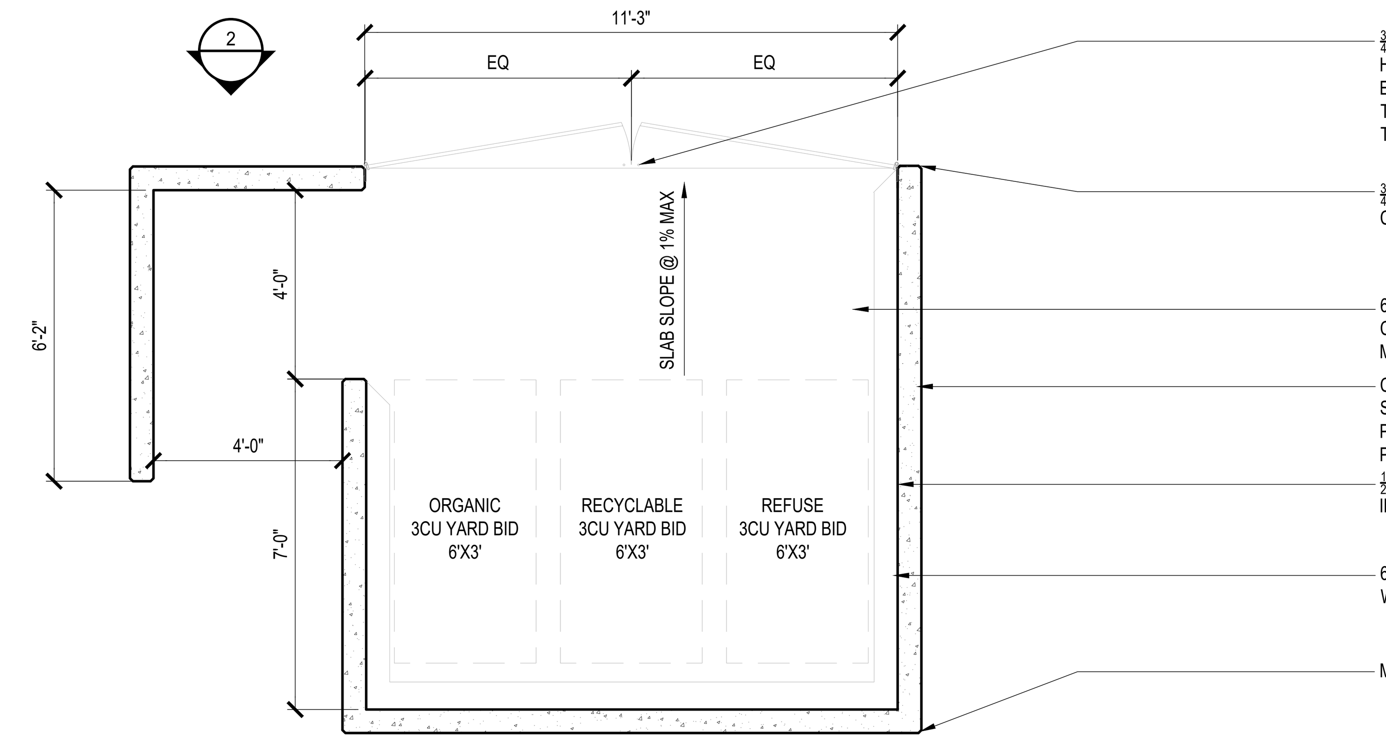
6" THICK COCNRETE SLAB WITH MEDIUM BROOM FINISH. PROVIDE CONTROL JOINTS AS REQUIRED

SWALE PER CIVIL DRAWINGS

CONCRETE APRON PER CIVIL

REFER TO SOIL'S REPORT FOR SLAB PREPARATION AND REINFORCEMENT FOR SLAB AS REQUIRED

TRASH ENCLOSURE SECTION — SCALE 3/8"=1'-0" — 5



3/4" DIAMETER X 2" DEEP DRILLED HOLES IN SLAB FOR CANE BOLTS FOR EACH FATE AND ALSO HOLES FOR THE CAN BOLTS WITH THE GATES IN THE OPEN POSITION

3/4" CHAMFER AT ALL OUTSIDE CORNERS TYP

6" THICK MIN. CONCRETE SLAB WITH CONTROL JOINTS AS REQUIRED AND MEDIUM BROOM FINISH

CONCRETE TILT UP PANELS PER STRUCTURAL DRAWINGS. SACK AND PATCH SMOOTH AND FINISH WITH PRIME AND PAINT PER ELEVATION

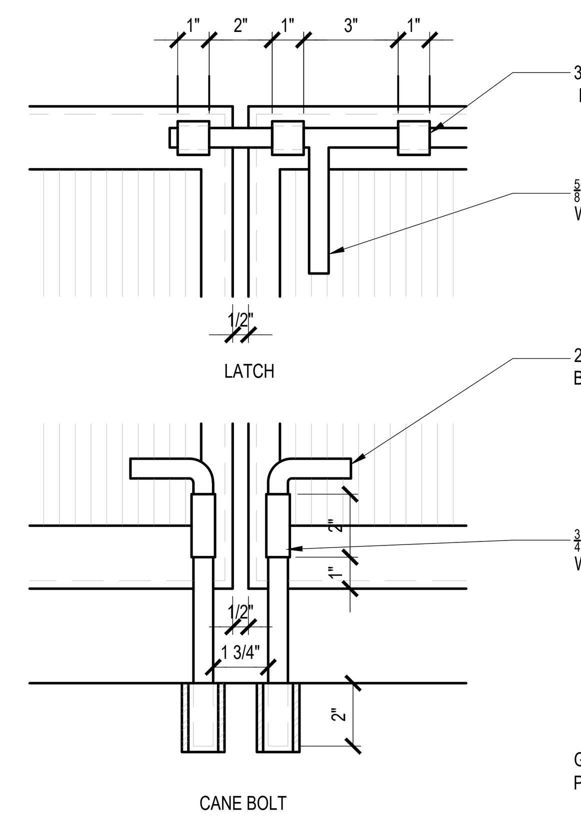
1/2" EXPANSION JOINT MATERIAL AT INTERIOR PERIMETER WALL

6"H X 6"W CONCRETE CURB FOR WALL PROTECTION

MITERED CORNERS SEE DETAIL 12

SEE STRUCTURAL FOR MORE INFORMATION

CONCRETE TILT TRASH ENCLOSURE — SCALE 3/8"=1'-0" — 1



3 - 3/4" DIM. STEEL HOLLOW PIPE X 1 LONG WELD TO GATE.

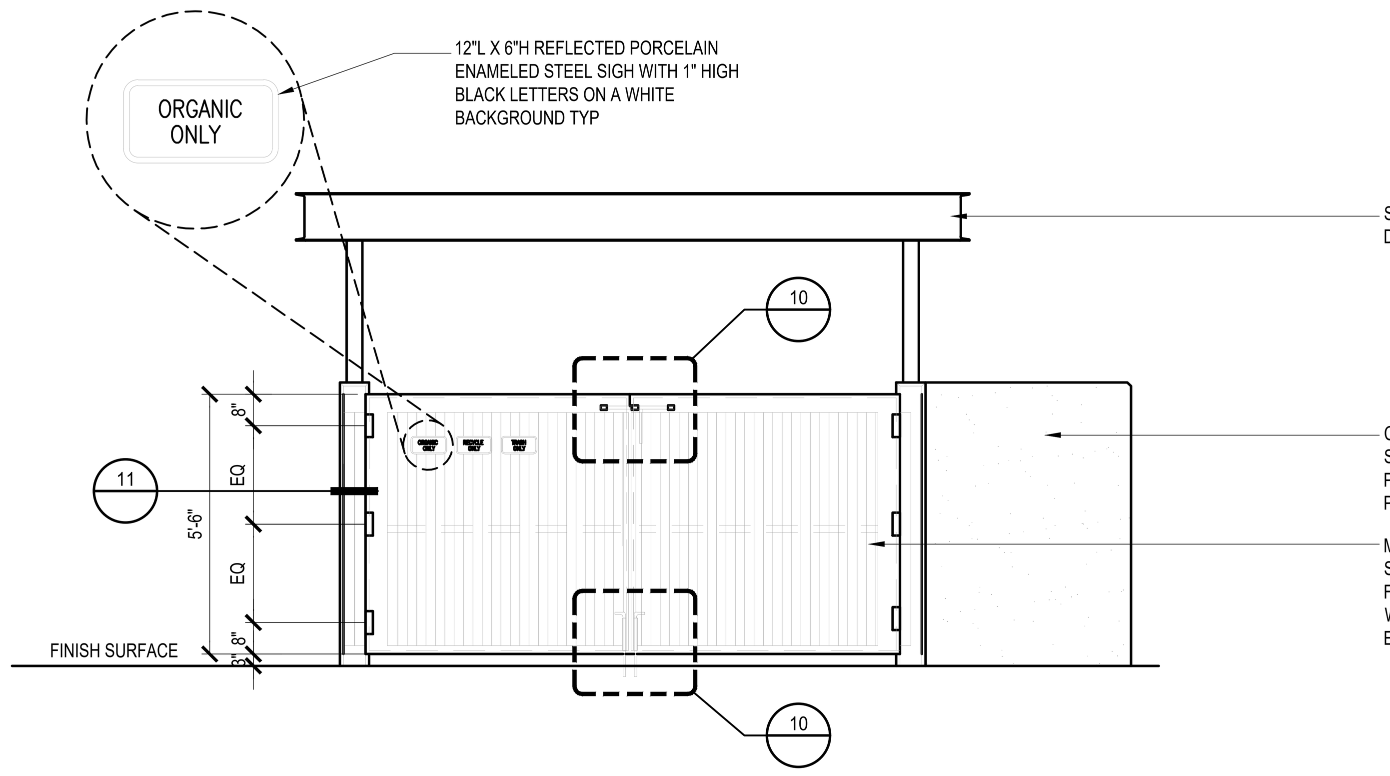
5/8" DIA. X 8" LONG STEEL PIN LATCH WITH 4" LONG HANDLE.

2 - 5/8" DIA. X 10" MIN LONG STEEL CANE BOLT WITH 2" LONG HANDLE

3/4" DIA. 2" LONG STEEL HOLLOW PIPE WELD TO GATE

GRIND SMOOTH ALL WELD, SAND, PRIME AND PAINT ALL ACCESSORIES

LATCH AND CANE BOLT — SCALE 3"=1'-0" — 10



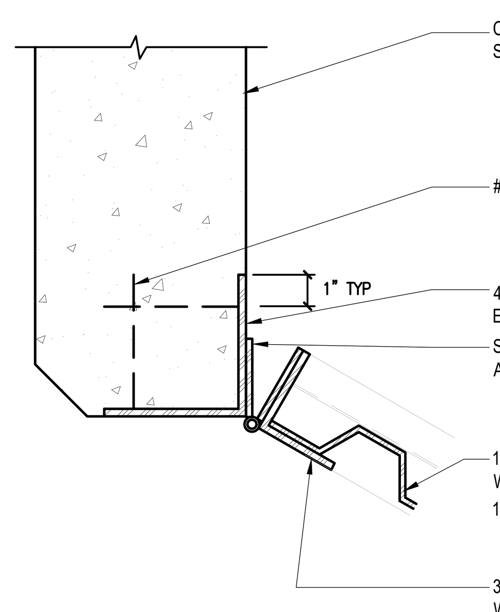
12"L X 6"H REFLECTED PORCELAIN ENAMELED STEEL SIGH WITH 1" HIGH BLACK LETTERS ON A WHITE BACKGROUND TYP

STRUCTURAL STEEL CANOPY SEE DETAIL 3 AND 4

CONCRETE TILT UP PANELS PER STRUCTURAL DRAWINGS. SACK AND PATCH SMOOTH AND FINISH WITH PRIME AND PAINT PER ELEVATION

METAL GATE WITH 1.5" X 1.2" X 1/4" STEEL ANGLE HORIZONTAL BRACE FOR SUPPORT. GRIND SMOOTH ALL WELD, PRIME AND PAINT PER ELEVATION

TRASH ENCLOSURE ELEVATION — SCALE 3/8"=1'-0" — 2



CONCRETE TILT PANEL PER STRUCTURAL AND ELEVATION

#4 REBARS @ EACH HINGE POINT

4.5" X 4.5" X 3/8" CONTINUOUS STEEL EMBED ANGLE

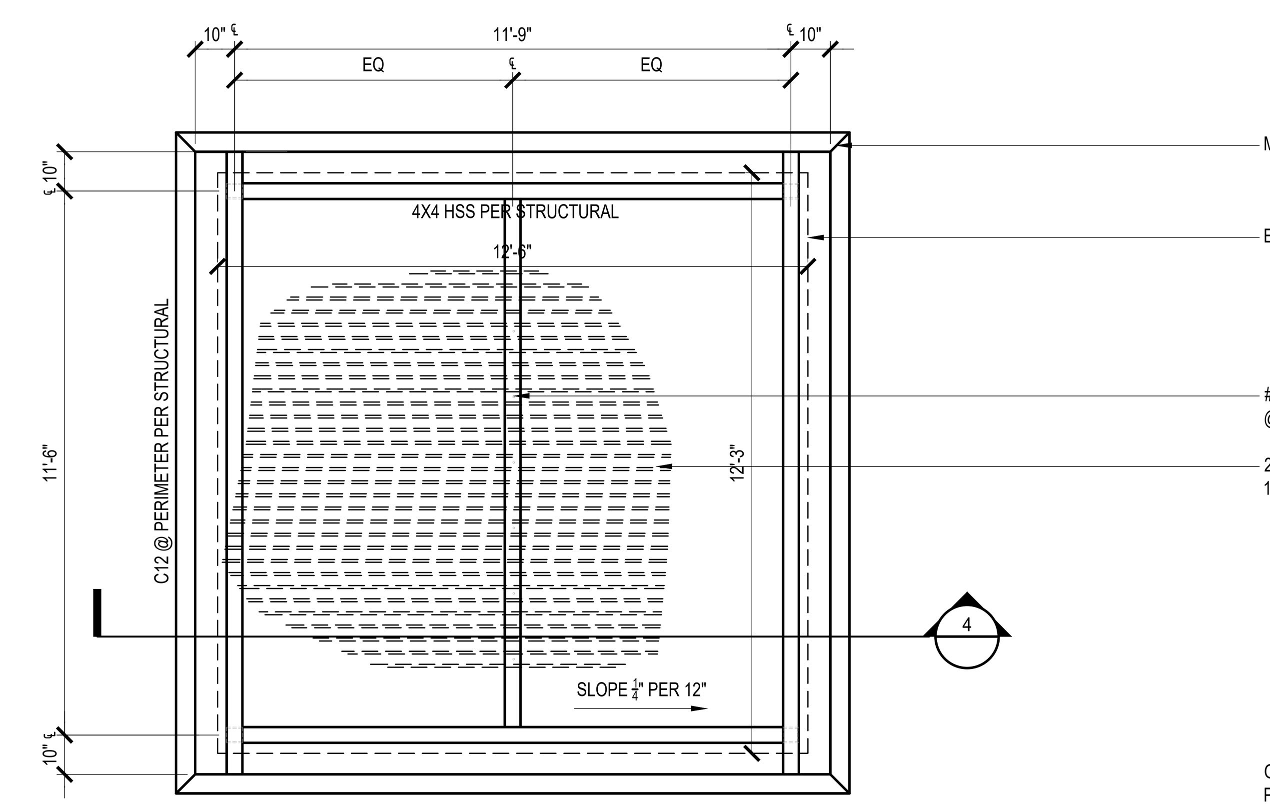
STEEL HINGES, WELD TO EMBED ANGLE.

18 GA X 1.5" DEEP STEEL DECKING WELD TO STEEL FRAME WITH 1.5" X 1.5" X 3/8" STEEL ANGLE CROSS BRACE

3"X3"X1.5" STEEL ANGLE FRAME WELDED TO HINGES

GRIND SMOOTH ALL WELDS, SAND, PRIME AND PAINT PER ELEVATION

HINGE AT GATE — SCALE 3"=1'-0" — 11



MITERED CORNERS TYP

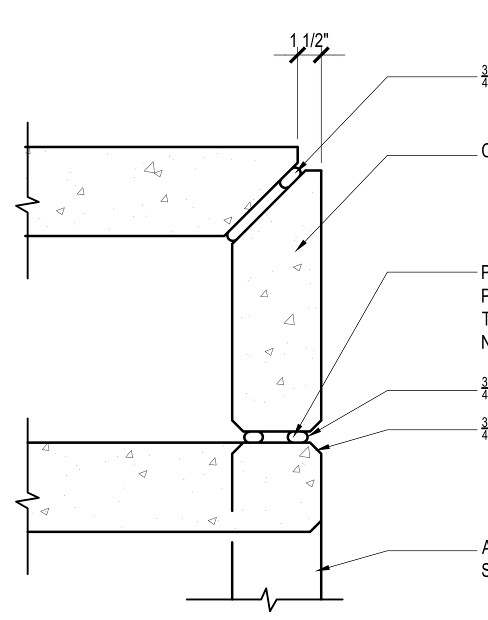
EXTEND OF METAL DECK TYP.

#10 SMS WITH NEOPRENE WASHERS @ EVERY 4TH FLUE

20 GA GALANIZED METAL DECK WITH 1.5" DEEP RIBS, SHIP LAP MIN 8"

GRIND SMOOTH ALL WELDS, SAND, PRIME AND PAINT ALL STRUCTURAL STEEL MEMBERS PER ELEVATION

TRASH ENCLOSURE METAL CANOPY — SCALE 3/8"=1'-0" — 3



3/4" MAX JOINT PER STRUCTURAL

CONCRETE TILT PANEL AS OCCUR

PAINT JOINT CAULKING OVER BACKING. POWER WASH, CLEAN AND DRY PRIOR TO APPLYING CAULKING. ENSURE THAT NO DEBRIS IS BETWEEN THE JOINTS

3/4" MAX JOINT PER STRUCTURAL

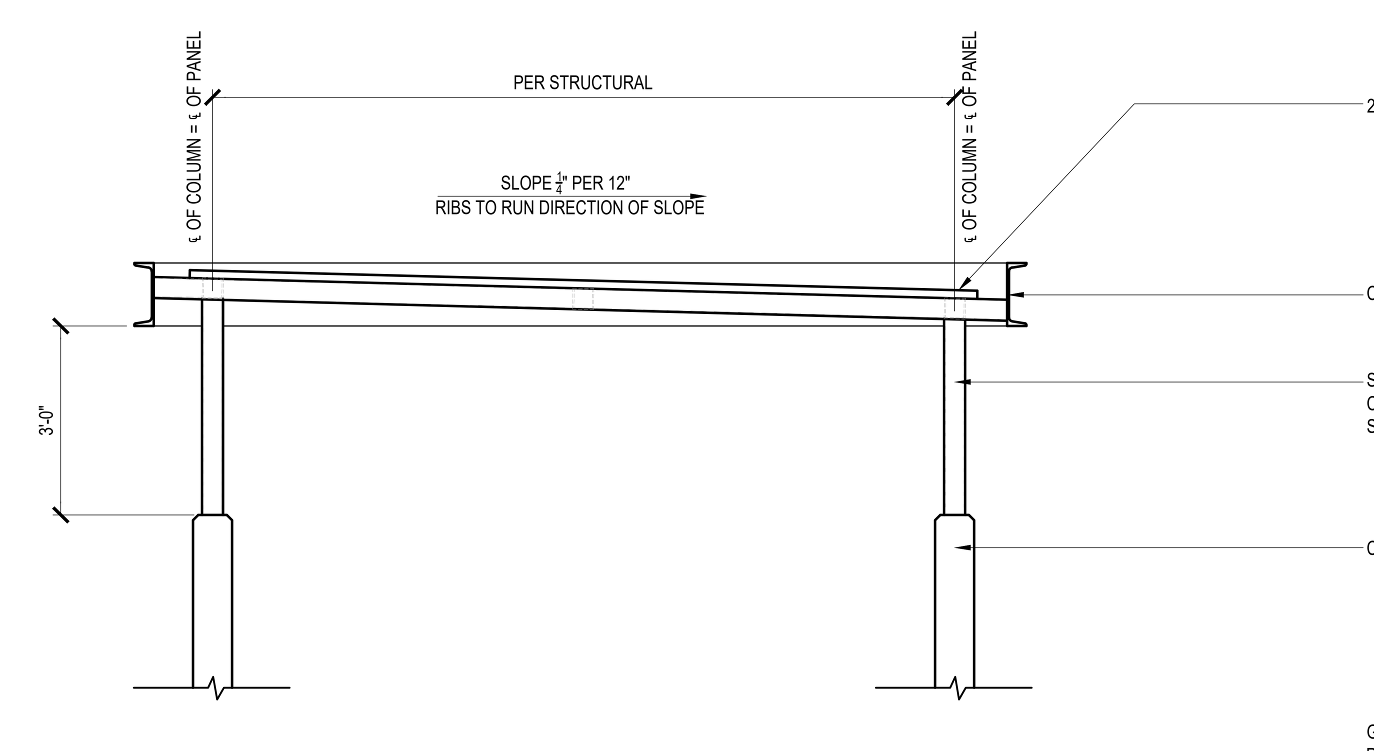
3/4" CHAMFER TYPICAL

ALTERNATE CONDITION AT BUTT ENDS, SEE FLOOR PLANS

REFER TO STRUCTURAL DRAWINGS FOR ADDITIONAL DETAILS.

PROVIDE 3HR RATED PANEL CAULK JOINT WHERE AT ALL REQUIRED EXTERIOR WALLS AS NOTED ON THE FLOOR PLAN

CONC. TILT TYP. PANEL JOINT — SCALE 1 1/2"=1'-0" — 12



20 GA GALVANIZED METAL DECK

C12 @ PERIMETER

STRUCTURAL COLUMN ATTACH TO CONCRETE TILT PANEL SEE STRUCTURAL DRAWINGS

CONCRETE TILT WALL AS OCCUR

GRIND SMOOTH ALL WELDS, SAND, PRIME AND PAINT ALL STRUCTURAL STEEL MEMBERS PER ELEVATION

TRASH ENCLOSURE CANOPY SECTION — SCALE 1/2"=1'-0" — 4

SKH ARCHITECT

STEVE K HONG ARCHITECT
4590 MACARTHUR BLVD. SUITE 500
IRVINE CALIFORNIA 92660
PROJECT MANAGER: STEVE HONG
714 - 822 - 1171, STEVE@SKHARCHITECT.COM

LICENSED ARCHITECT — STEVE K. HONG — NO. C-33677 — REN. 12-31-25 — STATE OF CALIFORNIA

CONSULTANTS

STRUCTURAL ENGINEER
DARIN FONG AND ASSOCIATES
3230 E. IMPERIAL HWY SUITE 302
BREA CA 92821949-579-1170
EMAIL: DARIN@DFAENGINEERING.COM
ATTN: DARIN FONG

MECHANICAL ENGINEER
AIR CONTROL SYSTEMS INC.
1940 S. GROVE AVE. ONTARIO CA 91761
949-450-1229
EMAIL: CWILLIAMS@AIRCONTROLSYSTEMS.NET
ATTN: CHAD WILLIAMS

PLUMBING ENGINEER
AMERICAN CONTRACTORS, INC.
404 W. BLUERIDGE AVE. ORANGE, CA. 92865
714-282-5700
EMAIL: TOM@ACIPLUMBING.COM
ATTN: TOM TIGHE

ELECTRICAL ENGINEER
MAMMOTH ELECTRIC
170 E. LIBERTY AVE. ANAHEIM CA. 92801
714-446-8880
EMAIL: FELIPE@MAMMOTHELECTRIC.COM
ATTN: FELIPE JIMENEZ

GEOTECHNICAL ENGINER
SOUTHERN CALIFORNIA GEOTECHNICAL
22885 SAVI RANCH PKWY SUITE E
YORBA LINDA CA 92887
714-685-1115 EMAIL: RTRAZO@SOCALGEO.COM
ATTN: ROBERT G TRAZO

CIVIL ENGINEER
raSMITH
891 RESEARCH DRIVE, IRVINE CA 92618
ERIC.ROBLES@raSMITH.COM
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949-242-8044

LANDSCAPE ARCHITECT
HUNTER LANDSCAPE INC.
711 S. FEE ANA ST.
PLACENTIA CA 92870
WILLC@HUNTERLANDSCAPE.NET
ATTN: WILL COCHRAN

JUNE SPRINGS BUSINESS PARK

T B D
SAN BERNARDINO, CA 92407

DUNLEER

269 S. BEVERLY DRIVE #1674
BEVERLY HILLS, CA 90212

No.	ISSUANCE	DATE

JOB No.
22-330

DRAWN: STEVE HONG — CHECKED: STEVE HONG

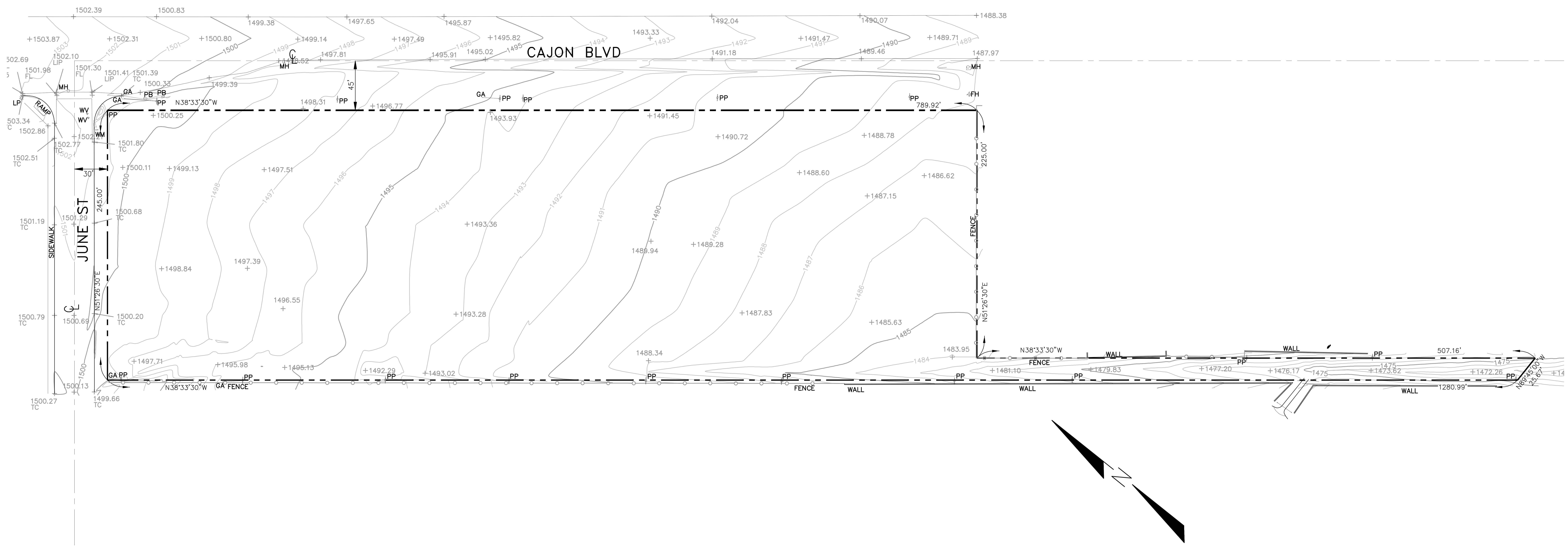
SHEET TITLE
ARCHITECTURAL DETAILS
ONSITE TRASH ENCLOSURE

SHEET NUMBER
A8.01

TOPOGRAPHY / BOUNDARY

CAJON BLVD / JUNE ST

CITY OF SAN BERNARDINO, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA



GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON THE CENTERLINE OF JUNE STREET BEING NORTH 51°26'30" EAST PER TRACT NO. 3238 M.B. 61-14-15

BENCHMARK

USGS

DESIGNATION: B 40
PID: EV1296

DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO.
3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

ELEV: 1516.40 (NAVD 88)

LEGEND

PROPERTY LINE

CENTERLINE

FH	FIRE HYDRANT
GA	GUY ANCHOR
LP	LIGHT POLE
MH	MANHOLE
PB	PULLBOX
PP	POWER POLE
WM	WATER METER
WV	WATER VALVE

DATE	DESCRIPTION
10/12/23	POWER POLES UPDATED

8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

raSmith
CREATIVITY BEYOND ENGINEERING

CAJON BLVD / JUNE ST
SAN BERNARDINO, CALIFORNIA

FIDELITY NATIONAL TITLE INSURANCE COMPANY
ORDER NO. 002-30076436-2AA

DATE: 02/13/2023

SCALE: 50

PROJECT MANAGER:
CHRIS BRATTY

DESIGNED BY: CW

CHECKED BY: KEC

SHEET NUMBER

1

PRECISE GRADING PLAN
JUNE SPRINGS BUSINESS PARK

3962 CAJON BLVD, SAN BERNARDINO, CA 92407

GRADING NOTES:

1. ALL GRADING SHALL CONFORM TO THE LATEST CALIFORNIA BUILDING CODE (CBC) CHAPTERS 17, 18, APPENDIX J AND ALL APPLICABLE SECTIONS.
2. A GRADING PERMIT SHALL BE OBTAINED PRIOR TO COMMENCEMENT OF ANY WORK ON THESITE.
3. ISSUANCE OF A GRADING PERMIT DOES NOT ELIMINATE THE NEED FOR PERMITS FROM OTHER REGULATORY AGENCIES WITH REGULATORY RESPONSIBILITIES FOR CONSTRUCTION ACTIVITIES ASSOCIATED WITH THE WORK AUTHORIZED IN THIS PLAN.
4. ALL WORK UNDER THIS PERMIT SHALL BE LIMITED TO WORK WITHIN THE PROPERTY LINES. A SEPARATE CONSTRUCTION, EXCAVATION OR ENCROACHMENT PERMIT FROM THE DEPARTMENT OF PUBLIC WORKS MAY BE REQUIRED FOR ANY WORK WITHIN THE COUNTY RIGHT-OF-WAY.
5. APPROVAL OF THESE PLANS DOES NOT AUTHORIZE ANY WORK OR GRADING TO BE PERFORMED UNTIL A VALID GRADING PERMIT HAS BEEN ISSUED.
6. THIS PLAN IS FOR GRADING PURPOSES ONLY AND IS NOT TO BE USED FOR THE PURPOSE OF CONSTRUCTING ONSITE OR OFFSITE IMPROVEMENTS. ISSUANCE OF A PERMIT BASED ON THIS PLAN DOES NOT CONSTITUTE APPROVAL OF DRIVEWAY LOCATIONS OR SIZES, PARKING LOT STRUCTURAL SECTIONS OR LAYOUT, ADA-RELATED REQUIREMENTS, BUILDING LOCATIONS OR FOUNDATIONS, WALLS, CURBING, OFFSITE DRAINAGE FACILITIES OR OTHER ITEMS NOT RELATED DIRECTLY TO THE BASIC GRADING OPERATION. ONSITE IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE TO THE APPROVED BUILDING PERMIT PLANS. OFFSITE IMPROVEMENTS SHALL BE CONSTRUCTED IN ACCORDANCE TO PLANS APPROVED FOR THIS PURPOSE BY THE PUBLIC WORKS DEPARTMENT.
7. MAXIMUM CUT AND FILL SLOPE = 2:1 (HORIZONTAL TO VERTICAL) AND MAXIMUM VERTICAL HEIGHT = 30 FEET, UNLESS AN APPROVED GEOTECHNICAL REPORT CAN JUSTIFY A STEEPER AND TALLER SLOPE.
8. NO FILL SHALL BE PLACED ON EXISTING GROUND UNTIL THE GROUND HAS BEEN CLEARED OF WEEDS, DEBRIS, TOPSOIL AND OTHER DELETERIOUS MATERIAL.
9. FILL SLOPES SHALL NOT HAVE LESS THAN 90% RELATIVE COMPACTION, OR AS RECOMMENDED ON THE APPROVED GEOTECHNICAL REPORT.
10. IT IS THE GRADING CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ADEQUATE COMPACTION HAS BEEN ATTAINED ON THE ENTIRE GRADING SITE, INCLUDING FILL AREAS OUTSIDE THE BUILDING PADS AND ON ALL FILLSLOPES.
11. UNLESS OTHERWISE RECOMMENDED IN AN APPROVED GEOTECHNICAL REPORT, OVER-EXCAVATION SHALL BE AT LEAST 24 INCHES MINIMUM BELOW THE BOTTOM OF FOOTINGS OR TO COMPETENT NATIVE SOIL OR BEDROCK MATERIALS, WHICHEVER IS DEEPER, AS APPROVED BY THE PROJECT'S GEOTECHNICAL ENGINEER OR GEOLOGIST.
12. EARTHWORK VOLUMES:

CUT (CY), FILL__ _ (CY), TOTAL DISTURBED AREA _ (SF)

13. EARTHWORK QUANTITIES ARE SHOWN FOR GRADING PERMIT PURPOSES ONLY, AND SAN BERNARDINO COUNTY IS NOT RESPONSIBLE FOR THEIR ACCURACY.
14. A COPY OF THE GRADING PERMIT AND APPROVED GRADING PLANS MUST BE IN THE POSSESSION OF A RESPONSIBLE PERSON AND AVAILABLE AT THE SITE AT ALL TIMES.
15. ANY ONSITE RETAINING WALLS SHOWN ON THE GRADING PLANS THAT ARE OVER 4'IN HEIGHT, MEASURED FROM TOP OF WALL TO BOTTOM OF FOOTING, ARE FOR REFERENCE ONLY. RETAINING WALLS OVER 4'IN HEIGHT ARE NOT CHECKED, PERMITTED, OR INSPECTED PER THE GRADING PERMIT. A SEPARATE RETAINING WALL PERMIT IS REQUIRED FOR ALL RETAINING WALLS OVER 4'IN HEIGHT.
16. ANY WALLS, FENCES, STRUCTURES AND/OR APPURTENANCES ADJACENT TO THIS PROJECT ARE TO BE PROTECTED IN PLACE. IF GRADING OPERATIONS DAMAGE OR ADVERSELY AFFECT SAID ITEMS IN ANY WAY, THE CONTRACTOR AND/OR DEVELOPER IS RESPONSIBLE FOR WORKING OUT AN ACCEPTABLE SOLUTION TO THE SATISFACTION OF THE AFFECTED PROPERTY OWNER(S).
17. FOR SITES WITH PROTECTED SPECIES OR TREES, THE PROPOSED GRADING MAY BE SUBJECT TO A SEPARATE PERMIT.
18. ADEQUATE FIRE ACCESS AROUND BUILDINGS (INCLUDING GARAGES) SHOULD BE PROVIDED AS APPROVED BY COUNTY FIRE.
19. EXISTING DRAINAGE COURSES SHALL NOT BE OBSTRUCTED, ALTERED, OR DIVERTED WITHOUT PRIOR APPROVAL FROM THE COUNTY OF SAN BERNARDINO, LAND DEVELOPMENT DIVISION. A STREAMBED ALTERATION AGREEMENT MAY ALSO BE REQUIRED FROM THE CALIFORNIA DEPARTMENT OF FISH ANDWILDLIFE.
20. DRAINAGE EASEMENTS SHALL NOT BE OBSTRUCTED, ALTERED OR DIVERTED WITHOUT PRIOR APPROVAL OF THE COUNTY OF SAN BERNARDINO, LAND DEVELOPMENT DIVISION.
21. SETBACKS AND BUILDING LOCATIONS SHOWN ON THIS PLAN ARE FOR REFERENCE ONLY AND MUST BE REVIEWED AND APPROVED UNDER A SEPARATE BUILDING PERMIT.
22. UTILITY AND SEPTIC IMPROVEMENTS SHOWN ON THIS PLAN ARE FOR REFERENCE ONLY AND MUST BE REVIEWED AND APPROVED UNDER A SEPARATE BUILDING PERMIT.
23. ON PROJECTS DISTURBING ONE ACRES OR MORE, THE FOLLOWING NOTE MUST BE ADDED: A NOTICE OF INTENT (NOI) HAS BEEN, OR WILL BE FILED WITH THE STATE WATER RESOURCES CONTROL BOARD (SWRCB) AND A STORM WATER POLLUTION PREVENTION PLAN (SWPPP) HAS BEEN OR WILL BE PREPARED IN ACCORDANCE WITH THE REQUIREMENTS OF CALIFORNIA GENERAL PERMIT FOR STORM WATER DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY (PERMIT NO. CAS000002) FOR ALL OPERATIONS ASSOCIATED WITH THESE PLANS. THE PERMITTEE SHALL KEEP A COPY OF THE SWPPP ON SITE AND AVAILABLE FOR REVIEW BY THE COUNTY.
24. IN CONJUNCTION WITH THE CALIFORNIA GENERAL PERMIT FOR PROPOSED DISTURBANCE OVER ONE ACRE, AN ACTIVE WASTEWATER DISCHARGE ID # (WDID) ___________________________MUST BE INCLUDED ON THE FINAL GRADING PLAN.
25. A FINAL GRADING CERTIFICATION WILL BE COLLECTED BY THE BUILDING INSPECTOR AT THE FINAL BUILDING INSPECTION OR PRIOR TO A GRADING FINAL STATUS ON THE PERMIT. THE FINAL GRADING CERTIFICATION IS TO BE COMPLETED BY THE ENGINEER OF RECORD.
26. THE SOILS ENGINEER SHALL PROVIDE A FINAL SOIL GRADING REPORT INCLUDING LOCATIONS AND ELEVATIONS OF FIELD DENSITY TESTS, SUMMARIES OF FIELD AND LABORATORY TESTS AND OTHER SUBSTANTIATING DATA AND COMMENTS ON ANY CHANGES MADE DURING GRADING AND THEIR EFFECT ON THE RECOMMENDATIONS MADE IN THE SOIL ENGINEERING INVESTIGATION REPORT. IT SHALL ALSO PROVIDE INFORMATION AS TO LOCATION AND NATURE OF TESTS, STATEMENTS RELATIVE TO THE EXPANSIVE NATURE OF SOIL AND/OR ROCK MATERIAL, LIMITS OFCOMPACTED FILL SHOWN ON THE AS-GRADED PLAN AND CERTIFICATION AS TO THE ADEQUACY AND STABILITY OF THE SITE FOR THE INTENDED USE.
27. IF APPLICABLE, THE ENGINEERING GEOLOGIST SHALL PROVIDE A GEOLOGIC GRADING REPORT INCLUDING A FINAL DESCRIPTION OF THE GEOLOGY OF THE SITE INCLUDING ANY NEW INFORMATION DISCLOSED DURING THE GRADING AND THE EFFECT OF SAME ON RECOMMENDATIONS INCORPORATED IN THE APPROVED GRADING PLAN. THE ENGINEERING GEOLOGIST SHALL PROVIDE CERTIFICATION AS TO THE ADEQUACY OF THE SITE FOR THE INTENDED USE AS AFFECTED BY GEOLOGIC FACTORS. WHERE NECESSARY, A REVISED GEOLOGIC MAP AND CROSS SECTIONS, AND ANY RECOMMENDATIONS REGARDING SPECIAL BUILDING RESTRICTIONS OR FOUNDATION SETBACKS SHALL BE INCLUDED.
28. SHOULD THE EXCAVATION DISCLOSE SOIL AND/OR ROCK CONDITIONS WHERE CUT SLOPES ARE UNSTABLE, THE ENGINEERING GEOLOGIST AND/OR THE SOILS ENGINEER SHALL RECOMMEND NECESSARY TREATMENT TO THE BUILDING OFFICIAL FOR APPROVAL.
29. GEOLOGICAL AND SOILS ENGINEERING REPORTS BY SOUTHERN CALIFORNIA GEOTECHNICAL ,DATED APRIL 4, 2023 AND ALL SOILS REPORT ADDENDUM(DA) SHALL BE INCORPORATED HEREWITH AND MADE PART OF THIS GRADING PLAN.
30. THE CONTRACTOR SHALL IMPLEMENT PREVENTIVE MEASURES TO ASSURE THAT NO ROCKS, SOIL, DUST, OR DEBRIS OF ANY FORM SHALL FALL, SLIDE OR FLOW ONTO ADJOINING PROPERTIES OR PUBLIC WAYS. ALL VEHICLE LOADS SHALL BE TRIMMED AND WATERED OR OTHERWISE SECURED TO PREVENT SPILLAGE FROM THE EQUIPMENT.
31. ALL EXPORT AND IMPORT OF MATERIAL OVER DEDICATED AND IMPROVED STREETS SHALL BE UNDERTAKEN OR CONDUCTED BY EQUIPMENT THAT COMPLIES IN ALL RESPECTS TO THE STATE VEHICLE CODE. REPAIR TO ANY DAMAGED DEDICATED OR IMPROVED STREETS SHALL BE MADE TO THE SATISFACTION OF THE BUILDING OFFICIAL AND IS THE RESPONSIBILITY OF THE OWNER, PERMITTEE, AND THE GRADING CONTRACTOR.
32. ALL FLOOD ZONE REQUIREMENTS MUST BE REFLECTED OR ACCOUNTED FOR ON THE GRADING PLANS. ELEVATIONS OR CONSTRUCTION NOTES MUST BE INCLUDED IN THE PLANS TO ENSURE COMPLIANCE WITH ALL APPLICABLE FIRST FLOOR ELEVATION REQUIREMENTS PER FEMA AND SAN BERNARDINO COUNTY DEVELOPMENT CODEGUIDELINES.
33. ALL GRADING SHALL COMPLY WITH SBC DEVELOPMENT CODE SECTION 82.14.050.C:IF FILL IS PLACED TO ELEVATE PADS ABOVE BASE ELEVATION, IT MUST BE DEMONSTRATED THAT FILL WILL NOT SETTLE AND IS PROTECTED FROM EROSION, SCOUR, OR DIFFERENTIAL SETTLEMENT, AS FOLLOWS.

    A) THE PAD ELEVATION SHALL BE CERTIFIED TO MEET OR EXCEED THE ELEVATION REQUIRED BY THE APPLICABLE FLOODPLAIN SAFETY REVIEW AREA, AND IT MUST BE DEMONSTRATED THAT THE CUMULATIVE EFFECT OF THE PROPOSED DEVELOPMENT WHEN COMBINED WITH ALL OTHER EXISTING AND ANTICIPATED DEVELOPMENT WILL NOT INCREASE THE WATER SURFACE ELEVATION OF THE BASE FLOOD AT ANY POINT WITHIN THE COMMUNITY.

    B) FILL SHALL BE COMPACTED TO 95 PERCENT PER ASTM (AMERICAN SOCIETY OF TESTING MATERIALS) STANDARD D-698.

    C) FILL SLOPES SHALL BE NO STEEPER THAN TWO FEET HORIZONTAL TO ONE FOOT VERTICAL RATIO UNLESS SUBSTANTIATING DATA FOR STEEPER SLOPES IS PROVIDED, AND THE SLOPES ARE APPROVED BY THE COUNTY.

    D) FILL SLOPES ADJACENT TO A WATER COURSE MAY BE REQUIRED TO BE ARMORED WITH STONE, ROCK OR APPROVED EQUAL PROTECTION.

34. FOR NONRESIDENTIAL PROJECTS, PROVIDE FOLLOWING NOTE ON PLANS:

CALIFORNIA GREEN BUILDING STANDARDS CODE

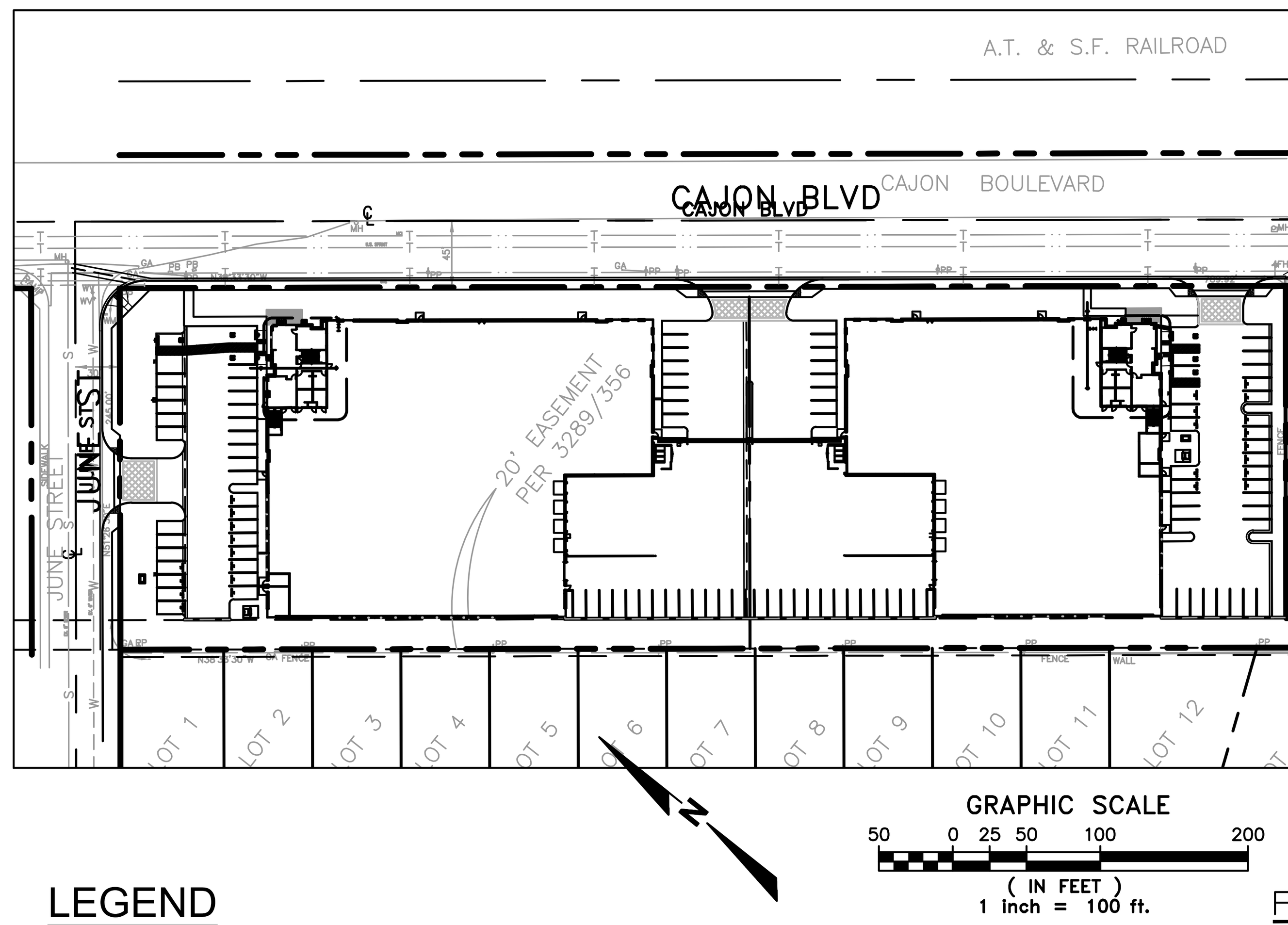
5.408.3 EXCAVATED SOIL AND LAND CLEARING DEBRIS.

100 PERCENT OF TREES, STUMPS, ROCKS AND ASSOCIATED VEGETATION AND SOILS RESULTING PRIMARILY FROM LAND CLEARING SHALL BE REUSED OR RECYCLED. FOR A PHASED PROJECT, SUCH MATERIAL MAY BE STOCKPILED ON SITE UNTIL THE STORAGE SITE IS DEVELOPED.

EXCEPTION: REUSE, EITHER ON-OR OFF-SITE, OF VEGETATION OR SOIL CONTAMINATED BY DISEASE OR PEST INFESTATION.

NOTES:

1. IF CONTAMINATION BY DISEASE OR PEST INFESTATION IS SUSPECTED, CONTACT THE COUNTY AGRICULTURAL COMMISSIONER AND FOLLOW ITS DIRECTION FOR RECYCLING OR DISPOSAL OF THE MATERIAL. (WWW.CDFA.CA.GOV/EXEC/COUNTY/COUNTY_CONTACTS.HTML)
2. FOR A MAP OF KNOWN PEST AND/OR DISEASE QUARANTINE ZONES, CONSULT WITH THE CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE. (WWW.CDFA.CA.GOV)



LEGEND

—— — — ——	= TRACT BOUNDARY/PROPERTY LINE
—— — — ——	= INTERIOR PARCEL LINES
– – – – – – – –	= EASEMENT LINE
— — — —W—	= PROPOSED WATER LINE
— — — —FW—	= PROPOSED FIRE LINE
———S—	= PROPOSED SANITARY SEWER LINE
— — —STD—	= PROPOSED STORM DRAIN LINE
— — —STD FM —	= PROPOSED STORM FORCE MAIN
ST	= STORM DRAIN MANHOLE
SS	= SEWER MANHOLE
	= EXISTING STORM DRAIN PIPE
	= STORM DRAIN INLET (AT GRADE)
ET	= ELECTRICAL TRANSFORMER
-XXXXXXXXXXXXXXX-	= SAWCUT LINE
G	= GAS METER (BY OTHERS)
W	= WATER METER
	= STORM DRAIN JUNCTION STRUCTURE (AT GRADE)
	= EXISTING FIRE HYDRANT
	= PROPOSED FIRE HYDRANT
	= WATER VALVE
	= THRUST BLOCK
C.O.	= SEWER OR STORM DRAIN CLEANOUT
>—FDC	= FIRE DEPARTMENT CONNECTION (FDC)
PIV	= POST INDICATING VALVE
(140.00)	= EXISTING SPOT ELEVATION/DIMENSION
DDC	= DOUBLE CHECK BACKFLOW ASSEMBLY
	= BACKFLOW PREVENTION ASSEMBLY
	= PROPOSED PARKING LOT LIGHT

ABBREVIATIONS:

ABS	–	ACRYLONITRILE-BUTADIENE-STYRENE
AB	–	AGGREGATE BASE
AC	–	ASPHALT CONCRETE
ACP	–	ASBESTOS CEMENT PIPE
AP	–	ANGLE POINT
APWA	–	AMERICAN PUBLIC WORKS ASSOCIATION
BC	–	BEGINNING OF A CURVE OR BACK OF CURB
BCR	–	BEGINNING OF CURB RETURN
BVC	–	BEGINNING OF VERTICAL CURVE
BW	–	BACK OF WALK
CB	–	CATCH BASIN
CD	–	CURB DRAIN
CF	–	CURB FACE
CL	–	CENTERLINE CONC CONCRETE
co	–	CLEANOUT
CONST.	–	CONSTRUCT, CONSTRUCTION
CSP	–	CORRUGATED STEEL PIPE
DI	–	DRAIN INLET
DWG	–	DRAWING
EC	–	END OF CURVE
E	–	EAST
EA	–	EACH
ECR	–	END OF CURB RETURN
E'LY	–	EASTERLY
EP	–	EDGE OF PAVEMENT
ESMT	–	EASEMENT
EVC	–	END OF VERTICAL CURVE
FG	–	FINISH GRADE
FL	–	FLOW LINE
FS	–	FINISHED SURFACE
GB	–	GRADE BREAK
HGL	–	HYDRAULIC GRADE LINE
INL	–	INLET (STORM DRAIN)
INV	–	INVERT ELEVATION
IE	–	INVERT ELEVATION
JS	–	JUNCTION STRUCTURE
LF	–	LINEAR FOOT
LP	–	LOW POINT
MH	–	MANHOLE
MOC	–	MIDDLE OF CURVE
NDW	–	NON DOMESTIC WATER
N'LY	–	NORTHERLY
N	–	NORTH
OC	–	ON CURVE
PCC	–	PORTLAND CEMENT CONCRETE OR POINT OF COMPOUND CURVATURE
PCVC	–	POINT OF COMPOUND VERTICAL CURVE
PI	–	POINT OF INTERSECTION
PL	–	PROPERTY LINE
PRC	–	POINT OF REVERSE CURVE PRVC POINT OF REVERSE VERTICAL CURVE
PUE	–	PUBLIC UTILITY EASEMENT
PVC	–	POLYVINYL CHLORIDE
R	–	RADIUS
RCP	–	REINFORCED CONCRETE PIPE
RW	–	RECLAIMED WATER
R/W	–	RIGHT-OF-WAY
SD	–	STORM DRAIN
SDCO	–	STORM DRAIN CLEANOUT
STA	–	STATION
STD	–	STANDARD
S'LY	–	SOUTHERLY
S	–	SOUTH
TAN	–	TANGENT
TC	–	TOP OF CURB
TD	–	TRENCH DRAIN
TS	–	TOP OF SLOPE
VC	–	VERTICAL CURVE
VCP	–	VITRIFIED CLAY PIPE
W	–	WATER OR WEST
WFM	–	WHOLE FOODS MARKET
W'LY	–	WESTERLY

FLOOD ZONE

THE PROPERTY LIES WITHIN ZONE "X" OF THE FLOOD INSURANCE RATE MAP 06071C7940J BEARING AN EFFECTIVE DATE OF SEPTEMBER 2, 2016.

ZONING

THE PROPERTY IS ZONED: MS/CG – MUSCOY/GENERAL COMMERCIAL

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON THE CENTERLINE OF JUNE STREET BEING NORTH 51°26'30" EAST PER TRACT NO. 3238 M.B. 61-14-15

PRIVATE ENGINEER'S NOTE TO CONTRACTOR

THE EXISTENCE AND LOCATION OF ANY UNDERGROUND UTILITY PIPES, CONDUITS, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A SEARCH OF THE AVAILABLE RECORDS. TO THE BEST OF OUR KNOWLEDGE THERE ARE NO EXISTING UTILITIES EXCEPT AS SHOWN ON THESE PLANS. THE CONTRACTOR IS REQUIRED TO TAKE DUE PRECAUTIONARY MEASURES TO PROTECT THE UTILITIES SHOWN ON THESE DRAWINGS. THE CONTRACTOR FURTHER ASSUMES ALL LIABILITY AND RESPONSIBILITY FOR THE UTILITY PIPES, CONDUITS OR STRUCTURES SHOWN ON THESE DRAWINGS.

CONTRACTOR AGREES THAT HE/SHE SHALL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT, INCLUDING SAFETY OF ALL PERSONS AND PROPERTY, THAT THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS, AND THAT THE CONTRACTOR SHALL DEFEND, INDEMNIFY AND HOLD THE COUNTY OF SAN BERNARDINO, THE OWNER AND THE ENGINEER HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER OR THE ENGINEER.

OWNER/DEVELOPER

DUNLEER

170 S BEVERLY DRIVE #306

BEVERLY HILLS, CA 90212

818-299-0494

CONTACT : JACK LUU

SOILS ENGINEER

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CIVIL PLAN INDEX

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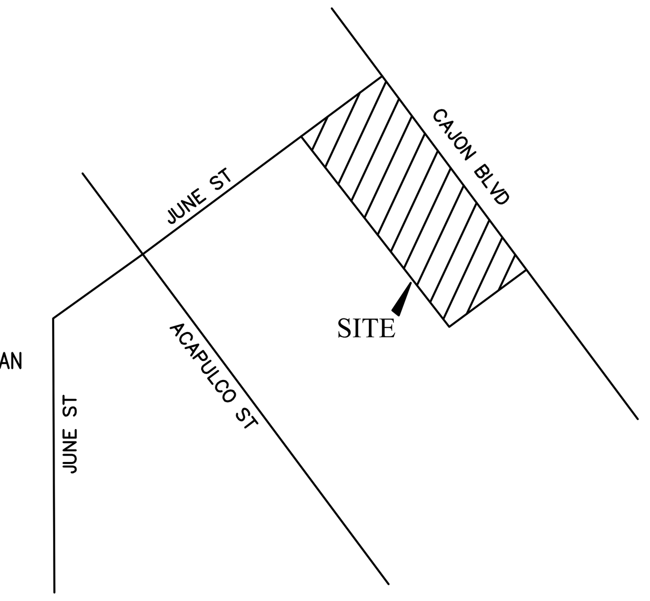

LOCATION MAP

NOT TO SCALE

ENGINEER'S NOTES TO CONTRACTOR:

1. CONTRACTOR AGREES THAT HE/SHE WILL ASSUME SOLE AND COMPLETE RESPONSIBILITY FOR JOB SITE CONDITIONS DURING THE COURSE OF CONSTRUCTION OF THIS PROJECT INCLUDING THE SAFETY OF ALL PERSONS AND PROPERTY. THIS REQUIREMENT SHALL APPLY CONTINUOUSLY AND NOT BE LIMITED TO NORMAL WORKING HOURS AND THAT THE CONTRACTOR SHALL DEFEND INDEMNIFY AND HOLD THE OWNER, THE CONSULTING ENGINEER AND THE GOVERNING AUTHORITIES HARMLESS FROM ANY AND ALL LIABILITY, REAL OR ALLEGED, IN CONNECTION WITH THE PERFORMANCE OF WORK ON THIS PROJECT, EXCEPTING FOR LIABILITY ARISING FROM THE SOLE NEGLIGENCE OF THE OWNER, THE CONSULTING ENGINEER OR THE GOVERNING AUTHORITIES.
2. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS, WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE; AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED, RECONNECTED, AND/OR RECONSTRUCTED SATISFACTORY TO THE ENGINEER AT THE EXPENSE OF THE CONTRACTOR.
3. ALL WORK SHALL CONFORM TO THE STANDARD PLANS AND SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION. (GREEN BOOK LATEST EDITION)
4. WORK WITHIN ADA PATH OF TRAVEL AND ADA PARKING SHALL CONFORM TO THE CURRENT CALIFORNIA TITLE 24 AND THE CALIFORNIA ACCESSIBILITY MANUAL FOR ALL ADA REQUIREMENTS.
5. THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING DIGALERT AT 811 TWO WORKING DAYS BEFORE PRIOR TO ANY DIGGING.
6. THE CONTRACTOR IS RESPONSIBLE FOR DUST CONTROL MEASURES AND COMPLIANCE WITH ALL SOUTH COAST AQMD RULES AND REGULATIONS. ALL GRADING OPERATIONS SHALL BE SUSPENDED DURING SECOND (OR WORSE) STAGE SMOG ALERTS BY AQMD.
7. WATER SHALL BE APPLIED TO THE SITE TWICE DAILY DURING GRADING OPERATIONS IN COMPLIANCE WITH SOUTH COAST AQMD RULE 403 (FUGITIVE DUST EMISSIONS). CONTRACTOR SHALL PERIODICALLY OPERATE STREET SWEEPERS ON PAVED AREAS ADJACENT TO THE SITE.
8. ALL EXISTING CURB PAINTED RED TO BE REMOVED AND REPLACED SHALL BE PAINTED RED PER THE LOCAL FIRE AUTHORITY DEPARTMENT REQUIREMENTS.
9. ALL PROPOSED PAVEMENT, SIDEWALK, AND CURBS JOINING EXISTING SHALL BE FLUSH AT TRANSITION.
10. ALL EXISTING UTILITY COVERS, GRATES, OR BOXES WITHIN THE PROJECT LIMITS SHALL BE ADJUSTED TO FINISHED SURFACE. ALL GRATES SHALL BE ORIENTED PERPENDICULAR TO THE DIRECTION OF TRAVEL. ALL NEW GRATES SHALL BE ADA COMPLIANT.
11. IT IS THE CONTRACTORS RESPONSIBILITY TO MAINTAIN 1% MIN. SURFACE GRADE FOR POSITIVE DRAINAGE IN ALL AREAS. NOTIFY ENGINEER PRIOR TO CONSTRUCTION WITH ANY DISCREPANCIES DISCOVERED.
12. WHERE OVERLAY AND JOIN LINES MAY RESULT IN PONDING, THE CONTRACTOR SHALL FEATHER OUT AT 1% MIN. TO MAINTAIN POSITIVE DRAINAGE.
13. ALL GRINDING ALONG CURBS, GUTTERS, AND LIMITS OF OVERLAY SHALL BE A MINIMUM OF 5-FEET WIDTH AND TAPERED FROM 1 5/8-INCH AT OUTSIDE LIMITS TO 0-INCH AT INSIDE LIMITS.
14. ALL DRIVE TRANSITIONS AT END OF OVERLAY LIMITS SHALL HAVE A DOUBLE HEADER CUT.
15. ALL PROPOSED ELEVATIONS/CONTOURS SHOWN REPRESENT FINISH SURFACE ELEVATIONS.
16. IRRIGATION LATERALS, PARKING LOT LIGHTING WIRING AND SIGNAL WIRING ARE NOT TYPICALLY SHOWN. IF SHOWN ON THE CIVIL DRAWINGS, THESE ITEMS ARE FOR REFERENCE ONLY AND NOT FOR CONSTRUCTION STAKING. VERIFY LOCATION BEFORE COMMENCING WITH GRADING. REPLACE OR REPAIR DAMAGED ITEM IMMEDIATELY TO PROVIDE UNINTERRUPTED SERVICE
17. GRADING MATCH POINTS TO EXISTING CONDITIONS ARE BASED ON ESTIMATED ELEVATIONS FROM AERIAL AND TOPOGRAPHIC FIELD SURVEYS. CONTRACTOR SHALL VERIFY ELEVATIONS AT MATCH POINTS BEFORE GRADING TO ENSURE PROPER DRAINAGE AND SLOPES.
18. THE CONTRACTOR SHALL ASSUME SOLE RESPONSIBILITY FOR THE COMPUTATIONS OF ALL GRADING QUANTITIES AND FOR THE ACTUAL LAND BALANCE, INCLUDING UTILITY TRENCH SPOIL. THE CONTRACTOR SHALL IMPORT OR EXPORT MATERIAL AS NECESSARY TO COMPLETE THE PROJECT.
19. ALL DIMENSIONS SHOWN ARE TO FACE OF CURB.
20. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY SIGNAGE/STRIPING CONFLICTS BY REMOVING, SANDBLASTING, AND OR HIGH PRESSURE POWER WASHING. SEE PLANS FOR TYPE OF REMOVALS AND MEANS OF REMOVALS.
21. ALL TRAFFIC CONTROL AND LANE CLOSURES TO BE PER THE CURRENT CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) STANDARDS.
22. SAWCUT LINE INDICATES LIMITS OF APPROXIMATE REMOVALS. FOR CONCRETE REMOVALS, CONTRACTOR SHALL REMOVE TO THE NEAREST EXPANSION JOINT.
23. NOISE SOURCES ASSOCIATED WITH CONSTRUCTION, REPAIR, REMODELING OR GRADING OF ANY REAL PROPERTY, AND DELIVERY OR REPAIR OF CONSTRUCTION AND GRADING EQUIPMENT, IS ALLOWED, PROVIDED SUCH ACTIVITIES DO NOT TAKE PLACE BETWEEN THE HOURS OF 8:00 P.M. TO 7:00 A.M. ON WEEKDAYS, INCLUDING SATURDAY, OR AT ANY TIME ON SUNDAY OR A FEDERAL HOLIDAY, OR AS NOTED IN THE COUNTY OF SAN BERNARDINO MUNICIPAL CODE.
24. THE CONTRACTOR SHALL ENSURE THAT ADA SIGNAGE WITHIN THE IMRPOVEMENTS LIMITS ARE LOCATED IN THE PROPER LOCATION WITHIN THE ADA PARKING STALLS AND SHALL ADJUST, RELOCATE, OR REPLACE TO COMPLY WITH THE CURRENT ADA, CBC, AND LOCAL CODE. ADA SIGNS IN A.C. PAVEMENT MODIFICATIONS MAY REQUIRE HEIGHT/LOCATION ADJUSTMENTS DUE TO NEW FINISH SURFACE ELEVATIONS. MAINTAIN 18-FEET MINIMUM CLEAR FROM ADA PARKING STALL AND 4-FEET MINIMUM CLEAR FOR ACCESS/PATH OF TRAVEL.
25. DESIGN SHALL COMPLY WITH THE CURRENT EDITIONS OF THE CBC, CMC, CPC AND CEC AS AMENDED BY CITY ORDINANCES AND THE CURRENT EDITION TITLE 24 ENERGY REGULATIONS.
26. CONTRACTOR SHALL LEAVE NO VERTICAL EDGES WHERE EXISTING/PROPOSED ASPHALT MEETS EXISTING PROPOSED CONCRETE. CONTRACTOR SHALL FEATHER EDGES PER PLANS AND/OR DETAILS. CONTRACTOR SHALL CONTACT ENGINEER IMMEDIATELY IF FURTHER DIRECTIONS IS NEEDED.
27. CONTRACTOR, SHALL REPLICATE EXISTING TRAFFIC CONTROL AS AFFECTED BY THE WORK HEREIN, EXCEPT AS DESCRIBED OTHERWISE.
28. ALL STRUCTURES AND FOOTINGS SHALL BE CONSTRUCTED PER SEPARATE BUILDING AND/OR STRUCTURAL PLANS, AND APPROVED GEOTECHNICAL REPORT. DO NOT CONSTRUCT FROM CIVIL PLANS.
29. CONTRACTOR SHALL COORDINATE FINAL PAD SECTION WITH APPROVED GEOTECHNICAL REPORT, PERMITTED STRUCTURAL PLANS, AND FINISH FLOOR ELEVATIONS AS SHOWN HEREON. CIVIL ENGINEER SHALL ASSUME NO RESPONSIBILITY RESULTING FROM INCONSISTENCY BETWEEN STRUCTURAL PLANS AND APPROVED GEOTECHNICAL REPORT.
30. WOOD FRAMING MEMBERS, INCLUDING WOOD SHEATHING, THAT ARE IN CONTACT WITH EXTERIOR FOUNDATION WALLS AND ARE LESS THAN 8 INCHES FROM EXPOSED EARTH SHALL BE OF NATURAL DURABLE OR PRESERVATIVE-TREATED WOOD PER CALIFORNIA BUILDING CODE SECTION 2304.12.1.2.
31. PER CALIFORNIA BUILDING CODE SECTION 1804A.4 – 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% SLOPE) FOR A MINIMUM DISTANCE OF 10 FEET MEASURED PERPENDICULAR TO THE FACE OF THE WALL. IF PHYSICAL OBSTRUCTIONS OR LOT LINES PROHIBIT 10 FEET OF HORIZONTAL DISTANCE, A 5% SLOPE SHALL BE PROVIDED TO AN APPROVED ALTERNATIVE METHOD OF DIVERTING WATER AWAY FROM THE FOUNDATION. SWALES USED FOR THIS PURPOSE SHALL BE SLOPES NOT LESS THAN 2% WHERE LOCATED WITHIN 10 FEET OF THE BUILDING FOUNDATION.

RA SMITH ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN WITHOUT THE EXPRESSED WRITTEN CONSENT OF RA SMITH.

THE LOCATIONS OF EXISTING UTILITY INSTALLATIONS AS SHOWN ON THIS PLAN ARE APPROXIMATE. THERE MAY BE OTHER UNDERGROUND UTILITY INSTALLATIONS WITHIN THE PROJECT AREA THAT ARE NOT SHOWN.

DATE: 1/3/24

SCALE: AS SHOWN

JOB NO. 3230032

PROJECT MANAGER: ERIC A. ROBLES

DESIGNED BY: JJL

CHECKED BY: EAR

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TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:

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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA

DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:

APPROVED BY:

DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND
JUNE ST., SAN BERNARDINO, CA 92407

TITLE SHEET

FILE NO.

DRAFT DRAFT DRAFT

EROSION CONTROL NOTES:

1. IN CASE OF EMERGENCY, CALL (RESPONSIBLE PERSON) AT (24–HOUR TELEPHONE).
2. POLLUTION AND EROSION PREVENTION MEASURES, ALSO KNOWN AS BEST MANAGEMENT PRACTICES (BMPS), MUST BE INSTALLED PRIOR TO GRADING. THESE MEASURES, INCLUDING THE PREVENTION OF SEDIMENTATION OR FLOOD DAMAGE, TO OFFSITE PROPERTY SHALL BE ADEQUATE WHETHER OR NOT AN EROSION CONTROL PERMIT IS REQUIRED.
3. ERODED SEDIMENTS AND OTHER POLLUTANTS MUST BE RETAINED ONSITE AND MAY NOT BE TRANSPORTED FROM THE SITE VIA SHEET FLOW, SWALES, AREA DRAINS, NATURAL DRAINAGE COURSES, OR WIND.
4. EROSION CONTROL DEVICES SHALL BE FUNCTIONING AT ALL TIMES. IN CASE OF FAILURE, RAPID CONSTRUCTION OF EMERGENCY DEVICES SHALL BE IMPLEMENTED.
5. STOCKPILES OF EARTH AND OTHER CONSTRUCTION–RELATED MATERIALS MUST BE PROTECTED FROM BEING TRANSPORTED FROM THE SITE BY THE FORCES OF WIND OR WATER.
6. FUELS, OILS, SOLVENTS, AND OTHER TOXIC MATERIALS MUST BE STORED IN ACCORDANCE WITH THEIR LISTING AND ARE NOT TO CONTAMINATE THE SOILS AND SURFACE WATERS. ALL APPROVED STORAGE CONTAINERS ARE TO BE PROTECTED FROM THE WEATHER. SPILLS MUST BE CLEANED UP IMMEDIATELY AND DISPOSED OF IN A PROPER MANNER. SPILLS MAY NOT BE WASHED INTO THE DRAINAGE SYSTEM.
7. EXCESS OR WASTE CONCRETE MUST BE CONTAINED ONSITE. PROVISIONS SHALL BE MADE TO RETAIN CONCRETE WASTES ONSITE UNTIL THEY CAN BE DISPOSED OF AS SOLID WASTE.
8. DEVELOPERS/CONTRACTORS ARE RESPONSIBLE TO ENSURE ALL EROSION CONTROL DEVICES AND BMPS ARE INSTALLED AND FUNCTIONING PROPERLY PER PLAN. PROPER PRECAUTION SHALL BE CONSIDERED WHEN 50% OR GREATER PROBABILITY OF PREDICTED PRECIPITATION, AND AFTER ACTUAL PRECIPITATION. A CONSTRUCTION SITE INSPECTION CHECKLIST AND INSPECTION LOG SHALL BE MAINTAINED AT THE PROJECT SITE AT ALL TIMES AND AVAILABLE FOR REVIEW BY THE BUILDING OFFICIAL.
9. TRASH AND CONSTRUCTION–RELATED SOLID WASTES MUST BE DEPOSITED INTO A COVERED RECEPTACLE TO PREVENT CONTAMINATION OF RAINWATER AND DISPERSAL BY WIND.
10. SEDIMENTS AND OTHER MATERIALS MAY NOT BE TRACKED FROM THE SITE BY VEHICLE TRAFFIC. THE CONSTRUCTION ENTRANCE ROADWAYS MUST BE STABILIZED SO AS TO INHIBIT SEDIMENTS FROM BEING DEPOSITED INTO THE PUBLIC WAY. ACCIDENTAL DEPOSITIONS MUST BE SWEPT UP IMMEDIATELY AND MAY NOT BE WASHED DOWN BY RAIN OR OTHER MEANS.
11. ANY SLOPES WITH DISTURBED SOILS OR DENUDED OF VEGETATION MUST BE STABILIZED SO AS TO INHIBIT EROSION BY WIND AND WATER.
12. ALL SILT AND DEBRIS SHALL BE REMOVED FROM ALL DEVICES WITHIN 24 HOURS AFTER EACH RAINSTORM AND BE DISPOSED OF PROPERLY.
13. ALL STORM WATER CAPTURE DEVICES SHALL BE PROTECTED AT ALL TIMES.
14. EROSION AND SEDIMENT CONTROL PRACTICES SHOULD BE IN CONFORMANCE WITH THE "CALIFORNIA STORMWATER BEST MANAGEMENT PRACTICE HANDBOOK"(WWW.CASQA.ORG). THE MOST COMMON EROSION CONTROL MEASURES ARE:
    - A. SCHEDULING (EC–1)
    - B. PRESERVATION OF EXISTING VEGETATION (EC–2)
    - C. STOCKPILE MANAGEMENT (WM–3)
    - D. SILT FENCE (SE–1)
    - E. FIBER ROLLS (SE–5)
    - F. SANDBAG BARRIER (SE–8)
    - G. STRAW BALE BARRIER (SE–9)
    - H. STORM DRAIN INLET PROTECTION (SE–10)
    - I. CONCRETE WASTE MANAGEMENT (WM–8)
    - J. VEHICLE AND EQUIPMENT FUELING (NS–9)
    - K. VEHICLE AND EQUIPMENT MAINTENANCE (NS–10)
    - L. STABILIZED CONSTRUCTION ENTRANCE/EXIT (TC–1)
    - M. ENTRANCE/EXIT TIRE WASH (TC–3)
    - N. WIND EROSION CONTROL (WE–1)
15. DUST SHALL BE CONTROLLED BY WATERING.

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

ALL THAT PORTION OF THE RANCHO MUSCUPLABE, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 7, OF MAPS, PAGE 23, RECORDS OF SAID COUNT, BEING A PORTION OF SECTION 18 TOWNSHIP 1 NORTH, RANGE 4 WEST, SAN BERNARDINO BASE AND MERIDIAN, IF SAID SECTION LINES WERE EXTENDED ACROSS SAID RANCHO, DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF LOT 17, TRACT NO. 3238, AS PER PLAT RECORDED IN BOOK 60 OF MAPS, PAGES 14 AND 15, RECORDS OF SAID COUNTY; THENCE ALONG THE NORTH LINE OF SAID LOT 59, TRACT NO. 2946, AS PER PLAT RECORDED IN BOOK 40 OF MAPS, PAGES 82, 83 AND 84 RECORDS OF SAID COUNTY, SOUTH 89° 45'EAST, 25.67 FEET TO AN ANGLE POINT THEREIN;
THENCE NORTH 38° 32'WEST, 507.19 FEET (NORTH 38° 33'30'WEST, 507.46 FEET, DEED); THENCE
NORTH 51° 26'30"EAST, 225 FEET TO A POINT IN THE SOUTHWESTERLY LINE OF 90 FOOT WIDE CAJON BOULEVARD; THENCE ALONG SAID SOUTHWESTERLY LINE OF CAJON BOULEVARD, NORTH 38°33'30"WEST, 789.92 FEET TO THE INTERSECTION WITH THE SOUTHEASTERLY LINE OF JUNE STREET, SOUTH 51° 26'30"WEST, 245 FEET TO THE MOST NORTHERLY CORNER OF LOT 1 OF SAID TRACT NO. 3238; THENCE ALONG THE NORTHEASTERLY LINE SAID TRACT NO. 3238, SOUTH 38° 33'30"EAST 1,280.99 FEET TO THE POINT OF BEGINNING.

ASSURANCE NOTE: THE ABOVE LEGAL DESCRIPTION IS AS DESCRIBED IN FIDELITY NATIONAL TITLE INSURANCE COMPANY ORDER NO. 002–30076436–2AA, DATED NOVEMBER 5, 2021 AT 7:30 AM

BENCHMARK

USGS

DESIGNATION: B 40
PID: EV1296

DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO.
3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

ELEV: 1516.40 (NAVD 88)

PROTECT IN PLACE NOTES:	
A - PROTECT IN PLACE EXISTING WATER LINE, WATER METER, FIRE HYDRANT, FIRE SERVICE, FIRE SYSTEM APPURTENANCES, AND INCIDENTALS.	
B - PROTECT IN PLACE EXISTING SANITARY SEWER LINE, MANHOLES, CLEANOUTS AND INCIDENTALS.	
C - PROTECT IN PLACE EXISTING TELEPHONE LINE.	
D - PROTECT IN PLACE EXISTING POWER POLE.	

DEMOLITION NOTES:	QTY
1 - REMOVE AND RELOCATE EXISTING LIGHT POLES PER SEPARATE PLANS.	7 EA

EROSION CONTROL NOTES:	QTY
1 - INSTALL AND MAINTAIN SAND BAGS PER CASQA BMP SE-8.	1 LS
2 - INSTALL AND MAINTAIN CONCRETE WASHDOWN AREA PER CASQA WM-8. COORDINATE LOCATION IN FIELD.	1 LS
3 - CONSTRUCT TEMPORARY STABILIZED CONSTRUCTION ENTRANCE PER CASQA TC-1, AT LIMITS OF WORK.	1 LS
4 - CONTRACTOR TO COORDINATE STOCKPILE LOCATION IN FIELD. CONTRACTOR SHALL INSTALL AND MAINTAIN EROSION/MANAGEMENT CONTROL PER CASQA WM-3.	1 LS
5 - INSTALL AND MAINTAIN MATERIAL DELIVERY AND STORAGE PER CASQA WM-1. COORDINATE LOCATION IN FIELD.	1 LS
6 - STREET SWEEPING AS REQUIRED. CONDUCT PER CASQA SE-7.	1 LS
7 - INSTALL WASTE MANAGEMENT AREA PER CASQA WM-9 AND WM-5. COORDINATE LOCATION IN FIELD.	1 LS
8 - CONTRACTOR SHALL PROVIDE FENCING AS SHOWN AND/OR AS NEEDED TO PROVIDE PEDESTRIAN PROTECTION PER CHAPTER 33 OF THE CBC.	1 LS
9 - CONSTRUCT & MAINTAIN SEDIMENT BASIN DURING GRADING OPERATION PER CASQA BMP SE-2 & SE-3	1 LS

HORIZONTAL CONTROL, STRIPING, AND SIGNAGE NOTES:	QTY
20 - PAINT 4" WHITE PARKING STALL, 2 COATS MINIMUM, PER SAN BERNARDINO COUNTY SPECIFICATIONS.	101 EA
21 - CONSTRUCT ADA PARKING STALL, SIGNAGE, ACCESS AISLE STRIPING, AND WHEEL STOP PER DETAIL 1 AND 3 ON SHEET 10.	4 EA
22 - CONSTRUCT VAN ACCESSIBLE PARKING STALL, WHEELSTOP, ACCESS AISLE, AND SIGNAGE PER DETAIL 1 AND 3 ON SHEET 10.	4 EA
23 - CONSTRUCT ADA CROSSWALK, 4" BLUE STRIPING PER DETAIL 2 ON SHEET 10.	1 LS

PAVING AND GRADING NOTES:	QTY
40 - CONSTRUCT 6" CONCRETE CURB, TYPE A-1, PER SPPWC STD. PLAN 120-2.	1331 LF
41 - CONSTRUCT 6" CONCRETE CURB AND GUTTER, PER SAN BERNARDINO COUNTY STD. PLAN 116.	327 LF
42 - CONSTRUCT 4" CONCRETE SIDEWALK PER APPROVED GEOTECHNICAL REPORT.	1938 SF
43 - CONSTRUCT 3' CONCRETE V-GUTTER PER SAN BERNARDINO COUNTY STD. PLAN 119.	396 LF
44 - CONSTRUCT DRIVEWAY APPROACH PER SAN BERNARDINO COUNTY STD. PLAN 128B.	3 EA
45 - CONSTRUCT CURB RAMP CASE B, TYPE 1, PER SPPWC STD PLAN 111-5. TRUNCATED DOMES SHALL EXTEND FULL WIDTH OF RAMP AND 36" IN DIRECTION OF TRAVEL PER CBC.	4 EA
46 - CONSTRUCT AC PAVEMENT PER APPROVED GEOTECHNICAL REPORT.	35891 SF
47 - CONSTRUCT PCC PAVEMENT PER APPROVED GEOTECHNICAL REPORT.	23579 SF
48 - CONSTRUCT CURB DRAIN OUTLET PER SPPWC STD. PLAN 150-4.	5 EA

PRIVATE STORM DRAIN NOTES :	QTY
60 - INSTALL 6" HDPE STORM DRAIN PER MANUFACTURER AND SAN BERNARDINO COUNTY SPECIFICATIONS. SIZE AND SLOPE PER PLAN.	489 LF
61 - INSTALL 18"X18" STORM DRAIN INLET, JENSEN PRECAST 1818-HDI OR APPROVED EQUAL, INLET AND STENCIL PER DETAIL 5 SHEET 10. INSTALL BIO CLEAN FULL CAPTURE FILTER PER DETAIL 4 SHEET 11.	4 EA
62 - INSTALL TRENCH DRAIN, NDS DURA SLOPE DS-114 OR APPROVED EQUAL WITH HEAVY DUTY H-20 GRATE AND LOCKING LID PER MANUFACTURER'S SPECIFICATIONS. INSTALL FLOGARD TRENCH DRAIN INLET FILTER PER DETAIL 4 SHEET 10.	84 LF
63 - INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-N-1 PER SHEET 11 DETAIL 1.	1 EA
64 - INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-N-2 PER SHEET 11 DETAIL 2.	1 EA
65 - INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-S-1 PER SHEET 12 DETAIL 1.	1 EA
66 - INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-S-2 PER SHEET 12 DETAIL 2.	1 EA
67 - INSTALL HYDRODYNAMIC SEPARATOR PER DETAIL 11 SHEET 3.	4 EA
68 - OVERFLOW CONNECTION INTO EXISTING SAN BERNARDINO COUNTY FLOOD CONTROL EASEMENT.	1 LS
69 - CONSTRUCT GREASE INTERCEPTOR PER DETAIL - SHEET -.	1 EA
70 - CONSTRUCT - STORM DRAIN PUMP PER MANUFACTURER SPECIFICATIONS AND DETAIL - SHEET -.	1 EA

PRIVATE WATER CONSTRUCTION NOTES:	QTY
110 - PROTECT-IN-PLACE EXISTING WATER METERS.	1 LS
111 - PROTECT-IN-PLACE EXISTING WATER LINES.	1 LS
112 - CONSTRUCT -" DOMESTIC WATER SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1.	21 LF
113 - CONSTRUCT -" IRRIGATION SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1. CONTINUATION PER SEPARATE LANDSCAPE PLANS.	5 LF
114 - CONSTRUCT -" FIRE WATER SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1.	29 LF
115 - INSTALL -" APPROVED BACK FLOW ASSEMBLY FOR DOMESTIC SUPPLY PER SBMWD STANDARD DWG. NO. W4.1.	2 EA
116 - INSTALL -" APPROVED BACK FLOW ASSEMBLY FOR IRRIGATION PER SBMWD STANDARD DWG. NO. W4.1.	2 EA
117 - INSTALL DCDA BACK FLOW PREVENTION DEVICE PER SBMWD STANDARD DWG. NO. W4.3.	2 EA
118 - STUB WATER PIPE 5' FROM BUILDING. SEE PLUMBING PLANS FOR CONTINUATION.	1 LS

PRIVATE SANITARY SEWER NOTES:	QTY
80 - INSTALL 6" PVC SEWER SERVICE PER SBMWD STANDARD DWG. NO. S.305 AND CPC. TRENCHING AND BEDDING PER SBMWD DWG. NO. S.306.	729 LF
81 - INSTALL STANDARD SEWER CLEANOUT PER SBMWD STANDARD DWG. NO. S.303.	8 EA
82 - CONSTRUCT SEWER MANHOLE PER SPPWC STD. PLAN 200-3 AND CPC.	1 EA
83 - INSTALL SANITARY SEWAGE PUMP PER -.	1 EA
84 - STUB SANITARY SEWER 5' FROM BUILDING FOR CONNECTION. SEE PLUMBING PLANS FOR CONTINUATION.	1 LS

DATE: 1/3/24
SCALE:
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

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BENCHMARK: USGS DESIGNATION: B 40
PID: EV1296 ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:
raSmith
CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

LICENSED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP.6/30/25
CIVIL
STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:
APPROVED BY: DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND
JUNE ST., SAN BERNARDINO, CA 92407

NOTES

FILE NO.

DRAFT DRAFT DRAFT

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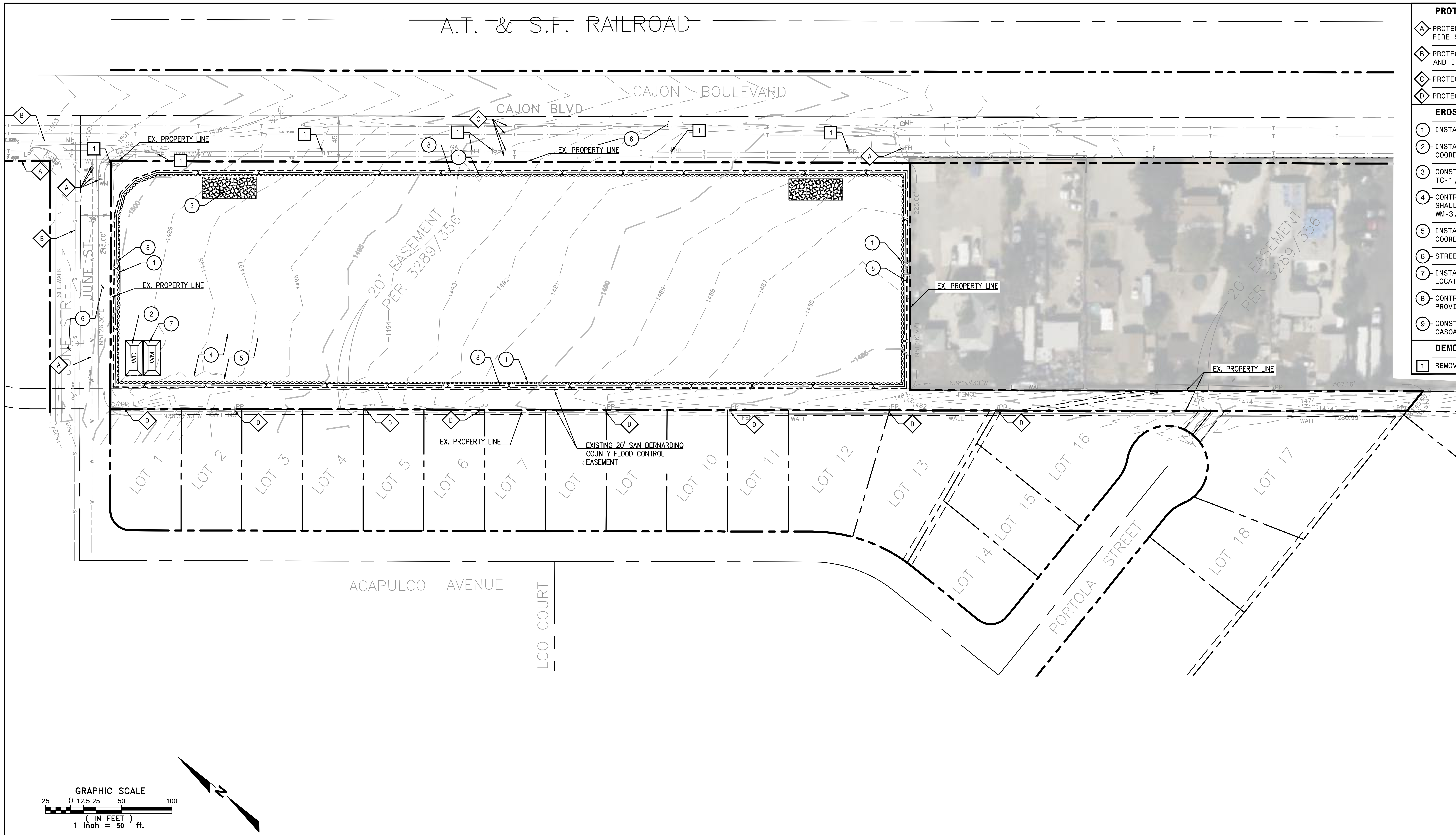

PROTECT IN PLACE NOTES:

- A - PROTECT IN PLACE EXISTING WATER LINE, WATER METER, FIRE HYDRANT, FIRE SERVICE, FIRE SYSTEM APPURTENANCES, AND INCIDENTALS.
- B - PROTECT IN PLACE EXISTING SANITARY SEWER LINE, MANHOLES, CLEANOUTS AND INCIDENTALS.
- C - PROTECT IN PLACE EXISTING TELEPHONE LINE.
- D - PROTECT IN PLACE EXISTING POWER POLE.

EROSION CONTROL NOTES:

1. INSTALL AND MAINTAIN SAND BAGS PER CASQA BMP SE-8.
2. INSTALL AND MAINTAIN CONCRETE WASHDOWN AREA PER CASQA WM-8. COORDINATE LOCATION IN FIELD.
3. CONSTRUCT TEMPORARY STABILIZED CONSTRUCTION ENTRANCE PER CASQA TC-1, AT LIMITS OF WORK.
4. CONTRACTOR TO COORDINATE STOCKPILE LOCATION IN FIELD. CONTRACTOR SHALL INSTALL AND MAINTAIN EROSION/MANAGEMENT CONTROL PER CASQA WM-3.
5. INSTALL AND MAINTAIN MATERIAL DELIVERY AND STORAGE PER CASQA WM-1. COORDINATE LOCATION IN FIELD.
6. STREET SWEEPING AS REQUIRED. CONDUCT PER CASQA SE-7.
7. INSTALL WASTE MANAGEMENT AREA PER CASQA WM-9 AND WM-5. COORDINATE LOCATION IN FIELD.
8. CONTRACTOR SHALL PROVIDE FENCING AS SHOWN AND/OR AS NEEDED TO PROVIDE PEDESTRIAN PROTECTION PER CHAPTER 33 OF THE CBC.
9. CONSTRUCT & MAINTAIN SEDIMENT BASIN DURING GRADING OPERATION PER CASQA BMP SE-2 & SE-3

DEMOLITION NOTES:

- 1 - REMOVE AND RELOCATE EXISTING LIGHT POLES PER SEPARATE PLANS.

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DATE: 1/3/24
SCALE: 1" = 50'
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

Underground Service Alert
CALL BEFORE YOU DIG
Call: TOLL FREE 1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
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DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
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RECOMMENDED BY:

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JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND
JUNE ST., SAN BERNARDINO, CA 92407

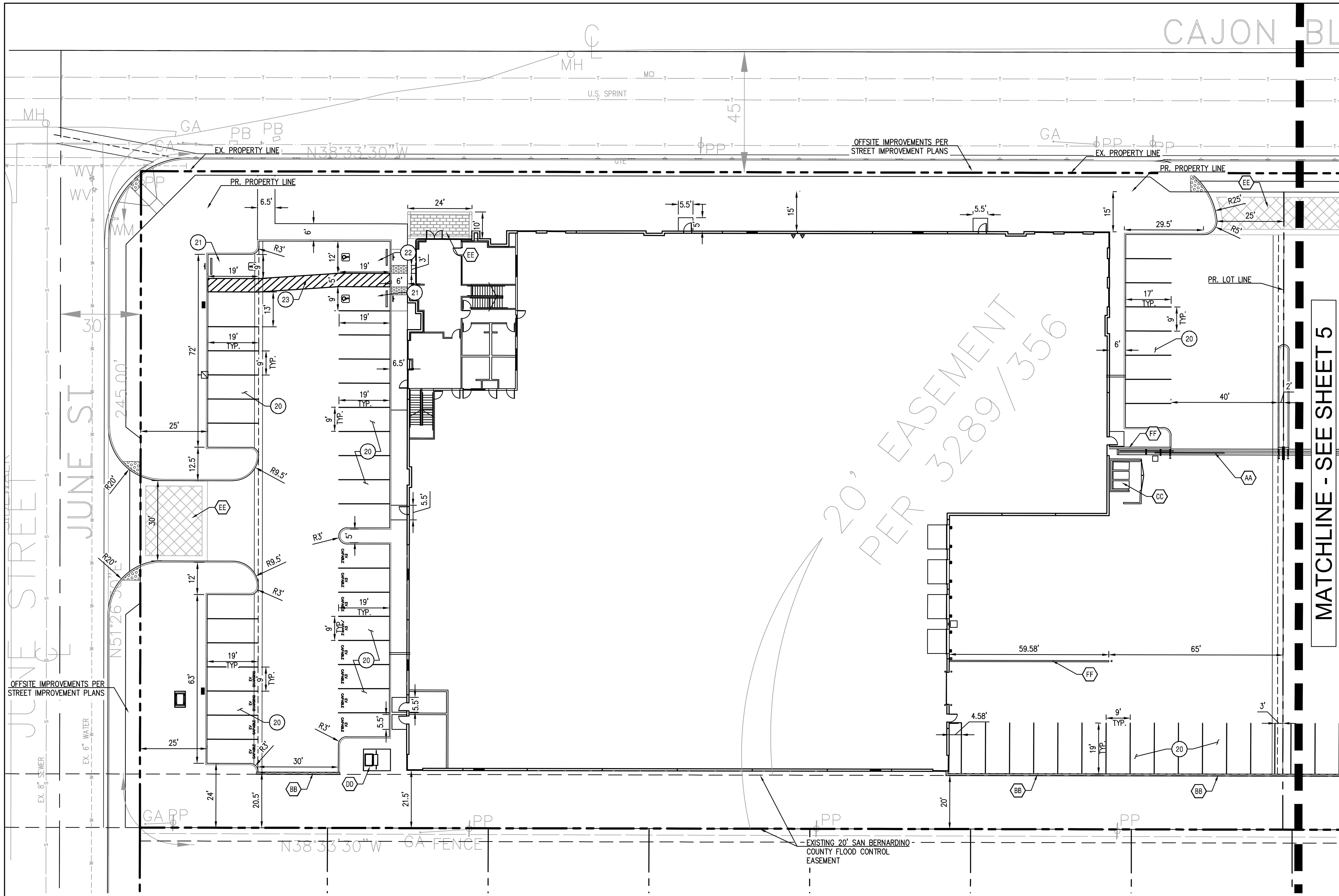
EXISTING CONDITIONS, EROSION CONTROL, AND DEMOLITION PLAN

FILE NO.

SHEET 3 OF 12

DRAFT DRAFT DRAFT

DRAFT DRAFT DRAFT



HORIZONTAL CONTROL, STRIPING, AND SIGNAGE NOTES:

- (20) PAINT 4" WHITE PARKING STALL, 2 COATS MINIMUM, PER SAN BERNARDINO COUNTY SPECIFICATIONS.
- (21) CONSTRUCT ADA PARKING STALL, SIGNAGE, ACCESS AISLE STRIPING, AND WHEEL STOP PER DETAIL 1 AND 3 ON SHEET 10.
- (22) CONSTRUCT VAN ACCESSIBLE PARKING STALL, WHEELSTOP, ACCESS AISLE, AND SIGNAGE PER DETAIL 1 AND 3 ON SHEET 10.
- (23) CONSTRUCT ADA CROSSWALK, 4" BLUE STRIPING PER DETAIL 2 ON SHEET 10.

PER SEPARATE PLAN:

- AA GATE
- BB RETAINING WALL
- CC TRASH ENCLOSURE
- DD TRANSFORMER
- EE DECORATIVE PAVEMENT
- FF SITE WALL

LEGEND:

- PROPERTY/RIGHT OF WAY LINE
- EXISTING CENTERLINE
- EXISTING EASEMENT
- EXISTING 5 FT CONTOUR
- EXISTING 1 FT CONTOUR
- PROPOSED 5 FT CONTOUR
- PROPOSED 1 FT CONTOUR
- 834.50 PROPOSED SPOT GRADE AT GUTTER OR SPOT GRADE ON PAVEMENT
- 3.4% PROPOSED DIRECTIONAL SLOPE ARROW
- PROPOSED AC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED PCC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- 4" CONCRETE SIDEWALK PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED LANDSCAPE PER SEPARATE PLANS

GRAPHIC SCALE
10 0 5 10 20 40
(IN FEET)
1 inch = 20 ft.

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PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
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DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

HORIZONTAL CONTROL PLAN NORTH

FILE NO.

SHEET 4 OF 12

DRAFT DRAFT DRAFT

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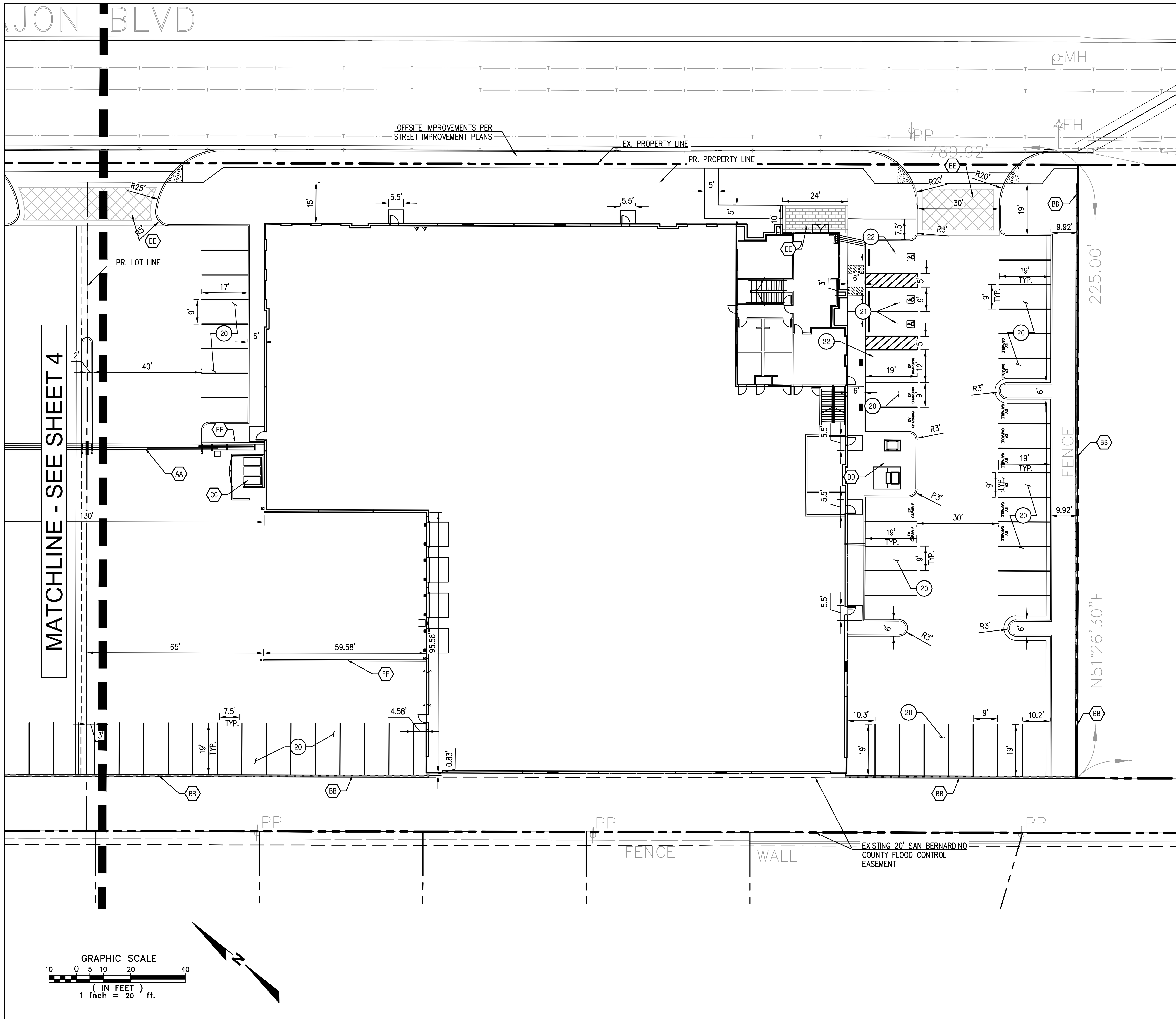

HORIZONTAL CONTROL, STRIPING, AND SIGNAGE NOTES:

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- (23) CONSTRUCT ADA CROSSWALK, 4" BLUE STRIPING PER DETAIL 2 ON SHEET 10.

PER SEPARATE PLAN:

- AA GATE
- BB RETAINING WALL
- CC TRASH ENCLOSURE
- DD TRANSFORMER
- EE DECORATIVE PAVEMENT
- FF SITE WALL

LEGEND:

- PROPERTY/RIGHT OF WAY LINE
- EXISTING CENTERLINE
- EXISTING EASEMENT
- 835 EXISTING 5 FT CONTOUR
- 834 EXISTING 1 FT CONTOUR
- 835 PROPOSED 5 FT CONTOUR
- 834 PROPOSED 1 FT CONTOUR
- 834.50 × PROPOSED SPOT GRADE AT GUTTER OR SPOT GRADE ON PAVEMENT
- 3.4% PROPOSED DIRECTIONAL SLOPE ARROW
- PROPOSED AC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED PCC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- 4" CONCRETE SIDEWALK PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED LANDSCAPE PER SEPARATE PLANS

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DESIGNED BY: JJL
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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
DATE 1/3/24

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APPROVED BY:
DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

HORIZONTAL CONTROL PLAN SOUTH

FILE NO.

SHEET 5 OF 12

DRAFT DRAFT DRAFT

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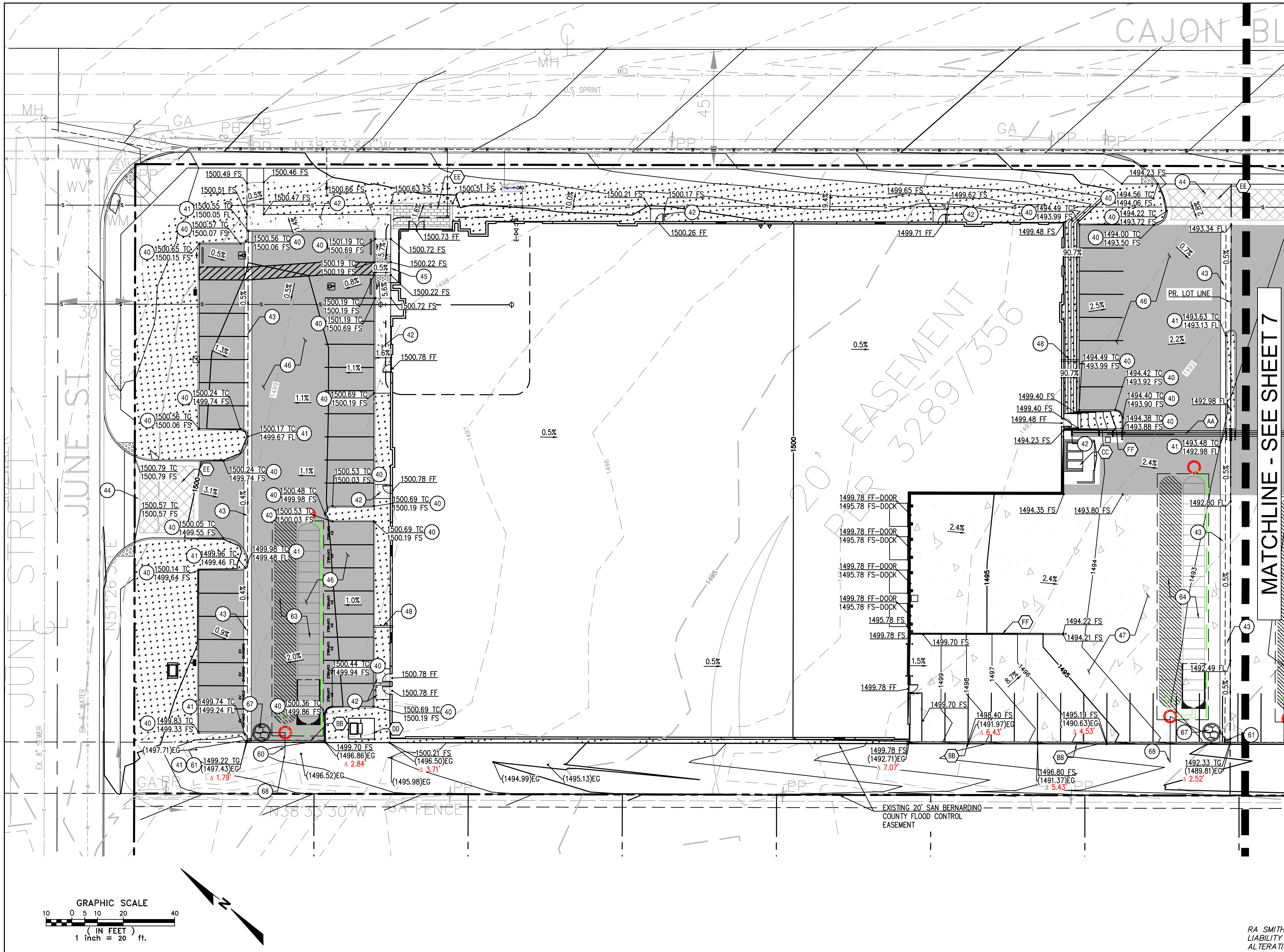

PAVING AND GRADING NOTES:

40. CONSTRUCT 6" CONCRETE CURB, TYPE A-1, PER SPPWC STD. PLAN 120-2.
41. CONSTRUCT 6" CONCRETE CURB AND GUTTER, PER SAN BERNARDINO COUNTY STD. PLAN 116.
42. CONSTRUCT 4" CONCRETE SIDEWALK PER APPROVED GEOTECHNICAL REPORT.
43. CONSTRUCT 3' CONCRETE V-GUTTER PER SAN BERNARDINO COUNTY STD. PLAN 119.
44. CONSTRUCT DRIVEWAY APPROACH PER SAN BERNARDINO COUNTY STD. PLAN 128B.
45. CONSTRUCT CURB RAMP CASE B, TYPE 1, PER SPPWC STD PLAN 111-5. TRUNCATED DOMES SHALL EXTEND FULL WIDTH OF RAMP AND 36" IN DIRECTION OF TRAVEL PER CBC.
46. CONSTRUCT AC PAVEMENT PER APPROVED GEOTECHNICAL REPORT.
47. CONSTRUCT PCC PAVEMENT PER APPROVED GEOTECHNICAL REPORT.
48. CONSTRUCT CURB DRAIN OUTLET PER SPPWC STD. PLAN 150-4.

PRIVATE STORM DRAIN NOTES :

60. INSTALL 6" HDPE STORM DRAIN PER MANUFACTURER AND SAN BERNARDINO COUNTY SPECIFICATIONS. SIZE AND SLOPE PER PLAN.
61. INSTALL 18"X18" STORM DRAIN INLET, JENSEN PRECAST 1818-HDI OR APPROVED EQUAL, INLET AND STENCIL PER DETAIL 5 SHEET 10. INSTALL BIO CLEAN FULL CAPTURE FILTER PER DETAIL 4 SHEET 11.
62. INSTALL TRENCH DRAIN, NDS DURA SLOPE DS-114 OR APPROVED EQUAL WITH HEAVY DUTY H-20 GRATE AND LOCKING LID PER MANUFACTURER'S SPECIFICATIONS. INSTALL FLOGARD TRENCH DRAIN INLET FILTER PER DETAIL 4 SHEET 10.
63. INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-N-1 PER SHEET 11 DETAIL 1.
64. INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-N-2 PER SHEET 11 DETAIL 2.
65. INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-S-1 PER SHEET 12 DETAIL 1.
66. INSTALL ADS STORM DRAIN INFILTRATION CHAMBER DMA-S-2 PER SHEET 12 DETAIL 2.
67. INSTALL HYDRODYNAMIC SEPARATOR PER DETAIL 11 SHEET 3.
68. OVERFLOW CONNECTION INTO EXISTING SAN BERNARDINO COUNTY FLOOD CONTROL EASEMENT.
69. CONSTRUCT GREASE INTERCEPTOR PER DETAIL - SHEET -.
70. CONSTRUCT - STORM DRAIN PUMP PER MANUFACTURER SPECIFICATIONS AND DETAIL - SHEET -.

PER SEPARATE PLAN:

- AA GATE
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LEGEND:

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- PROPOSED AC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED PCC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- 4" CONCRETE SIDEWALK PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED LANDSCAPE PER SEPARATE PLANS

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PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
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APPROVED BY:
DATE

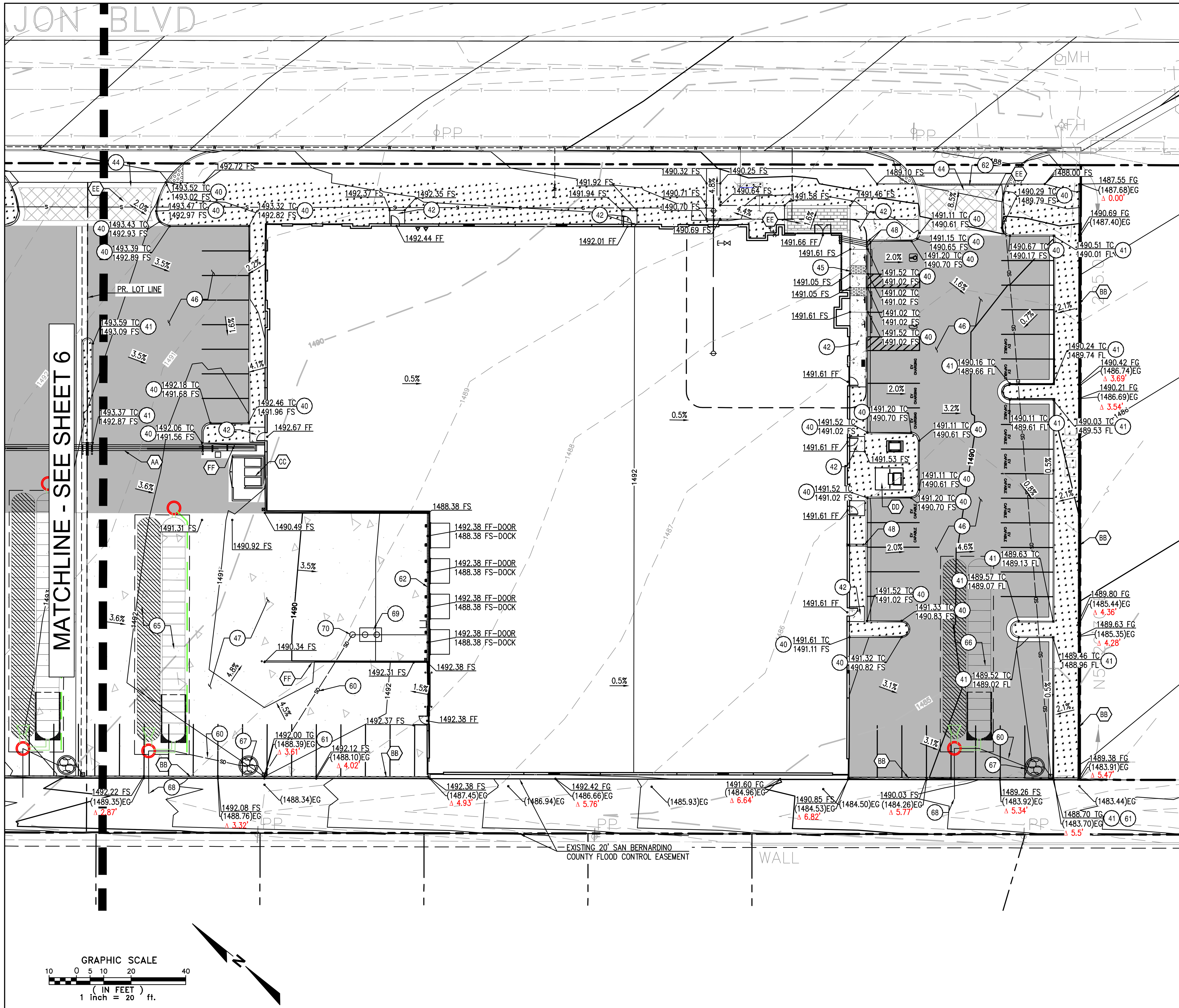
JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

GRADING AND DRAINAGE PLAN NORTH

FILE NO.

SHEET 6 OF 12

DRAFT DRAFT DRAFT



PAVING AND GRADING NOTES:

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- (41) CONSTRUCT 6" CONCRETE CURB AND GUTTER, PER SAN BERNARDINO COUNTY STD. PLAN 116.
- (42) CONSTRUCT 4" CONCRETE SIDEWALK PER APPROVED GEOTECHNICAL REPORT.
- (43) CONSTRUCT 3' CONCRETE V-GUTTER PER SAN BERNARDINO COUNTY STD. PLAN 119.
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- (67) INSTALL HYDRODYNAMIC SEPARATOR PER DETAIL 11 SHEET 3.
- (68) OVERFLOW CONNECTION INTO EXISTING SAN BERNARDINO COUNTY FLOOD CONTROL EASEMENT.
- (69) CONSTRUCT GREASE INTERCEPTOR PER DETAIL - SHEET -.
- (70) CONSTRUCT - STORM DRAIN PUMP PER MANUFACTURER SPECIFICATIONS AND DETAIL - SHEET -.

PER SEPARATE PLAN:

- AA GATE
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- DD TRANSFORMER
- EE DECORATIVE PAVEMENT
- FF SITE WALL

LEGEND:

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- 3.4% PROPOSED DIRECTIONAL SLOPE ARROW
- PROPOSED AC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED PCC PAVEMENT PER GEOTECHNICAL RECOMMENDATIONS
- 4" CONCRETE SIDEWALK PER GEOTECHNICAL RECOMMENDATIONS
- PROPOSED LANDSCAPE PER SEPARATE PLANS

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rasmith.com

LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

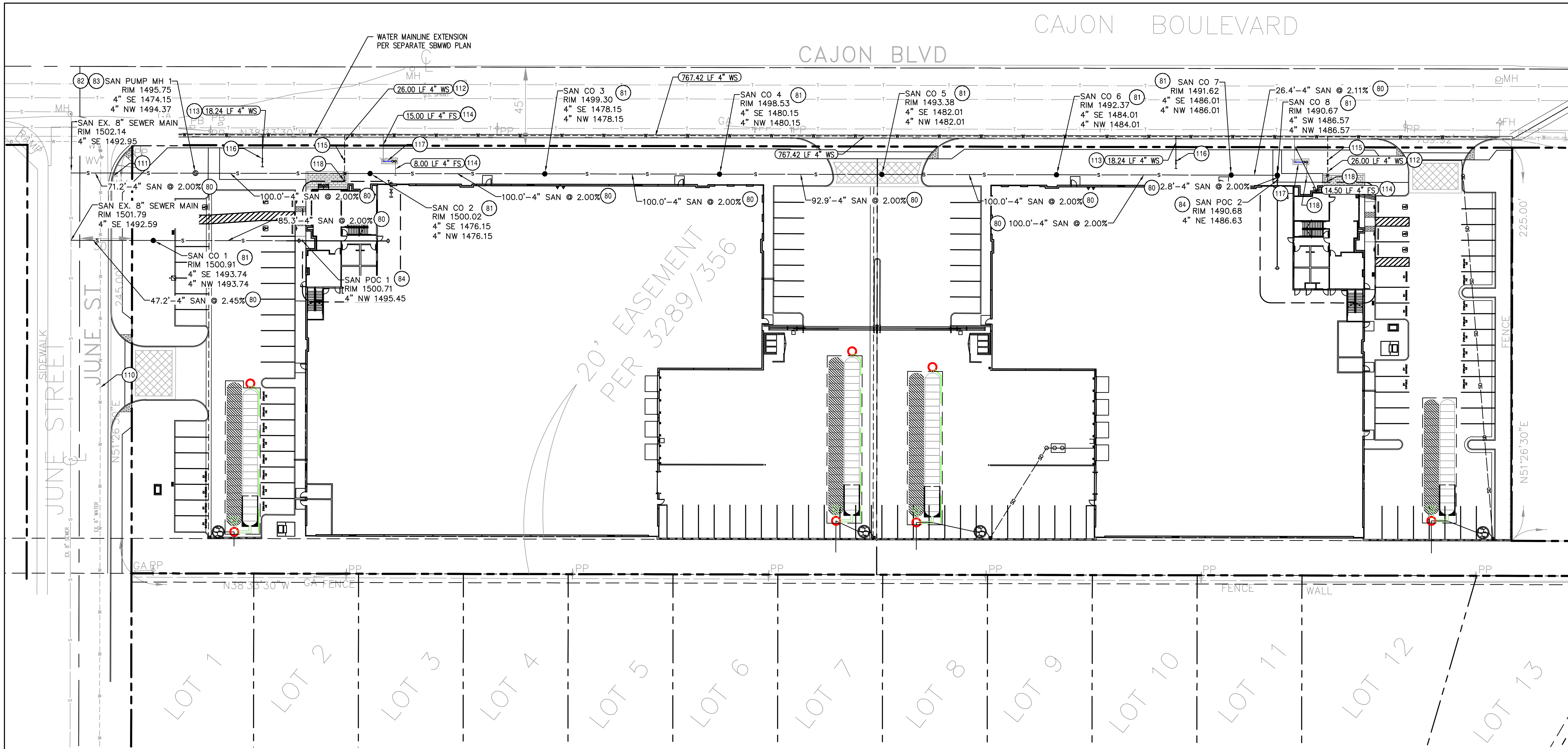
COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES
RECOMMENDED BY:
APPROVED BY: DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

GRADING AND DRAINAGE PLAN SOUTH

FILE NO.

SHEET 7 OF 12



PRIVATE WATER CONSTRUCTION NOTES:

(110)- PROTECT-IN-PLACE EXISTING WATER METERS.

(111)- PROTECT-IN-PLACE EXISTING WATER LINES.

(112)- CONSTRUCT -" DOMESTIC WATER SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1.

(113)- CONSTRUCT -" IRRIGATION SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1. CONTINUATION PER SEPARATE LANDSCAPE PLANS.

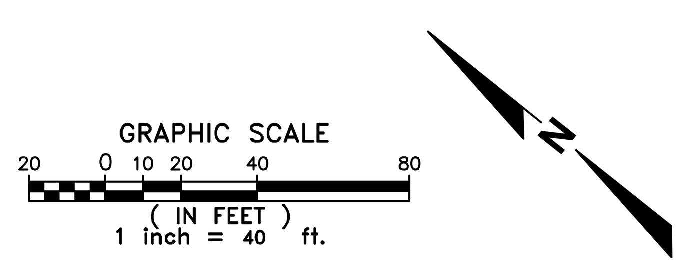
(114)- CONSTRUCT -" FIRE WATER SERVICE PER SBMWD STANDARD DWG. NO. W1.2. AND CPC. TRENCHING AND BEDDING PER SBMWD STANDARD DWG. NO. W5.1.

(115)- INSTALL -" APPROVED BACK FLOW ASSEMBLY FOR DOMESTIC SUPPLY PER SBMWD STANDARD DWG. NO. W4.1.

(116)- INSTALL -" APPROVED BACK FLOW ASSEMBLY FOR IRRIGATION PER SBMWD STANDARD DWG. NO. W4.1.

(117)- INSTALL DCDA BACK FLOW PREVENTION DEVICE PER SBMWD STANDARD DWG. NO. W4.3.

(118)- STUB WATER PIPE 5' FROM BUILDING. SEE PLUMBING PLANS FOR CONTINUATION.



PRIVATE SANITARY SEWER NOTES:

(80)- INSTALL 6" PVC SEWER SERVICE PER SBMWD STANDARD DWG. NO. S.305 AND CPC. TRENCHING AND BEDDING PER SBMWD DWG. NO. S.306.

(81)- INSTALL STANDARD SEWER CLEANOUT PER SBMWD STANDARD DWG. NO. S.303.

(82)- CONSTRUCT SEWER MANHOLE PER SPPWC STD. PLAN 200-3 AND CPC.

(83)- INSTALL SANITARY SEWAGE PUMP PER -.

(84)- STUB SANITARY SEWER 5' FROM BUILDING FOR CONNECTION. SEE PLUMBING PLANS FOR CONTINUATION.

RA SMITH ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN WITHOUT THE EXPRESSED WRITTEN CONSENT OF RA SMITH.

THE LOCATIONS OF EXISTING UTILITY INSTALLATIONS AS SHOWN ON THIS PLAN ARE APPROXIMATE. THERE MAY BE OTHER UNDERGROUND UTILITY INSTALLATIONS WITHIN THE PROJECT AREA THAT ARE NOT SHOWN.

811 Know what's below. Call before you dig.

DATE: 1/3/24
SCALE: 1" = 30'
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

Underground Service Alert
Call: TOLL FREE 1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961 3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:
raSmith CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:

APPROVED BY: DATE

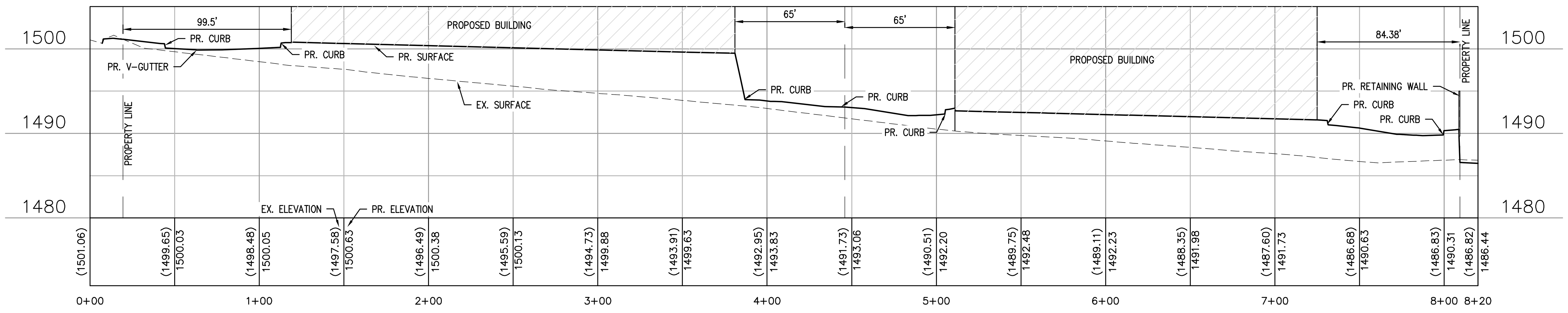
JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

UTILITY PLAN

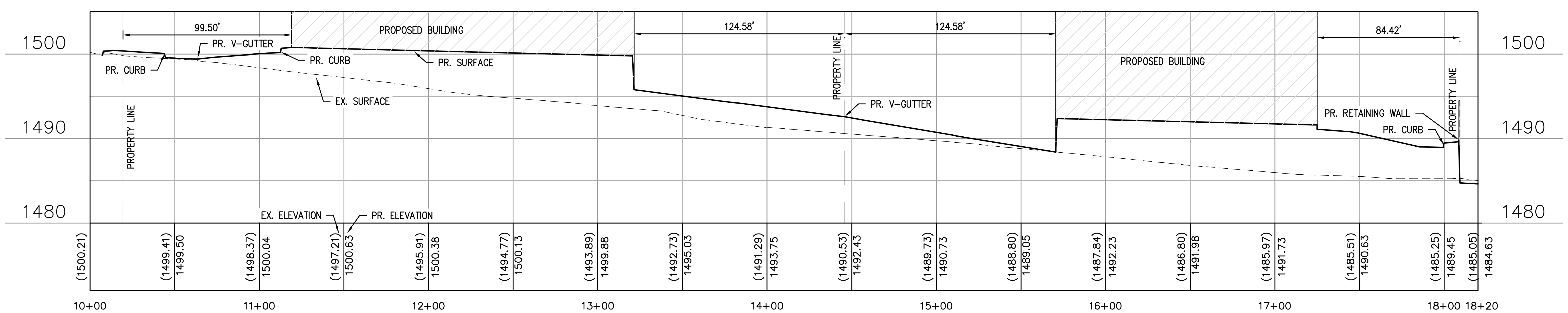
FILE NO.

SHEET 8 OF 12

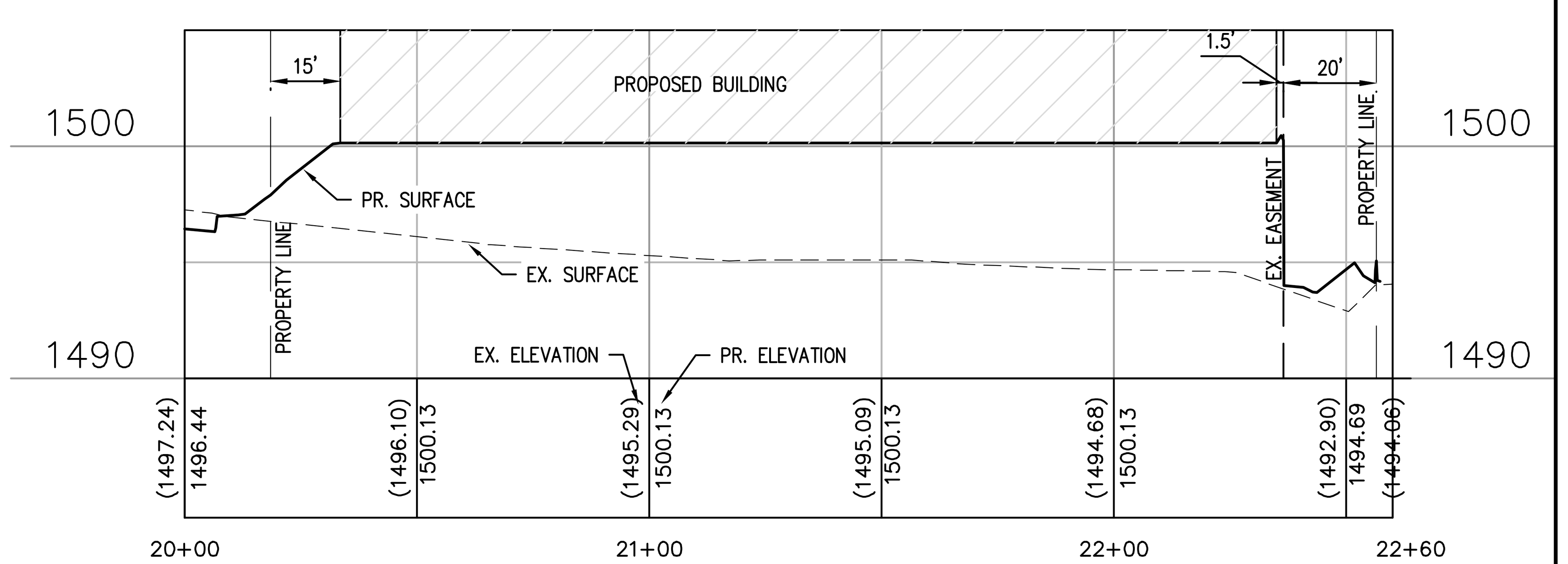
DRAFT DRAFT DRAFT



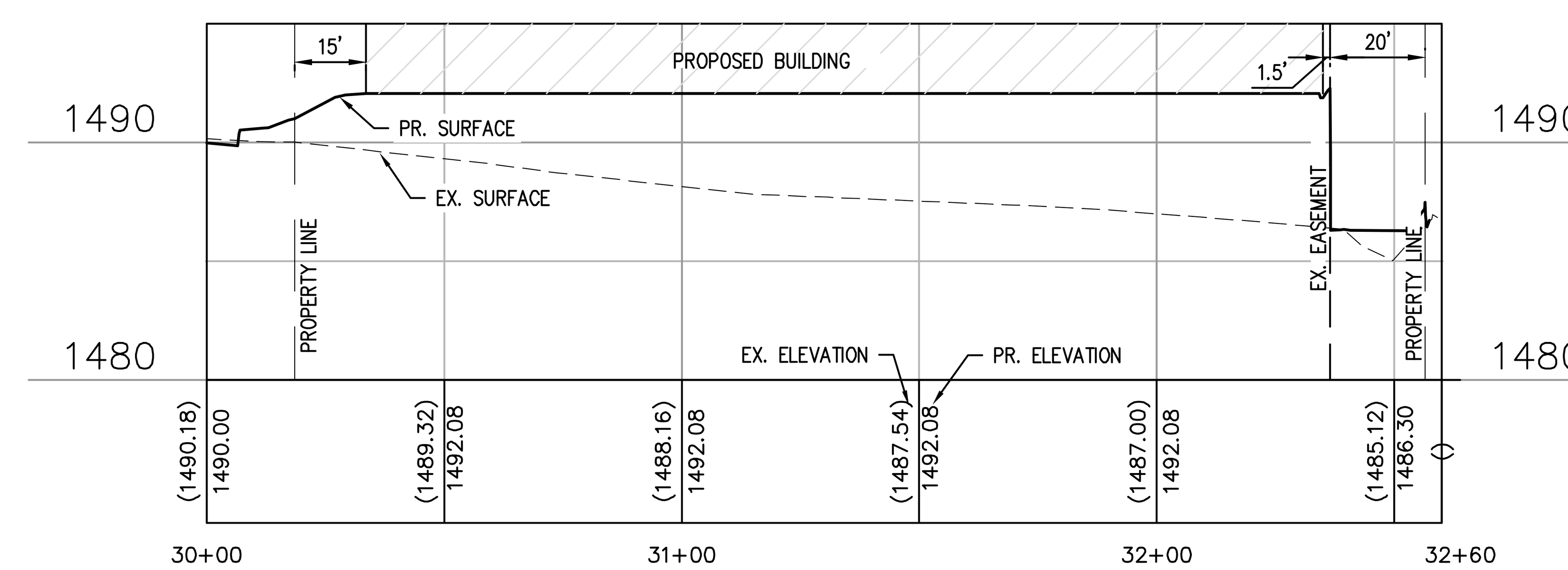
A SECTION A-A
HORIZ SCALE: 1" = 40'
VERT SCALE: 1" = 8'



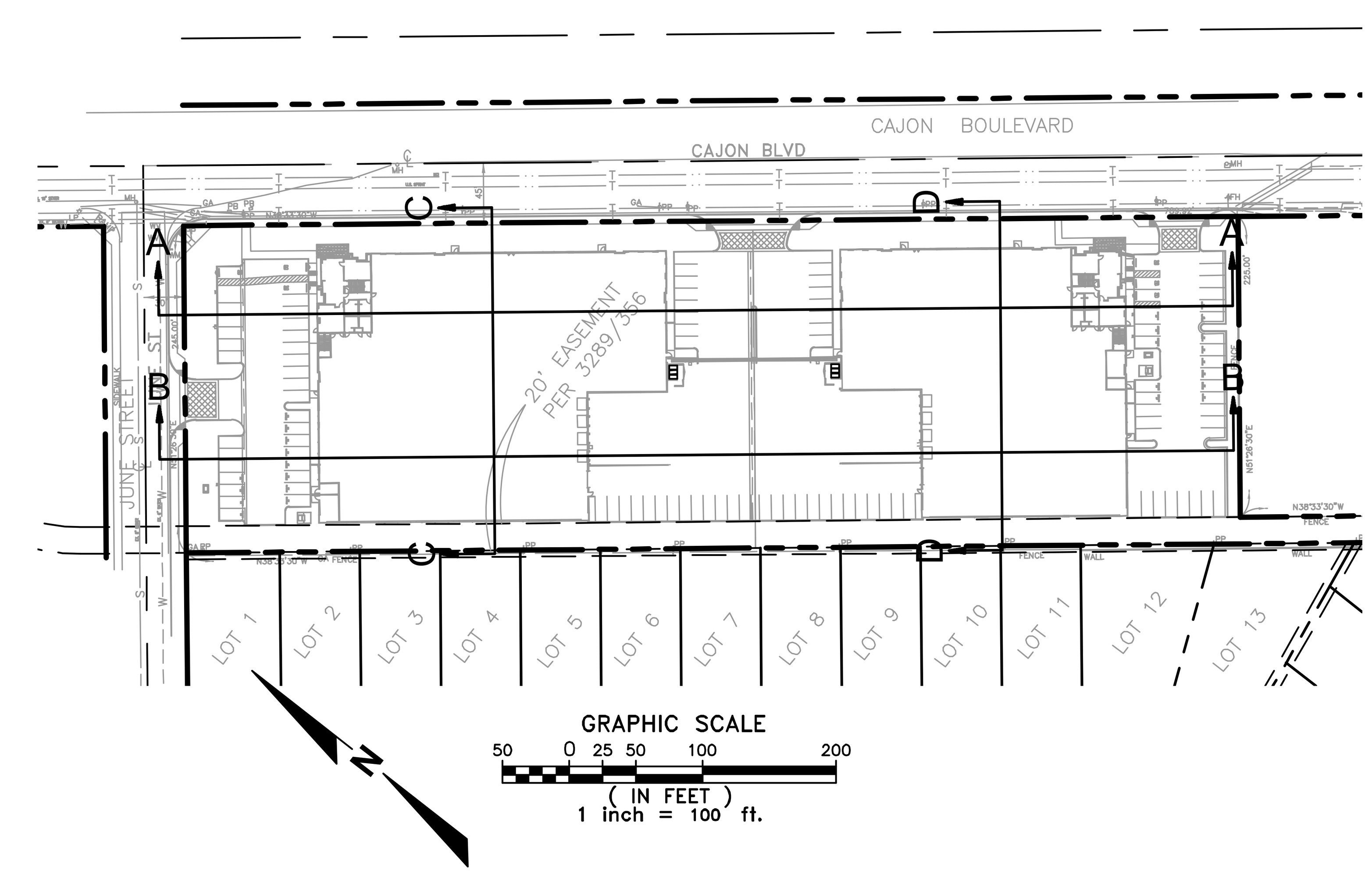
B SECTION B-B
HORIZ SCALE: 1" = 40'
VERT SCALE: 1" = 8'



C SECTION C-C
HORIZ SCALE: 1" = 30'
VERT SCALE: 1" = 6'



D SECTION D-D
HORIZ SCALE: 1" = 30'
VERT SCALE: 1" = 6'



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DATE: 1/3/24
SCALE: AS SHOWN
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

Underground Service Alert
Call: TOLL FREE 1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:
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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA
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DATE

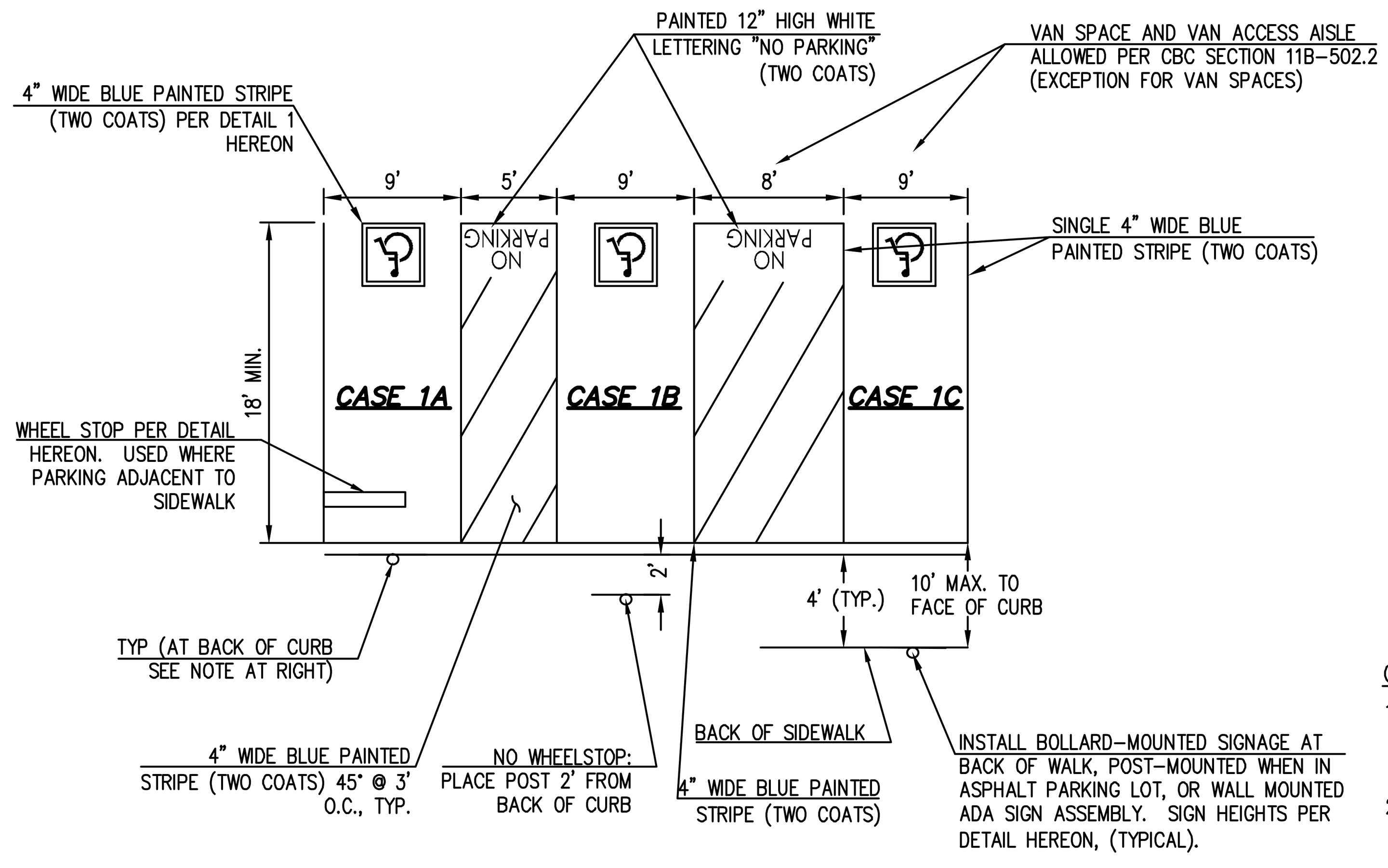
JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

CROSS SECTIONS

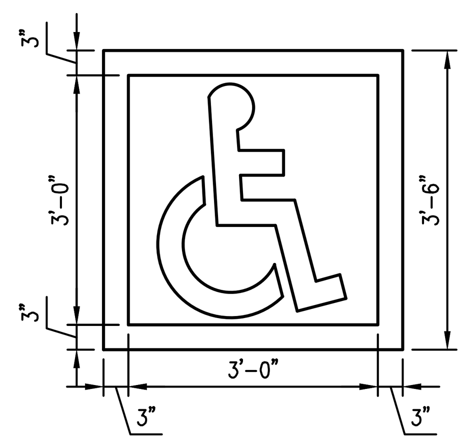
FILE NO.

SHEET 9 OF 12

DRAFT DRAFT DRAFT

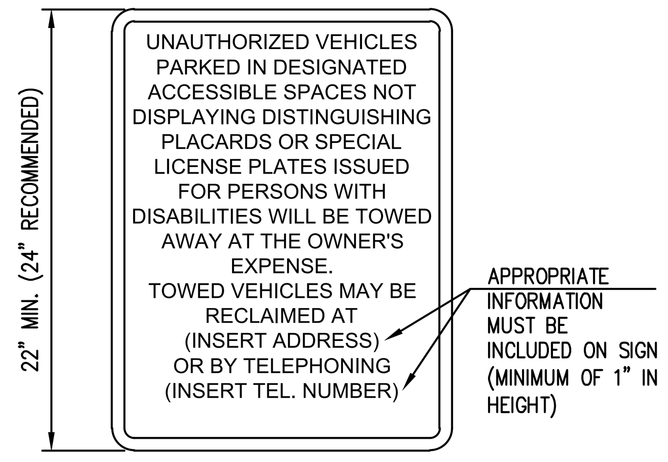


90° ACCESSIBLE PARKING DETAIL



ADA SYMBOL NOTES:

A. ALL STROKES TO BE 3" WIDE.
B. PROVIDE TWO COATS OF PAINT MINIMUM.
C. BLUE BACKGROUND WITH WHITE SYMBOL.
D. LOCATE SYMBOL AT CENTER OF STALL WHERE SHOWN ON SITE PLAN.
E. ONE SYMBOL FOR EACH ADA PARKING SPACE.



UNAUTHORIZED VEHICLE WARNING SIGN

N.T.S.

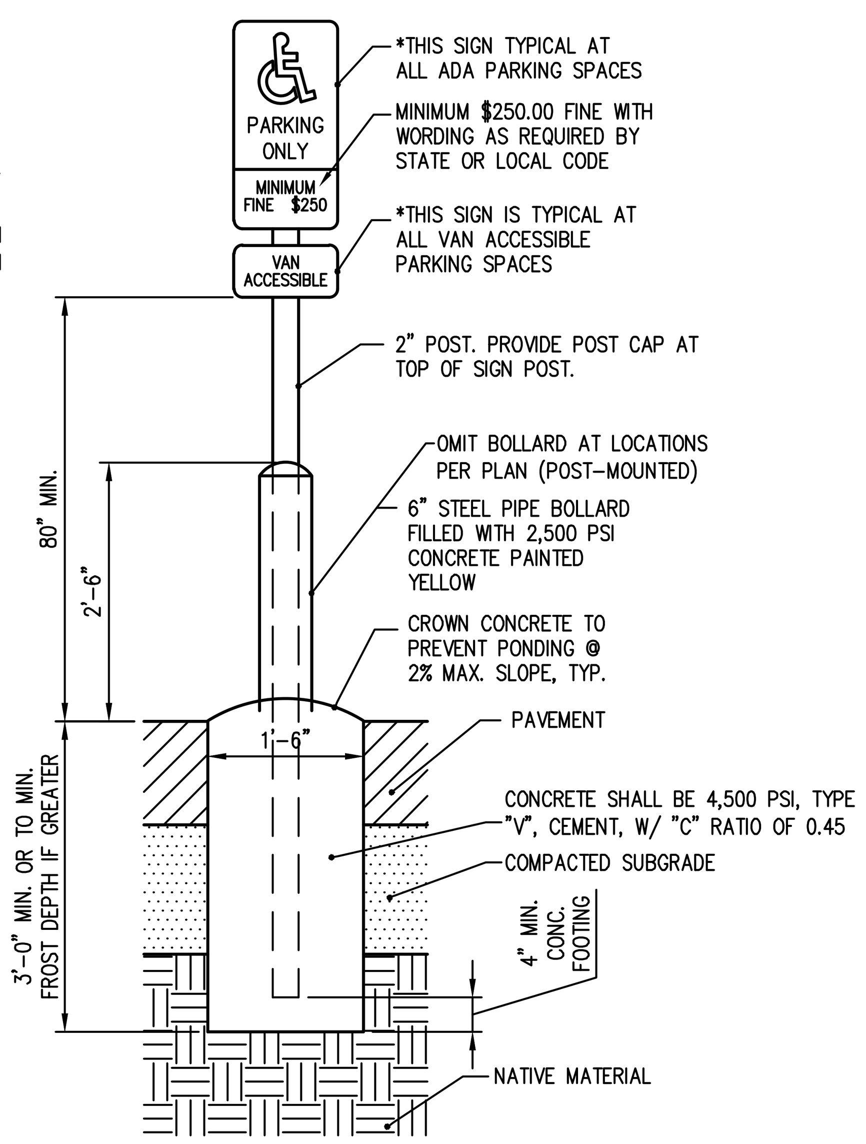
WALL MOUNT SIGN

IN PEDESTRIAN AREAS, MIN. CLEARANCE 80" (6'-8") TO THE LOWEST SIGN ON POLE*

GENERAL NOTES

1. ALL WALKWAYS, RAMPS, ADA PARKING SIGNAGE, ETC. SHALL MEET CURRENT APPROVED A.D.A. AND CBC STANDARDS.
2. 2.0% MAX. SLOPE IN ALL DIRECTION IN AREAS OF ADA PARKING SPACES.
3. ALL BLUE STRIPING SHALL BE NON-REFLECTORIZE PAINT.
4. STRIPING SHALL HAVE TWO COATS OF PAINT, ALKYD BASE SYNTHETIC RESIN, FED. SPEC. TTP-115 TYPE 1 (OR APPROVED EQUAL). IF SEAL COAT IS USED, IT SHALL BE COMPATIBLE WITH STRIPING COMPOUND.

CLEAN AND PREPARE SITE FOR PERMANENT STRIPING APPLICATION.

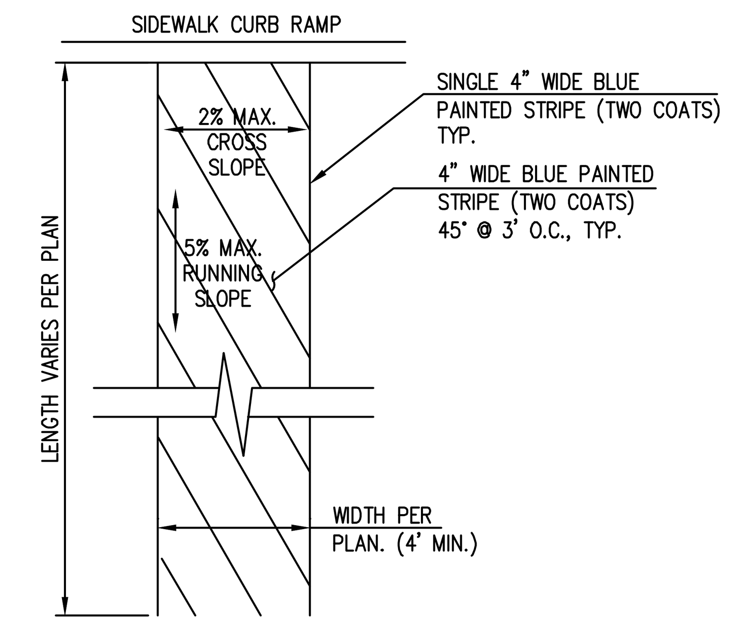


* ALL SIGNS ARE TO BE AFFIXED TO POST WITH RUST RESISTANT HARDWARE.

NOTE:
ALL SIGNS ARE TO BE AFFIXED TO POST OR WALL WITH RUST RESISTANT HARDWARE.

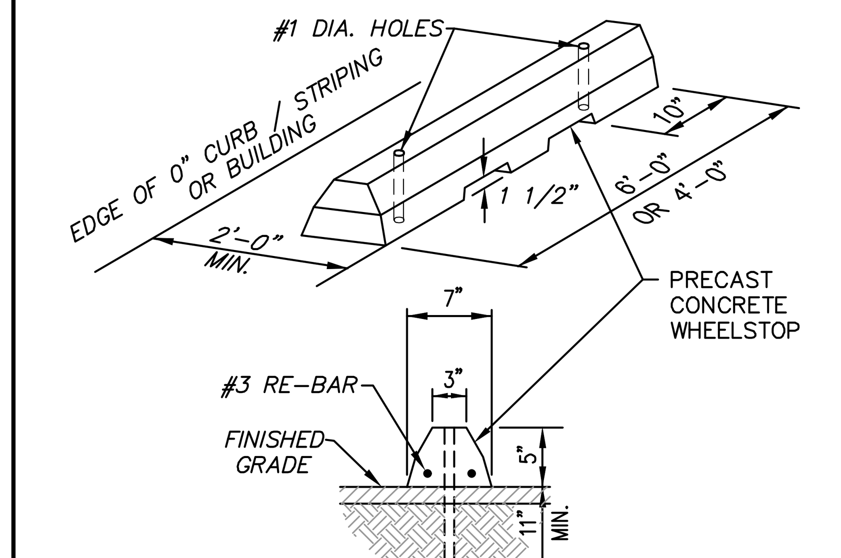
1 ADA SIGNAGE AND STRIPING DETAIL

N.T.S.



2 ADA CROSSWALK STRIPING DETAIL

N.T.S.



NOTE:

1. *ANCHOR WHEELSTOPS WITH #6 RE-BAR – 18" MIN. LENGTH.*
2. *WHEELSTOPS TO BE PAINTED TRAFFIC YELLOW*

3 CONCRETE WHEEL STOP DETAIL

N.T.S.

NOTE:

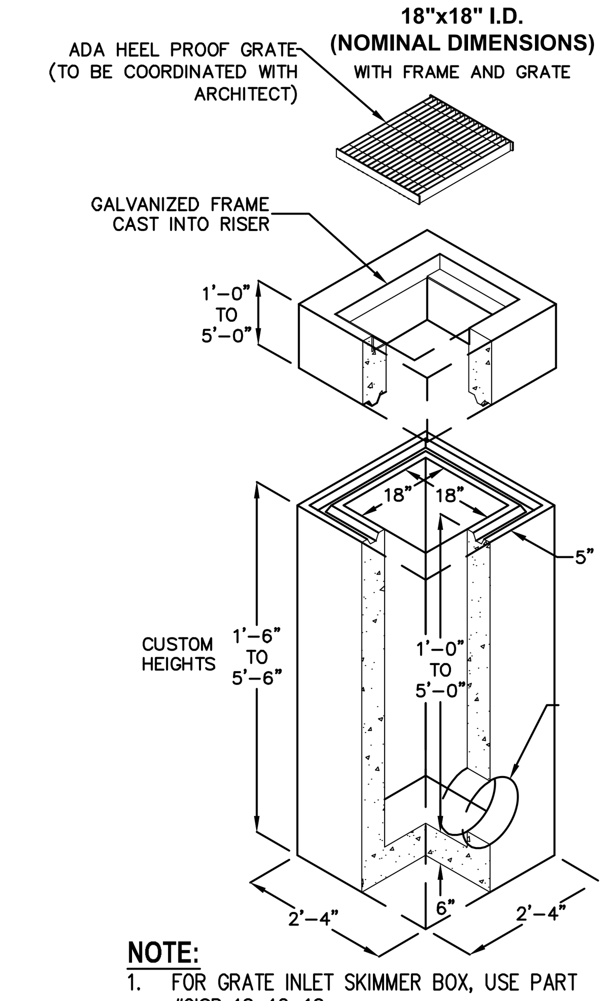
ALL DRAIN INLETS THAT DISCHARGE INTO AN EXISTING OR PROPOSED STORM DRAIN MUST BE LABELED TO DISCOURAGE ILLEGAL DUMPING OF POLLUTANTS WITH THE STENCIL ABOVE IN A VISIBLE AREA. 2 COATS MINIMUMM.

DROP INLET

18"x18" I.D.

(NOMINAL DIMENSIONS)

WITH FRAME AND GRATE

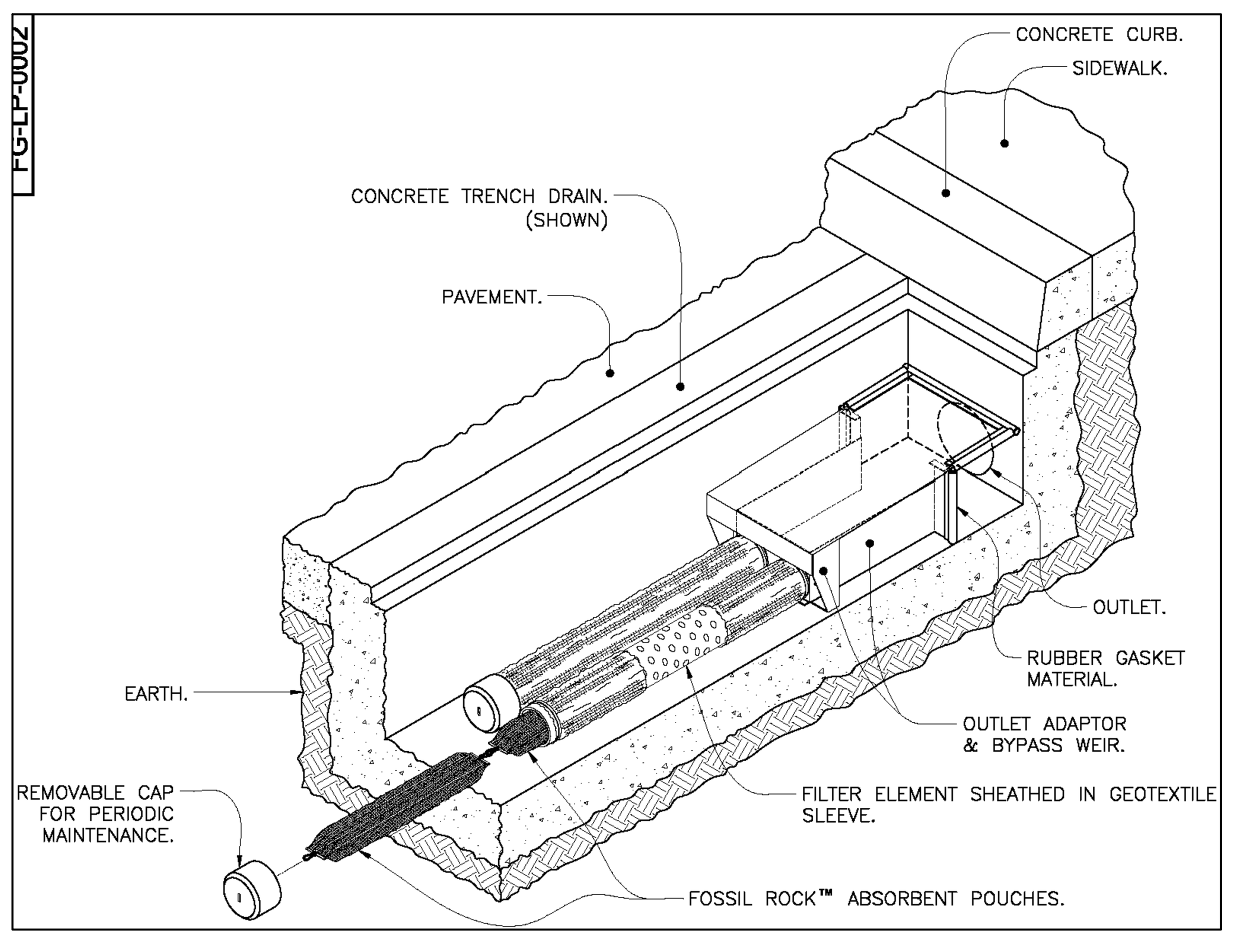


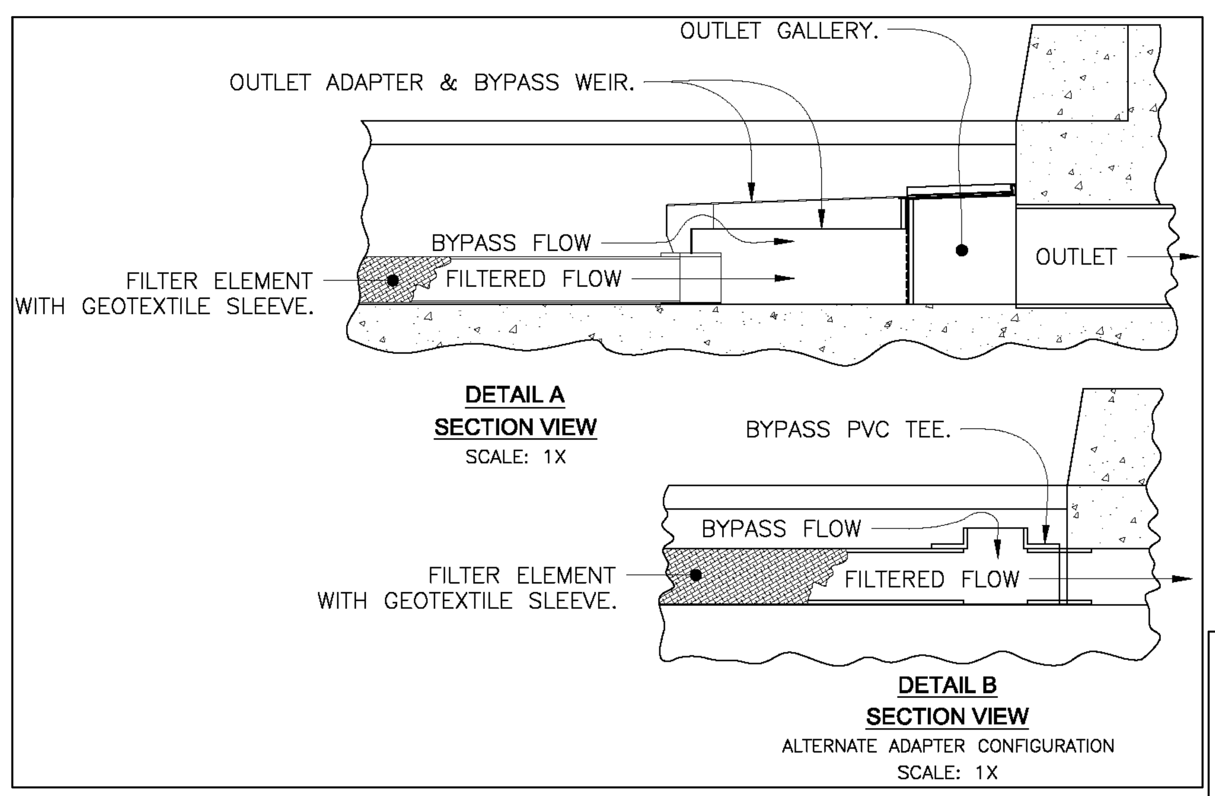
NOTE:

1. FOR GRATE INLET SKIMMER BOX, USE PART #GISB 18-18-18

5 STORM DRAIN INLET DETAIL

N.T.S.





DETAIL A

SECTION VIEW

SCALE: 1X

DETAIL B

SECTION VIEW

ALTERNATE ADAPTER CONFIGURATION

SCALE: 1X

SPECIFIER CHART

MODEL	FILTER TYPE	TRENCH WIDTH "ID" (CLEAR OPENING)	MINIMUM TRENCH DEPTH (FROM BOTTOM OF GRATE)	SOLIDS STORAGE CAPACITY CUBIC FEET **	FILTERED FLOW CUBIC FEET / SECOND **	TOTAL BYPASS CAPACITY CUBIC FEET /SECOND
FG-TDOF3	PIPE *	3.0	6.5	0.1	0.5	0.1
FG-TDOF4	PIPE *	4.0	6.5	0.2	0.5	0.1
FG-TDOF6	PIPE	6.0	6.5	0.4	0.5	0.2
FG-TDOF8	PIPE	8.0	6.5	0.7	0.5	0.3
FG-TDOF10	PIPE	10.0	6.5	0.9	0.5	0.5
FG-TDOF12	PIPE	12.0	6.5	0.9	1.0	0.6
FG-TDOF18	PIPE	18.0	6.5	1.3	1.5	1.1
FG-TDOF24	PIPE	24.0	6.5	1.8	2.0	1.5
FG-TDOA6	PANEL	6.0	4.5	0.4	0.2	0.2
FG-TDOA8	PANEL	8.0	4.5	0.7	0.2	0.3
FG-TDOA10	PANEL	10.0	4.5	0.8	0.3	0.5
FG-TDOA12	PANEL	12.0	4.5	1.0	0.4	0.6
FG-TDOA18	PANEL	18.0	4.5	1.4	0.8	1.1
FG-TDOA24	PANEL	24.0	4.5	1.8	1.1	1.5

* ALTERNATE ADAPTER CONFIGURATION. SEE DETAIL B.
**CAPACITY PER 4-FT. SEGMENT USED.

NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter outlet adapter shall be constructed from stainless steel Type 304. Alternate outlet adaptor for shallow installations shall be PVC SCH-40. See detail B, sheet 2 of 2.
3. Filter medium shall be *Fossil Rock* ™, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.
5. For alternate outlet adapter configurations used for extremely shallow trench drains contact Oldcastle Stormwater Solutions for engineering assistance.
6. Filter element should be a minimum of one half the length of trench. Confirm flow rate upon order.

4 FLOGARD TRENCH DRAIN INLET FILTER DETAIL BY OLDCASTLE

DATE: 1/3/24

SCALE: AS SHOWN

JOB NO. 3230032

PROJECT MANAGER: ERIC A. ROBLES

DESIGNED BY: JJL

CHECKED BY: EAR

Underground Service Alert

Call: TOLL FREE 1-800-227-2600

TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
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PREPARED BY:

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LICENSED PROFESSIONAL ENGINEER ERIC A. ROBLES C89866 EXP.6/30/25 CIVIL STATE OF CALIFORNIA

DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:

APPROVED BY:

DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND
JUNE ST., SAN BERNARDINO, CA 92407

DETAILS

FILE NO.

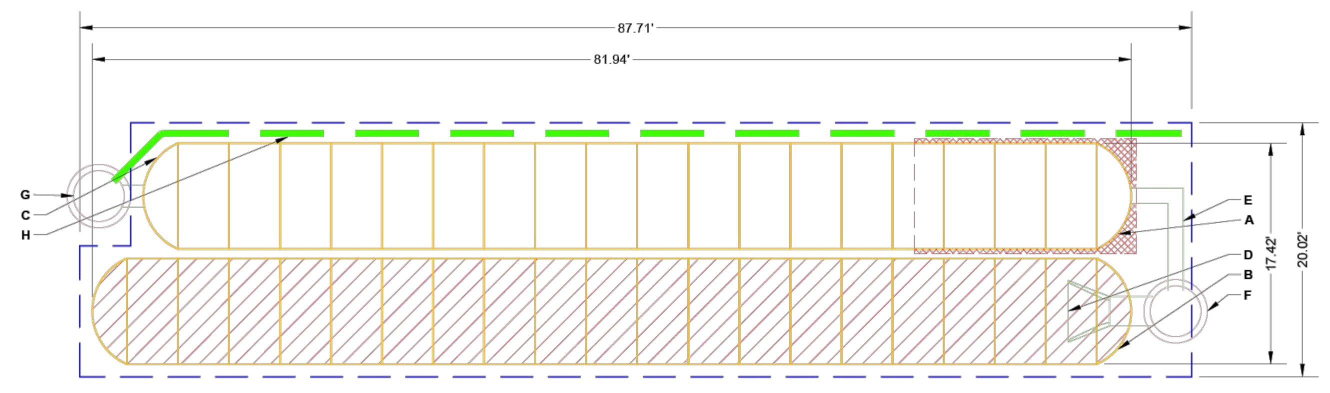
SHEET 10 OF 12

PROPOSED LAYOUT	
37	STORMTECH MC-4500 CHAMBERS
4	STORMTECH MC-4500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
7094	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
1717	SYSTEM AREA (SF)
215.5	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-4500 CHAMBER:	5.75
12" x 12" TOP MANIFOLD INVERT:	3.72
24" ISOLATOR ROW PLUS INVERT:	0.94
18" BOTTOM CONNECTION INVERT:	0.91
BOTTOM OF MC-4500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
PREFABRICATED END CAP	C	18" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 18" BOTTOM CONNECTIONS	1.97"	
FLAMP	D	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	E	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN
CONCRETE STRUCTURE	G	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		4.0 CFS OUT
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS SEE DETAIL()

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

CAJUN & JUNE N-1
SAN BERNARDINO, CA, USA
DRAWN: JM
CHECKED: N/A
DATE:
PROJECT #:

StormTech® Chamber System
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

SHEET 2 OF 5

1 INFILTRATION CHAMBER DMA-N-1

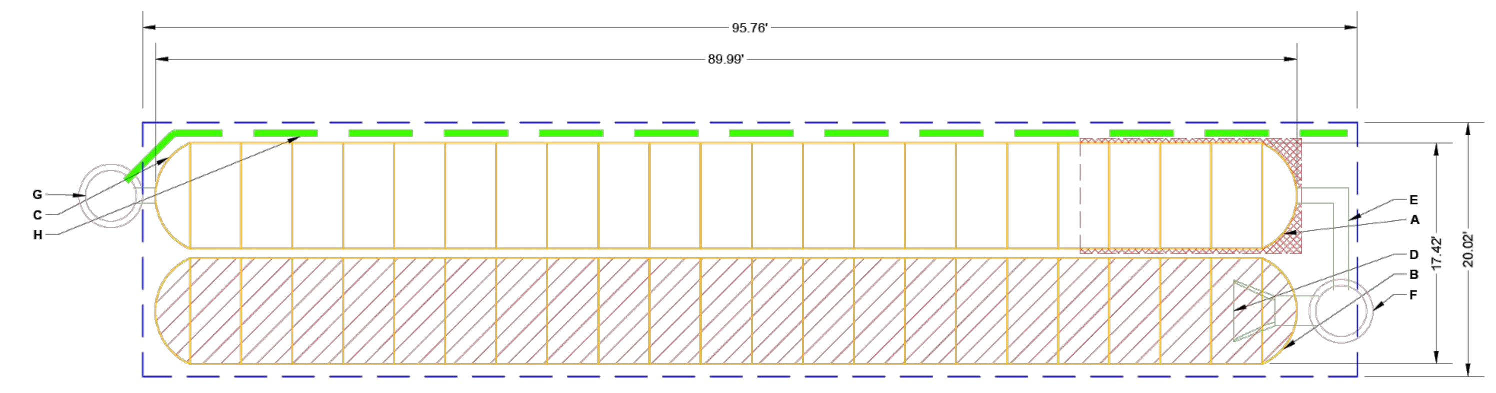
N.T.S.

PROPOSED LAYOUT	
42	STORMTECH MC-4500 CHAMBERS
4	STORMTECH MC-4500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
7954	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
1917	SYSTEM AREA (SF)
231.6	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-4500 CHAMBER:	5.75
12" x 12" TOP MANIFOLD INVERT:	3.72
24" ISOLATOR ROW PLUS INVERT:	0.94
12" BOTTOM CONNECTION INVERT:	0.88
BOTTOM OF MC-4500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
PREFABRICATED END CAP	C	12" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP12B / TYP OF ALL 12" BOTTOM CONNECTIONS	1.55"	
FLAMP	D	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	E	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN
CONCRETE STRUCTURE	G	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.0 CFS OUT
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS SEE DETAIL()

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
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CAJUN & JUNE N-2
SAN BERNARDINO, CA, USA
DRAWN: JM
CHECKED: N/A
DATE:
PROJECT #:

StormTech® Chamber System
ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

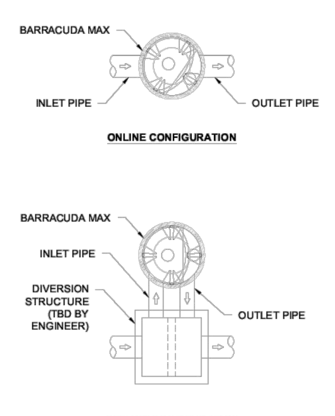
SHEET 2 OF 5

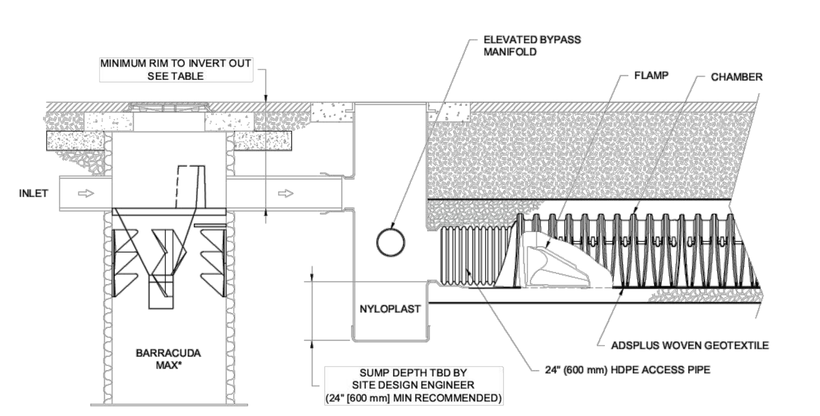
2 INFILTRATION CHAMBER DMA-N-2

N.T.S.

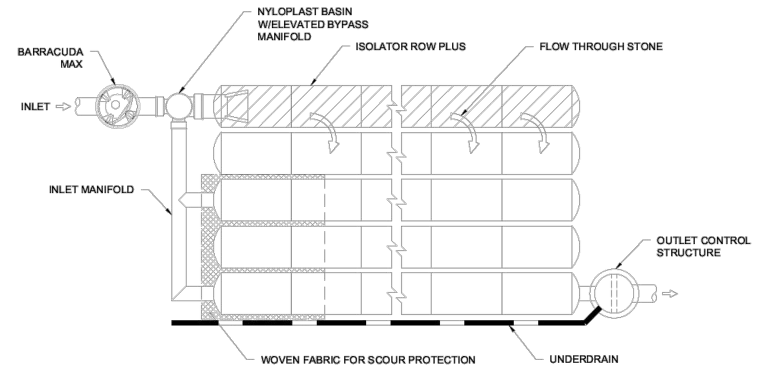
BARRACUDA MAX MINIMUM RIM TO INVERT OUT	
MODEL	INCH (MM)
S3	36 (914)
S4	36 (914)
S6	39 (991)
S8	41 (1041)

THE S3, S4, S6, AND S8 CAN BE INSTALLED IN A STANDARD 36" (900 mm), 48" (1200 mm), 72" (1800 mm), AND 96" (2400 mm) PRECAST MANHOLE, RESPECTIVELY. THE S3 AND S4 CAN BE PROVIDED FACTORY INSTALLED WITHIN A 36" (900 mm) AND 48" (1200 mm) ADS HP MANHOLE AND DELIVERED TO THE JOBSITE.





BARRACUDA MAX & ISOLATOR ROW PLUS CROSS SECTION/PROFILE
NTS



BARRACUDA MAX & ISOLATOR ROW PLUS SCHEMATIC
NTS

ISOLATOR ROW PLUS FLOW RATES			
CHAMBER MODEL	SURFACE LOADING RATE GPM/FT² (L/S/m²)	EFFECTIVE FILTRATION TREATMENT AREA FT² (m²)	MTFR CFS (L/S)*
SC-160	4.13 (2.8)	11.45 (1.064)	0.11 (2.983)
SC-310	4.13 (2.8)	17.7 (1.644)	0.16 (4.612)
SC-740	4.13 (2.8)	27.8 (2.583)	0.26 (7.244)
DC-780	4.13 (2.8)	27.8 (2.583)	0.26 (7.244)
MC-3500	4.13 (2.8)	42.9 (3.986)	0.40 (11.178)
MC-4500	4.13 (2.8)	30.1 (2.796)	0.28 (7.843)
MC-7200	4.13 (2.8)	50.0 (4.645)	0.46 (13.028)

* PER CHAMBER LOADING RATES BASED ON NJCAT VERIFICATION TESTING OF THE STORMTECH SC-740 ISOLATOR ROW PLUS IN ACCORDANCE WITH NJDEP LABORATORY PROTOCOL TO ACCESS TOTAL SUSPENDED SOLIDS REMOVAL BY FILTRATION MANUFACTURED TREATMENT DEVICES, 2013.

KEY BENEFITS OF THE BARRACUDA MAX

- SINGLE MANHOLE DESIGN
- VARIABLE INLET/OUTLET ANGLE CONFIGURATIONS (NOT JUST 180 DEGREE ORIENTATION)
- INTERNAL BYPASS FOR INLINE INSTALLATION (WHERE APPLICABLE)
- ALL UNITS CAN BE INSTALLED INTO A STANDARD PRECAST MANHOLE
- 3' & 4' UNITS CAN BE FACTORY FABRICATED IN HP MANHOLES FOR QUICK DELIVERY WITH A LIGHT, EASY TO INSTALL STRUCTURE
- IN-STOCK COMPONENTS FOR QUICK DELIVERY
- NO ELEVATION LOSS BETWEEN THE INLET AND OUTLET
- SURFACE INSPECTION AND MAINTENANCE WITH NO CONFINED SPACE ENTRY
- DESIGNED FOR EASY MAINTENANCE USING A VACUUM TRUCK OR SIMILAR EQUIPMENT
- FIELD ENGINEERS AND INTERNAL ENGINEERING SERVICES DEPARTMENT TO ASSIST ENGINEERING WITH SIZING/DETAILS

BARRACUDA DESIGN TOOL
https://www.ads-pipe.com/water-quality-design-tool

BARRACUDA MAX TREATMENT FLOW (80% TSS)	
MODEL	CFS (L/s)
S3	0.85 (24.1)
S4	1.52 (43.0)
S6	3.40 (96.3)
S8	6.08 (172.2)

BARRACUDA MAX CAN BE CONFIGURED WITH AN OIL POUCH OR TRASH GUARD FOR ENHANCED TREATMENT.

KEY BENEFITS OF A BARRACUDA MAX & ISOLATOR PLUS DESIGN

- ENHANCED SEDIMENT REMOVAL BY COMBINING TWO INDUSTRY PROVEN DEVICES
- EXTENDED MAINTENANCE CYCLES
- EASY TO INSTALL AND CONFIGURE TO SPECIFIC SITE CONSTRAINTS
- ONLINE DESIGN TOOLS ALLOW DESIGNERS TO EASILY CREATE LAYOUTS AND DETAILS

KEY BENEFITS OF STORMTECH CHAMBERS

- LARGE FAMILY OF CHAMBERS TO FIT YOUR SITE
- EASILY CONFIGURABLE FOR IRREGULAR SHAPED BEDS
- MEETS PRODUCT REQUIREMENTS OF ASTM F2418 AND ASTM F2922 AND DESIGN REQUIREMENTS OF ASTM F2787
- EXCEED AASHTO LRFD DESIGN SPECIFICATIONS FOR HS-20 LIVE LOADS & DEEP BURIAL EARTH LOADS
- PATENTED ISOLATOR ROW PLUS FOR LESS FREQUENT MAINTENANCE, WATER QUALITY AND LONG-TERM PERFORMANCE
- THIRD PARTY VERIFIED PERFORMANCE
- FIELD ENGINEERS AND INTERNAL ENGINEERING SERVICES DEPARTMENT TO ASSIST ENGINEERING WITH LAYOUTS

STORMTECH DESIGN TOOL
https://designtool.ads-pipe.com/

STORMTECH® + WQ STD DETAIL
BARRACUDA®
& ISOLATOR ROW PLUS®
DATE: 2/10/22 DRAWN: KLJ
PROJECT #: N/A CHECKED: KMS

DATE DRWN CHKD DESCRIPTION

ADS Advanced Drainage Systems, Inc.
4640 TRUEMAN BLVD HILLIARD, OH 43026

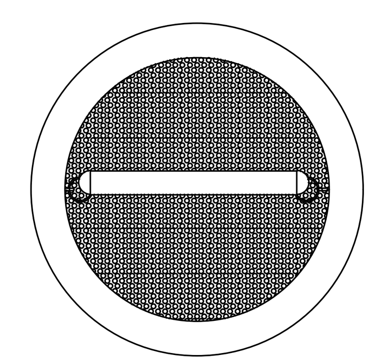
SHEET 1 OF 1

3 BARRACUDA HYDRO DYNAMIC SEPARATOR DMA-N-1, DMA-N-2

N.T.S.

BIO CLEAN FULL CAPTURE FILTER

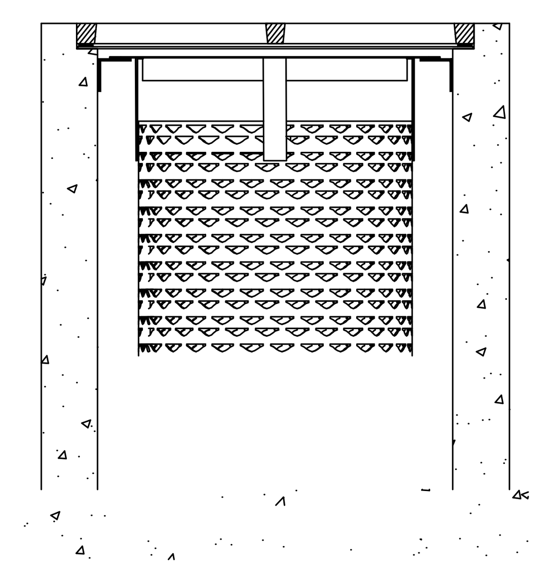
FOR USE IN GRATE INLETS

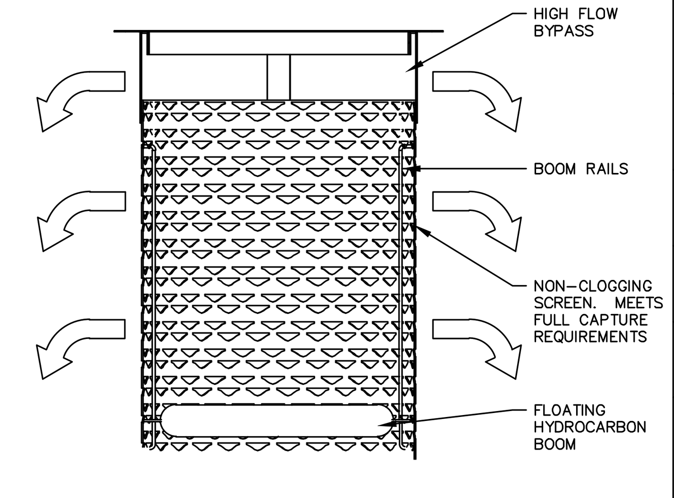


TOP VIEW

NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL
2. HYDROCARBON BOOM SHALL BE 2" DIAMETER AND CONNECTED, MECHANICALLY TO THE FILTER FRAME WITH RAILS ALLOWING IT TO FLOAT ON THE WATER SURFACE REGARDLESS OF HEIGHT
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDIING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURE SOLD SEPARATELY.





MODEL #	TREATMENT FLOW (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.55	1.55	0.27
BIO-GRATE-FULL 18-18-18	4.32	3.68	1.05
BIO-GRATE-FULL 24-24-24	7.67	4.83	2.41
BIO-GRATE-FULL 30-30-24	12.97	6.21	3.98
BIO-GRATE-FULL 25-38-24	13.53	6.59	4.16

4 STORM DRAIN INLET AND FILTER SCREEN DETAIL

N.T.S.

THE LOCATIONS OF EXISTING UTILITY INSTALLATIONS AS SHOWN ON THIS PLAN ARE APPROXIMATE. THERE MAY BE OTHER UNDERGROUND UTILITY INSTALLATIONS WITHIN THE PROJECT AREA THAT ARE NOT SHOWN.

RA SMITH ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN WITHOUT THE EXPRESSED WRITTEN CONSENT OF RA SMITH.

DATE: 1/3/24
SCALE: AS SHOWN
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

Underground Service Alert
CALL BEFORE YOU DIG
Call: TOLL FREE 1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS PID: EV1296 DESIGNATION: B 40 ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:
raSmith
CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

LICENSED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP. 6/30/25
CIVIL
STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:

APPROVED BY: DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND JUNE ST., SAN BERNARDINO, CA 92407

DETAILS

FILE NO.

SHEET 11 OF 12

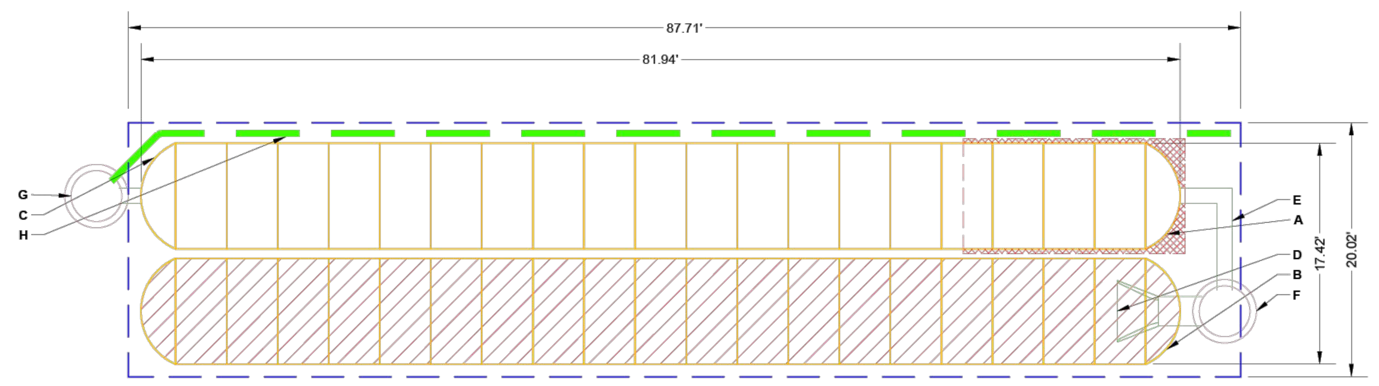
1 INFILTRATION CHAMBER DMA-S-1

PROPOSED LAYOUT	
38	STORMTECH MC-4500 CHAMBERS
4	STORMTECH MC-4500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
7264	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
1756	SYSTEM AREA (SF)
215.5	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-4500 CHAMBER:	5.75
12" x 12" TOP MANIFOLD INVERT:	3.72
24" ISOLATOR ROW PLUS INVERT:	0.94
12" BOTTOM CONNECTION INVERT:	0.88
BOTTOM OF MC-4500 CHAMBER:	0.75
UNDERDRAIN INVERT:	0.00
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
PREFABRICATED END CAP	C	12" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP12B / TYP OF ALL 12" BOTTOM CONNECTIONS	1.55"	
FLAMP	D	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	E	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN
CONCRETE STRUCTURE	G	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.0 CFS OUT
UNDERDRAIN	H	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		



ISOLATOR ROW PLUS
SEE DETAIL()

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
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CAJUN & JUNE S-1
SAN BERNARDINO, CA, USA
DATE: | DRAWN: JM
PROJECT #: | CHECKED: N/A

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

SHEET 2 OF 5

1 INFILTRATION CHAMBER DMA-S-1 N.T.S.

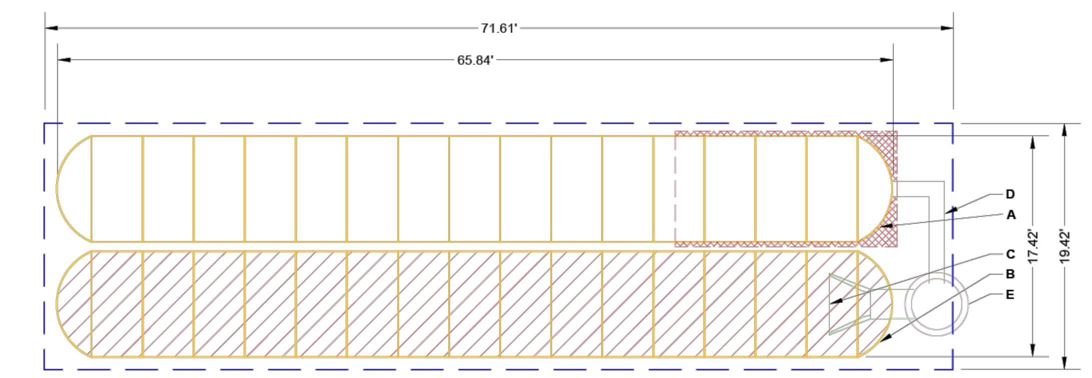
2 INFILTRATION CHAMBER DMA-S-2

PROPOSED LAYOUT	
30	STORMTECH MC-4500 CHAMBERS
4	STORMTECH MC-4500 END CAPS
12	STONE ABOVE (in)
9	STONE BELOW (in)
40	STONE VOID
5766	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
1390	SYSTEM AREA (SF)
182.1	SYSTEM PERIMETER (ft)

CONCEPTUAL ELEVATIONS:	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	12.75
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	8.25
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	7.75
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	7.75
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	7.75
TOP OF STONE:	6.75
TOP OF MC-4500 CHAMBER:	5.75
12" x 12" TOP MANIFOLD INVERT:	3.72
24" ISOLATOR ROW PLUS INVERT:	0.94
BOTTOM OF MC-4500 CHAMBER:	0.75
BOTTOM OF STONE:	0.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	12" TOP PARTIAL CUT END CAP, PART#: MC4500IEPP12T / TYP OF ALL 12" TOP CONNECTIONS	35.69"	
PREFABRICATED END CAP	B	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	2.26"	
FLAMP	C	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	D	12" x 12" TOP MANIFOLD, ADS N-12	35.69"	
CONCRETE STRUCTURE	E	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		2.5 CFS IN



ISOLATOR ROW PLUS
SEE DETAIL()

PLACE MINIMUM 17.50' OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

BED LIMITS

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CAJUN & JUNE S-2
SAN BERNARDINO, CA, USA
DATE: | DRAWN: JM
PROJECT #: | CHECKED: N/A

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

SHEET 2 OF 5

2 INFILTRATION CHAMBER DMA-S-2 N.T.S.

THE LOCATIONS OF EXISTING UTILITY INSTALLATIONS AS SHOWN ON THIS PLAN ARE APPROXIMATE. THERE MAY BE OTHER UNDERGROUND UTILITY INSTALLATIONS WITHIN THE PROJECT AREA THAT ARE NOT SHOWN.

RA SMITH ASSUMES NO RESPONSIBILITY FOR DAMAGES, LIABILITY OR COSTS RESULTING FROM CHANGES OR ALTERATIONS MADE TO THIS PLAN WITHOUT THE EXPRESSED WRITTEN CONSENT OF RA SMITH.

DATE: 1/3/24
SCALE: AS SHOWN
JOB NO. 3230032
PROJECT MANAGER: ERIC A. ROBLES
DESIGNED BY: JJL
CHECKED BY: EAR

Underground Service Alert
CALL BEFORE YOU DIG
Call: TOLL FREE
1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK: USGS
PID: EV1296
DESIGNATION: B 40
ELEV: 1516.40 (NAVD 88)
DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO. 3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

PREPARED BY:
raSmith
CREATIVITY BEYOND ENGINEERING
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

LICENSED PROFESSIONAL ENGINEER
ERIC A. ROBLES
C89866
EXP.6/30/25
CIVIL
STATE OF CALIFORNIA
DATE 1/3/24

MARK	REVISIONS	APPR	DATE

COUNTY OF SAN BERNARDINO
DEPARTMENT LAND USE SERVICES

RECOMMENDED BY:

APPROVED BY:

DATE

JUNE SPRINGS BUSINESS PARK
SE CORNER OF CAJON BLVD. AND
JUNE ST., SAN BERNARDINO, CA 92407

DETAILS

FILE NO.

SHEET 12 OF 12

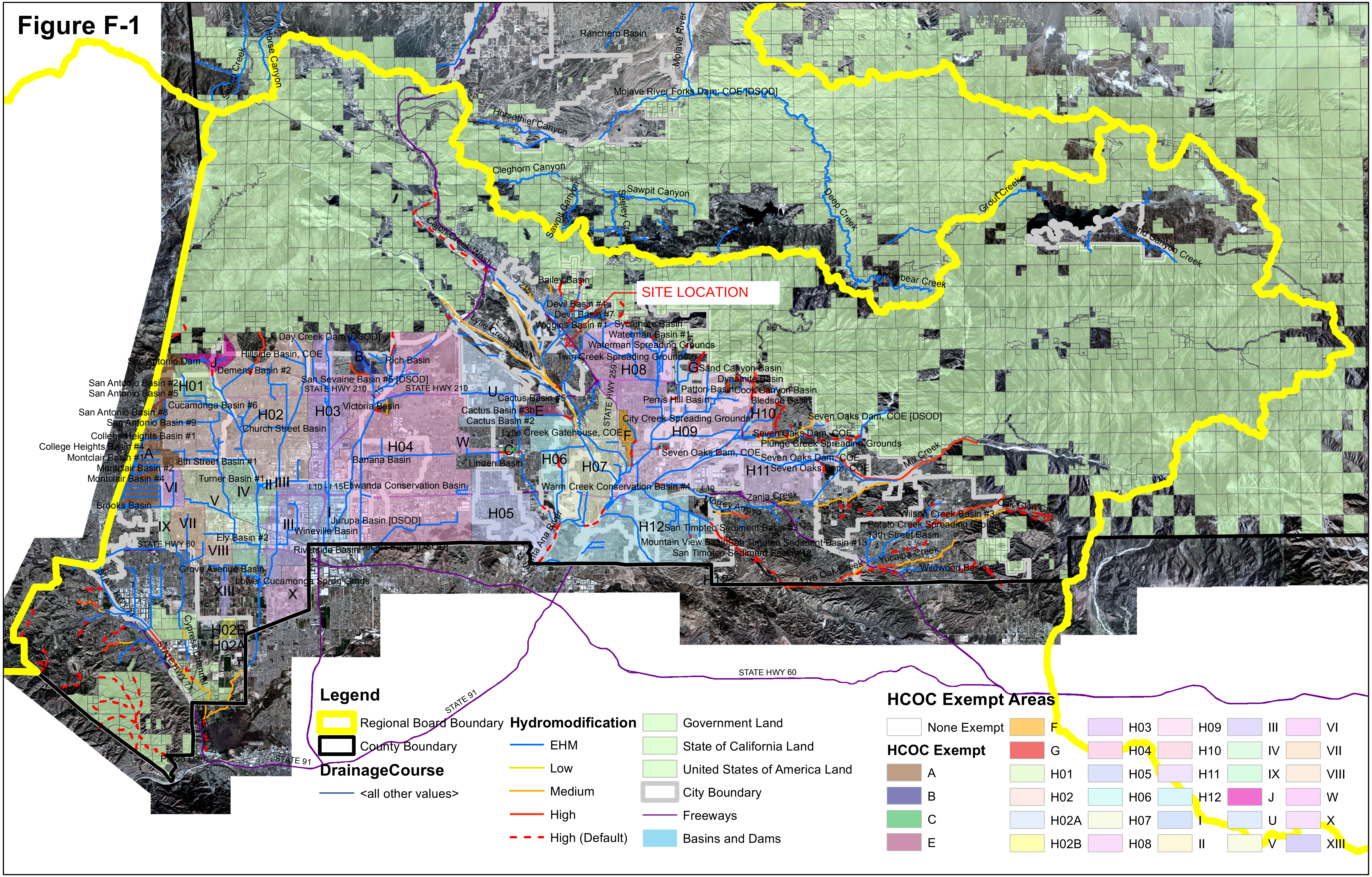

Figure F-1
SITE LOCATION
Ranchero Basin
Mojave River
Mojave River Forks Dam: COE [DSOD]
Horse Canyon
Horsethief Canyon
Cleghorn Canyon
Sawpit Canyon
Seeley Creek
Deep Creek
Grout Creek
Sand Canyon Creek
Cajon Creek Wash
Bailey Basin
Devil Basin #4
Devil Basin #7
Wiggins Basin #1
Sycamore Basin
Waterman Basin #1
Waterman Spreading Grounds
Twin Creek Spreading Grounds
Lytle Creek Wash
Day Creek Dam [DSOD]
Hillside Basin, COE
San Antonio Dam
Demens Basin #2
Rich Basin
San Sevaine Basin #5 [DSOD]
STATE HWY 210
San Antonio Basin #2
San Antonio Basin #5
Cucamonga Basin #6
San Antonio Basin #8
San Antonio Basin #9
Church Street Basin
Victoria Basin
College Heights Basin #1
College Heights Basin #4
Montclair Basin #1
Montclair Basin #2
Montclair Basin #4
8th Street Basin #1
Turner Basin #1
Banana Basin
Etiwanda Conservation Basin
Cactus Basin #5
Cactus Basin #3b
Cactus Basin #2
Lytle Creek Gatehouse, COE
Linden Basin
Sand Canyon Basin
Dynamite Basin
Patton Basin
Cook Canyon Basin
Perris Hill Basin
Bledsoe Basin
City Creek Spreading Grounds
Seven Oaks Dam, COE [DSOD]
Seven Oaks Dam, COE
Plunge Creek Spreading Grounds
Mill Creek
Warm Creek Conservation Basin #4
Zanja Creek
Morrey Arroyo
Wilson Creek Basin #3
Oak Glen Creek
Potato Creek Spreading Grounds
13th Street Basin
Yucaipa Creek
Wildwood Basin
Live Oak Creek
San Timoteo Sediment Basin #5
Mountain View Basin
San Timoteo Sediment Basin #13
San Timoteo Sediment Basin #18
Brooks Basin
Jurupa Basin [DSOD]
Wineville Basin
Riverside Basin
Ely Basin #2
Grove Avenue Basin
Lower Cucamonga Sprdg Grnds
STATE HWY 60
STATE HWY 259
STATE HWY 71
STATE 91
Cypress Channel
Prado Dam
Santa Ana River
I 10
I 15
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
H11
H12
A
B
C
E
F
G
J
U
W
X
I
II
III
IV
V
VI
VII
VIII
IX
XIII
Legend
Regional Board Boundary
County Boundary
DrainageCourse
<all other values>
Hydromodification
EHM
Low
Medium
High
High (Default)
Government Land
State of California Land
United States of America Land
City Boundary
Freeways
Basins and Dams
HCOC Exempt Areas
None Exempt
HCOC Exempt
A
B
C
E
F
G
H01
H02
H02A
H02B
H03
H04
H05
H06
H07
H08
H09
H10
H11
H12
I
II
III
IV
IX
J
U
V
VI
VII
VIII
W
X
XIII

Hydromodification

A.1 Hydrologic Conditions of Concern (HCOC) Analysis

HCOC Exemption:

1. **Sump Condition:** All downstream conveyance channel to an adequate sump (for example, Prado Dam, Santa Ana River, or other Lake, Reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Sensitivity Maps.

2. **Pre = Post**: The runoff flow rate, volume and velocity for the post-development condition of the Priority Development Project do not exceed the pre-development (i.e, naturally occurring condition for the 2-year, 24-hour rainfall event utilizing latest San Bernardino County Hydrology Manual.

   a. Submit a substantiated hydrologic analysis to justify your request.

3. **Diversion to Storage Area**: The drainage areas that divert to water storage areas which are considered as control/release point and utilized for water conservation.

   a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (http://sbcounty.permitrack.com/wap) for reference.

4. **Less than One Acre**: The Priority Development Project disturbs less than one acre. The Co-permittee has the discretion to require a Project Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The project disturbs less than one acre and is not part of a common plan of development.

5. **Built Out Area**: The contributing watershed area to which the project discharges has a developed area percentage greater than 90 percent.

   a. See Appendix F for the HCOC Exemption Map and the on-line Watershed Geodatabase (http://sbcounty.permitrack.com/wap) for reference.

Summary of HCOC Exempted Area

	HCOC Exemption reasoning				
	1	2	3	4	5
Area					
A			X		X
B			X		
C					X
E			X		
F					X
G			X		X
H01	X		X		
H02	X		X		
H02A	X		X		
H02B			X		
H03			X		
H04	X		X		
H05	X				
H06			X		
H07	X				
H08	X		X		
H09	X				
H10	X		X		
H11	X		X		
H12	X				
J			X		
U			X		
W			X		
I			X		
II			X		
III					X
IV			X		X
V			X*		
VI					X
VII					X
VIII			X		
IX					X
X			X		
XIII			X		

*Detention/Conservation Basin

NOAA Atlas 14, Volume 6, Version 2
Location name: San Bernardino, California, USA*
Latitude: 34.1683°, Longitude: -117.3465°
Elevation: 1493 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	**0.139** (0.115-0.169)	**0.185** (0.154-0.226)	**0.249** (0.206-0.303)	**0.302** (0.248-0.371)	**0.378** (0.300-0.481)	**0.439** (0.341-0.571)	**0.503** (0.381-0.671)	**0.573** (0.422-0.786)	**0.672** (0.474-0.962)	**0.754** (0.513-1.12)
10-min	**0.199** (0.165-0.242)	**0.266** (0.221-0.323)	**0.356** (0.295-0.435)	**0.433** (0.355-0.532)	**0.541** (0.430-0.689)	**0.629** (0.488-0.818)	**0.721** (0.546-0.962)	**0.821** (0.604-1.13)	**0.963** (0.680-1.38)	**1.08** (0.736-1.60)
15-min	**0.241** (0.200-0.292)	**0.321** (0.267-0.391)	**0.431** (0.357-0.526)	**0.523** (0.430-0.644)	**0.655** (0.520-0.833)	**0.760** (0.591-0.989)	**0.872** (0.661-1.16)	**0.993** (0.731-1.36)	**1.16** (0.822-1.67)	**1.31** (0.890-1.94)
30-min	**0.355** (0.295-0.431)	**0.474** (0.393-0.576)	**0.635** (0.526-0.775)	**0.771** (0.633-0.949)	**0.965** (0.766-1.23)	**1.12** (0.870-1.46)	**1.29** (0.974-1.72)	**1.46** (1.08-2.01)	**1.72** (1.21-2.46)	**1.93** (1.31-2.86)
60-min	**0.531** (0.441-0.645)	**0.708** (0.588-0.862)	**0.950** (0.787-1.16)	**1.15** (0.948-1.42)	**1.44** (1.14-1.84)	**1.68** (1.30-2.18)	**1.92** (1.46-2.56)	**2.19** (1.61-3.00)	**2.57** (1.81-3.68)	**2.88** (1.96-4.27)
2-hr	**0.781** (0.650-0.949)	**1.01** (0.840-1.23)	**1.32** (1.10-1.61)	**1.58** (1.30-1.94)	**1.94** (1.54-2.48)	**2.24** (1.74-2.91)	**2.54** (1.92-3.38)	**2.86** (2.11-3.93)	**3.32** (2.34-4.75)	**3.68** (2.51-5.46)
3-hr	**0.971** (0.807-1.18)	**1.24** (1.03-1.51)	**1.61** (1.33-1.96)	**1.91** (1.57-2.35)	**2.33** (1.85-2.97)	**2.67** (2.07-3.47)	**3.01** (2.28-4.02)	**3.38** (2.49-4.64)	**3.89** (2.75-5.57)	**4.30** (2.93-6.38)
6-hr	**1.41** (1.17-1.71)	**1.78** (1.48-2.17)	**2.29** (1.89-2.79)	**2.70** (2.22-3.32)	**3.26** (2.59-4.15)	**3.70** (2.88-4.82)	**4.16** (3.15-5.54)	**4.63** (3.41-6.35)	**5.28** (3.72-7.56)	**5.79** (3.94-8.59)
12-hr	**1.86** (1.55-2.26)	**2.38** (1.98-2.90)	**3.05** (2.53-3.72)	**3.60** (2.95-4.42)	**4.33** (3.44-5.51)	**4.89** (3.80-6.36)	**5.46** (4.14-7.28)	**6.05** (4.45-8.30)	**6.83** (4.82-9.78)	**7.44** (5.07-11.0)
24-hr	**2.49** (2.21-2.87)	**3.23** (2.86-3.73)	**4.19** (3.69-4.84)	**4.95** (4.33-5.77)	**5.97** (5.06-7.20)	**6.74** (5.60-8.29)	**7.52** (6.09-9.47)	**8.30** (6.54-10.8)	**9.35** (7.08-12.6)	**10.2** (7.43-14.2)
2-day	**3.04** (2.70-3.50)	**4.03** (3.56-4.65)	**5.31** (4.68-6.14)	**6.34** (5.55-7.40)	**7.74** (6.56-9.32)	**8.80** (7.30-10.8)	**9.87** (8.00-12.4)	**11.0** (8.64-14.2)	**12.4** (9.42-16.8)	**13.6** (9.93-19.0)
3-day	**3.24** (2.87-3.73)	**4.36** (3.86-5.03)	**5.83** (5.14-6.74)	**7.03** (6.15-8.20)	**8.67** (7.34-10.4)	**9.93** (8.24-12.2)	**11.2** (9.09-14.1)	**12.6** (9.90-16.3)	**14.4** (10.9-19.4)	**15.8** (11.6-22.0)
4-day	**3.44** (3.04-3.96)	**4.68** (4.14-5.40)	**6.32** (5.57-7.31)	**7.66** (6.71-8.94)	**9.52** (8.06-11.5)	**11.0** (9.09-13.5)	**12.4** (10.1-15.7)	**14.0** (11.0-18.1)	**16.1** (12.2-21.7)	**17.7** (13.0-24.8)
7-day	**3.86** (3.42-4.44)	**5.33** (4.72-6.15)	**7.30** (6.44-8.44)	**8.92** (7.81-10.4)	**11.2** (9.46-13.5)	**12.9** (10.7-15.9)	**14.8** (12.0-18.6)	**16.7** (13.1-21.6)	**19.3** (14.6-26.1)	**21.4** (15.7-29.9)
10-day	**4.20** (3.72-4.84)	**5.86** (5.19-6.76)	**8.09** (7.13-9.35)	**9.94** (8.70-11.6)	**12.5** (10.6-15.1)	**14.5** (12.1-17.9)	**16.6** (13.5-21.0)	**18.9** (14.9-24.4)	**21.9** (16.6-29.6)	**24.4** (17.8-34.1)
20-day	**5.18** (4.59-5.97)	**7.33** (6.48-8.45)	**10.2** (9.02-11.8)	**12.7** (11.1-14.8)	**16.1** (13.6-19.4)	**18.8** (15.6-23.1)	**21.6** (17.5-27.3)	**24.7** (19.4-31.9)	**28.9** (21.9-39.0)	**32.3** (23.7-45.1)
30-day	**6.12** (5.42-7.05)	**8.66** (7.66-9.98)	**12.1** (10.7-14.0)	**15.0** (13.1-17.5)	**19.1** (16.2-23.0)	**22.4** (18.6-27.6)	**25.9** (21.0-32.6)	**29.6** (23.3-38.3)	**34.8** (26.3-46.9)	**39.0** (28.5-54.5)
45-day	**7.42** (6.57-8.54)	**10.4** (9.20-12.0)	**14.5** (12.8-16.7)	**17.9** (15.7-20.9)	**22.8** (19.3-27.5)	**26.8** (22.2-33.0)	**31.0** (25.1-39.0)	**35.5** (27.9-45.9)	**41.8** (31.6-56.4)	**47.0** (34.4-65.6)
60-day	**8.72** (7.73-10.1)	**12.1** (10.7-13.9)	**16.7** (14.7-19.3)	**20.6** (18.0-24.0)	**26.2** (22.2-31.5)	**30.7** (25.5-37.7)	**35.5** (28.7-44.7)	**40.6** (32.0-52.6)	**48.0** (36.3-64.7)	**54.0** (39.5-75.3)

[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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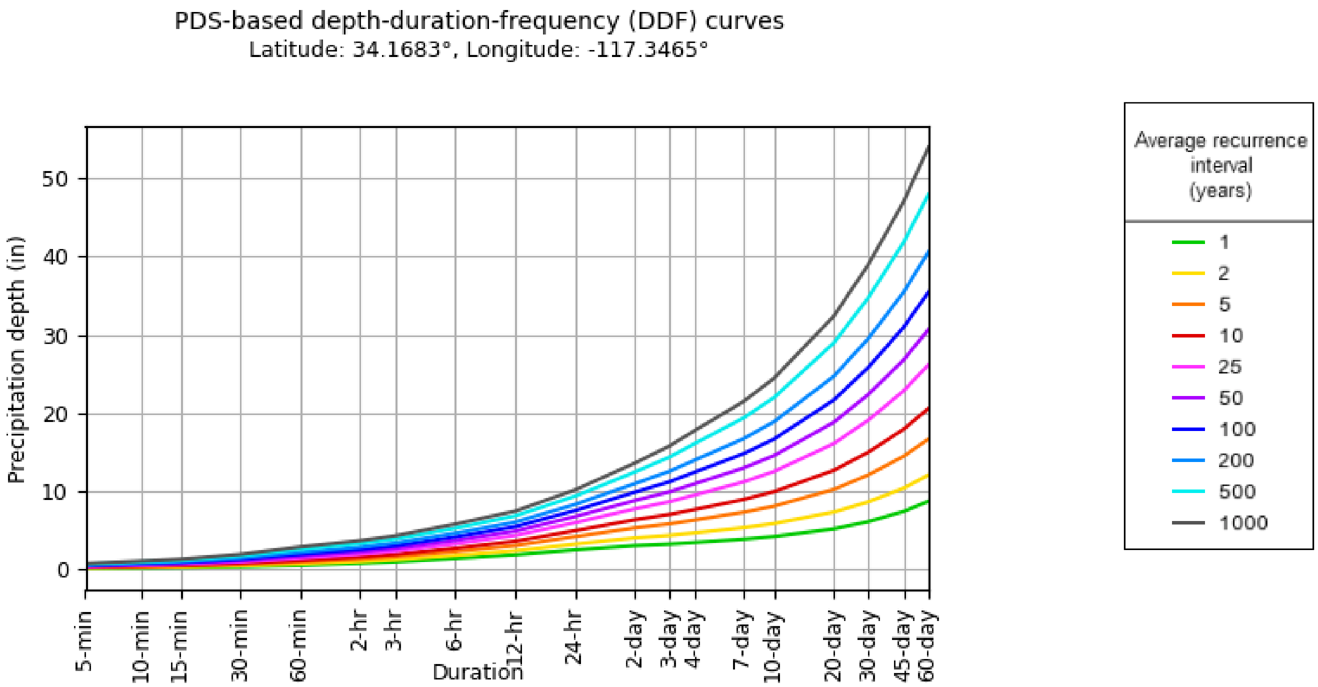
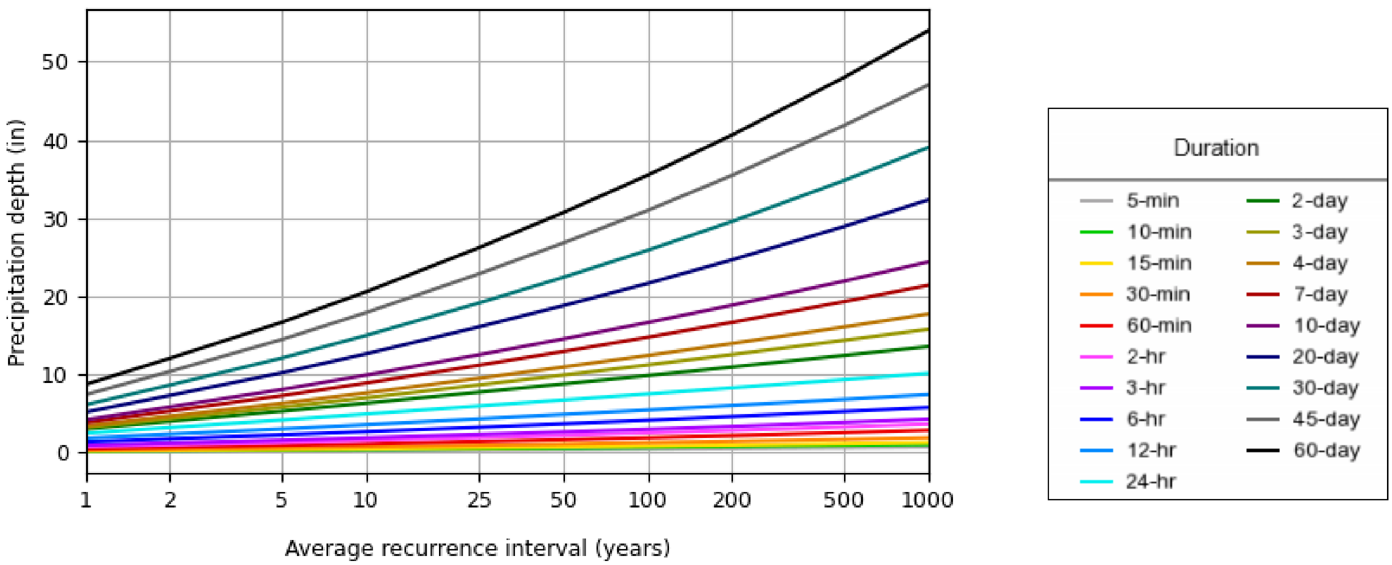
PF graphical





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Created (GMT): Wed Feb 28 15:35:38 2024

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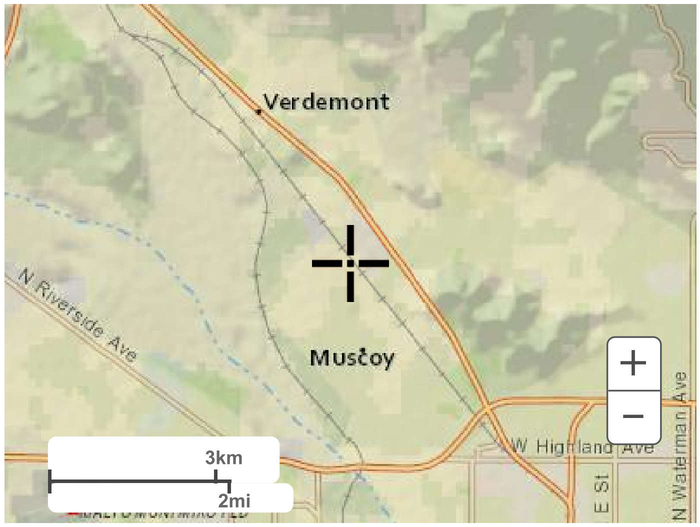
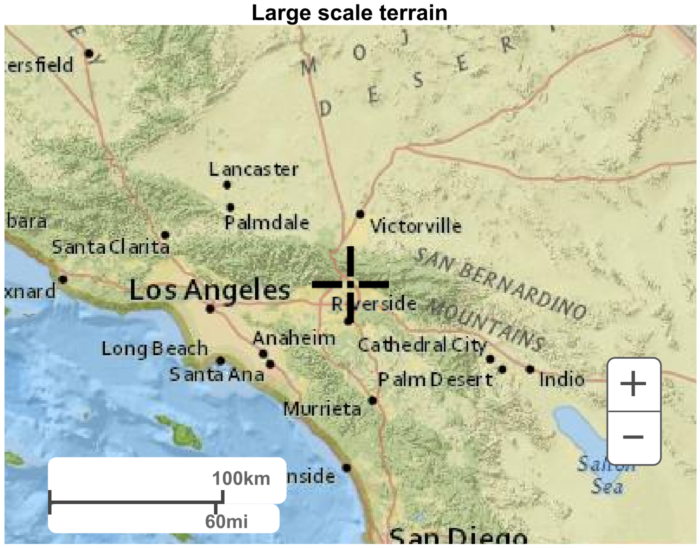
Maps & aerials

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

Disclaimer

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent.)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	25	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		77	86	91	94

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

Figure C-3 (1 of 2)

Curve (1) Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS (Continued)					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. All curve numbers are for Antecedent Moisture Condition (AMC) II.
2. Quality of cover definitions:

   Poor-Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.

   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.
3. See Figure C-2 for definition of cover types.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

CURVE NUMBERS FOR PERVIOUS AREAS

ACTUAL IMPERVIOUS COVER

Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent (2)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (3)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2 dwellings/acre	20 - 40	30
3-4 dwellings/acre	30 - 50	40
5-7 dwellings/acre	35 - 55	50
8-10 dwellings/acre	50 - 70	60
More than 10 dwellings/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions.

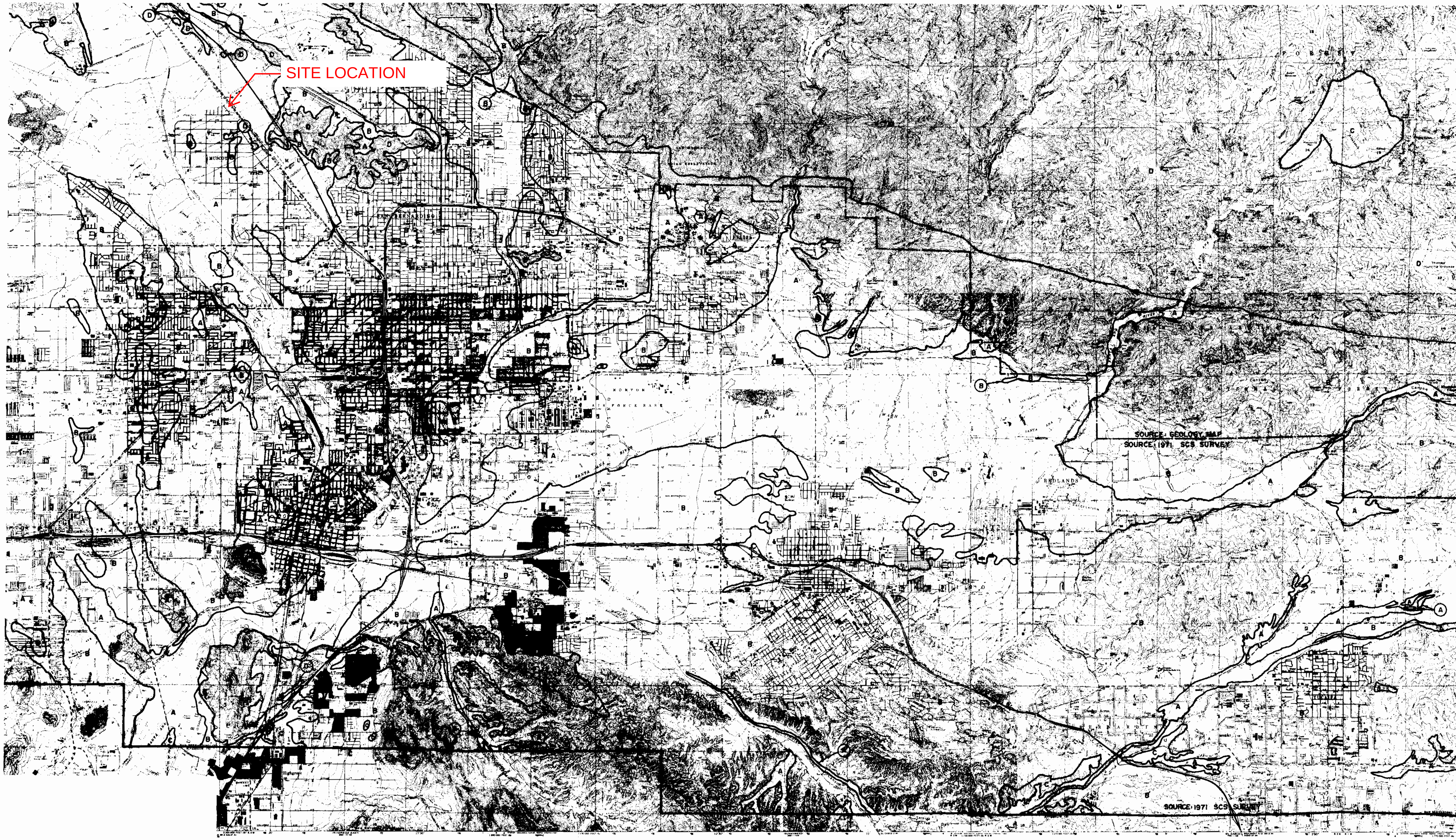
2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

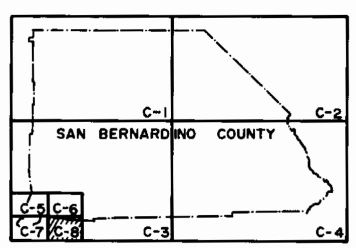
3. For typical equestrian subdivisions increase impervious area 5 percent over the values recommended in the table above.

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS





INDEX MAP

LEGEND

———	SOIL GROUP BOUNDARY
A	SOIL GROUP DESIGNATION
— · —	BOUNDARY OF INDICATED SOURCE

SCALE 1:48,000

SCALE REDUCED BY 1/2

SAN BERNARDINO COUNTY

HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-D AREA

FIGURE C-16

April 5, 2023

NOJ92, LLC
170 S Beverly Drive, #306
Beverly Hills, California 90212

Attention: Mr. Jack Luu
Principal

Project No.: **23G113-2**

Subject: **Results of Infiltration Testing**
Proposed Industrial Development
South Corner of Cajon Boulevard and June Street
Muscoy, California

Reference: Geotechnical Investigation, Proposed Industrial Development, South Corner of Cajon Boulevard and June Street. Muscoy (San Bernardino County), California, prepared by Southern California Geotechnical, Inc. (SCG), prepared for NOJ92, LLC, SCG Project No. 23G113-1, dated April 4, 2023.

Mr. Luu:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 23P159, dated February 24, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The subject site is located at the south corner of Cajon Boulevard and June Street in Muscoy, an unincorporated community in the county of San Bernardino, California. The site is bounded to the northeast by Cajon Boulevard, to the southeast and southwest by existing single-family residences (SFR) and to the northwest by June Street. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 of this report.

The site consists of a rectangular-shaped parcel, 4.67± acres in size and is presently vacant and undeveloped. Ground surface consists of dense native grass and weed growth with areas of exposed soil.

Detailed topographic information was provided on the site plan prepared by RA Smith. Based on this plan, the site topography ranges from 1501± feet mean sea level (msl) in the north corner to 1485± feet msl in the south corner. Overall, the site topography slopes gently to the southwest There is 16± feet of elevation differential across the site.

Proposed Development

Based on a conceptual site plan, prepared by SKH, the site will be developed with two (2) industrial buildings identified as Building 1 and Building 2. Building 1 will be 50,488± ft^2 in size, located in the north area of the site. Building 2 will be 39,829± ft^2 in size, located in the south area of the site. Dock-high doors will be constructed along portions one building wall of each of the buildings. The buildings are expected to be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete in the truck-court areas and limited areas of landscape planters throughout.

The proposed development will include on-site storm water infiltration. The infiltration systems will consist of three (3) below-grade chamber systems (identified as Infiltration Systems "A" through C" located in the southwestern area of the site. The bottoms of the infiltration systems will extend to 10± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site (referenced above). As part of this study, five (5) borings were advanced to depths of 10 to 25± feet below existing site grades.

Native alluvial soils were encountered at the ground surface at all of the boring locations. In general, the soils encountered at the boring locations consist of medium dense to very dense fine to coarse sands with varying fine to coarse gravel content, but some of the borings encountered loose to medium dense silty sands and sands in the upper 3 to 5± feet. Occasional cobbles were observed in the auger spoils during drilling, especially at depts greater than 3 to 5± feet. Native alluvium extends to at least the maximum depth explored of 25± feet below the existing site grades.

Groundwater was not encountered at any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet below existing site grades, at the time of the subsurface investigation.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of four (4) backhoe-excavated trenches, extending to a depth 10± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as Infiltration Trench Nos. I-1 through I-4) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Artificial fill soils were encountered at the ground surface at all of the infiltration test locations, extending to depths ranging from 1½ to 3± feet below existing site grades. The fill soils consist of medium dense silty fine sands, silty fine to medium sands, and silty fine to coarse sands with trace amounts of gravel. Based on review of historic aerial photographs, it appears that the fill soils were placed on-site in between 1938 and 1959 during a mass grading operation. Native alluvial soils were encountered beneath the fill soils at all of the infiltration test locations, extending to at least the maximum explored depth of 10± feet below existing site grades. The alluvium generally consists of dense fine to coarse sands, sandy fine to coarse gravels, and gravelly fine to coarse sands. Occasional to extensive cobbles and boulders were encountered in the alluvium. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

Groundwater was not encountered during excavation of any of the trenches and drilling of any of the borings during the concurrent geotechnical investigation. Based on the lack of any water within the borings and trenches, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet below existing site grades, at the time of the subsurface investigation.

As a part of our research, we reviewed available groundwater data in order to determine groundwater levels for the site. Recent water level data was obtained from the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well on record is located 1,845± feet northwest of the site. Water level readings within this monitoring well indicate a groundwater level 300± feet below the ground surface in December 2022.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration system that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at all of the trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 5-minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	**Depth (feet)**	**Soil Description**	**Measured Infiltration Rate (inches/hour)**
I-1	10	Light Brown Gravelly fine to coarse Sand, occasional Cobbles	20.0
I-2	10	Light Brown Sandy fine to coarse Gravel, occasional Cobbles, occasional Boulders	18.1
I-3	10	Brown Gravelly fine to coarse Sand, occasional Cobbles	21.0
I-4	10	Brown Gravelly fine to coarse Sand, occasional Cobbles	19.8

Design Recommendations

Four (4) infiltration tests were performed at the subject site. As noted above, the calculated infiltration rates at the infiltration test locations range from 18.1 to 21.0 inches per hour. Our recommendations are summarized below:

Infiltration Test Nos.	**Infiltration System**	**Location**	**Design Infiltration Rate (inches/hour)**
I-1	"A"	Northwest	20.0
I-2, I-3	"B"	West	18.1
I-4	"C"	Southwest	19.8

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration system to identify the soil classification at the base of the infiltration basin. It should be confirmed that the soils at the base of the proposed infiltration system corresponds with those presented in this report to ensure that the performance of the system will be consistent with the rates reported herein.

The design of storm water disposal systems should be performed by the project civil engineer, in accordance with the City of Muscoy and/or County of San Bernardino guidelines. It is recommended any such systems be designed and constructed to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the flow rates through the system. It should be noted that the recommended infiltration rates are based on infiltration testing at four (4) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Infiltration Rate Considerations

The infiltration rates presented herein was determined in accordance with the Riverside County guidelines and are considered valid only for the time and place of the actual test. Varying subsurface conditions will exist in other areas of the site, which could alter the recommended infiltration rates presented above. The infiltration rates will decline over time between maintenance cycles as silt or clay particles accumulate on the BMP surface. The infiltration rate is highly dependent upon a number of factors, including density, silt and clay content, grainsize distribution throughout the range of particle sizes, and particle shape. Small changes in these factors can cause large changes in the infiltration rates.

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the basins. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. It should be confirmed that the soils at the base of the proposed infiltration systems correspond with those presented in this report to ensure that the performance of the systems will be consistent with the rates reported herein.

We recommend that scrapers and other rubber-tired heavy equipment not be operated on the basin bottom, or at levels lower than 2 feet above the bottom of the system, particularly within basins. As such, the bottom 24 inches of the infiltration systems should be excavated with non-rubber-tired equipment, such as excavators.

Chamber Maintenance

The proposed project may include below-grade infiltration chambers. Water flowing into these chambers will carry some level of sediment. This layer has the potential to significantly reduce the infiltration rate of the basin subgrade soils. Therefore, a formal chamber maintenance program should be established to ensure that these silt and clay deposits are removed from the chamber on a regular basis.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rates contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between trench locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

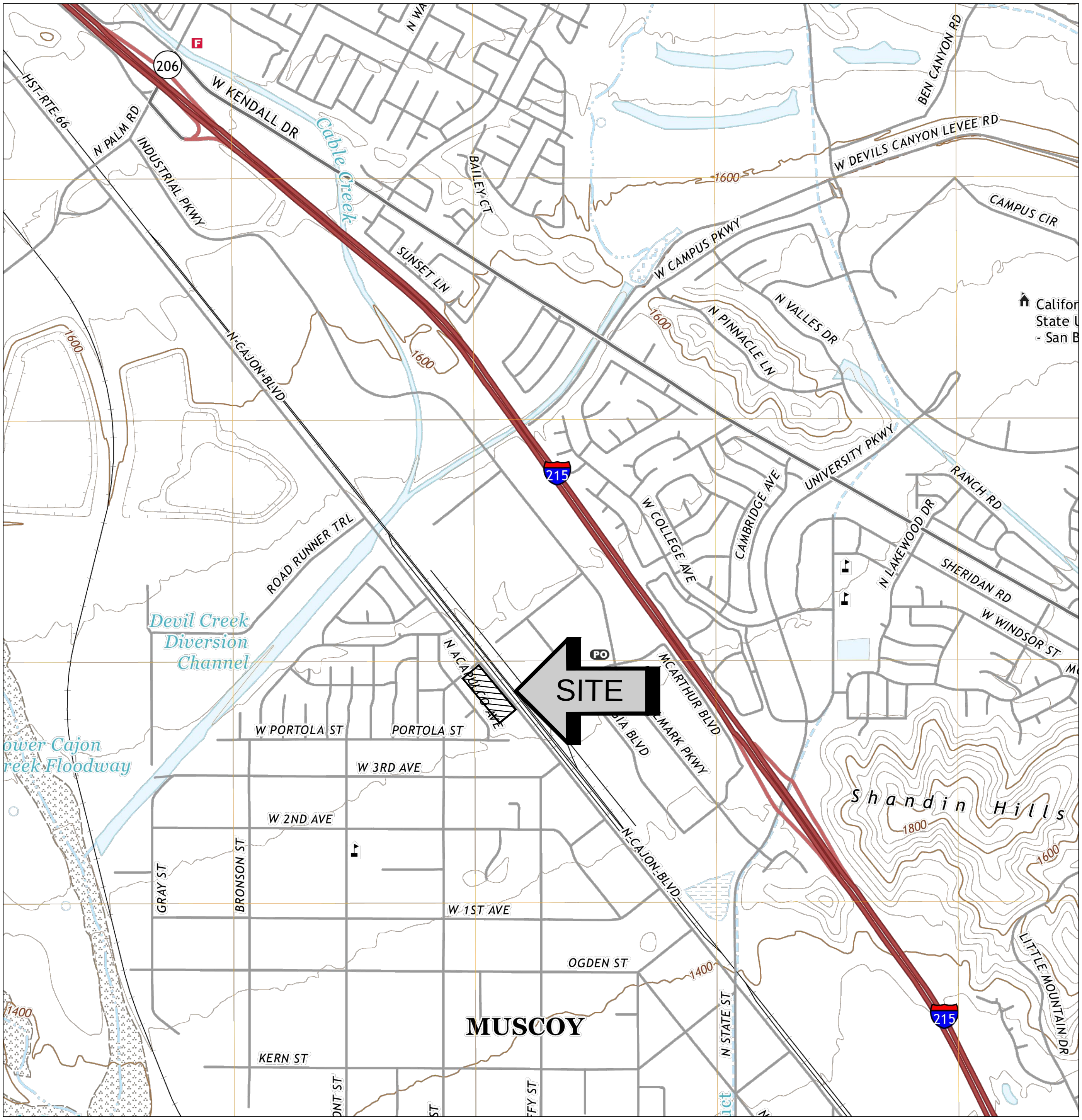
Ryan Bremer
Staff Geologist

REGISTERED PROFESSIONAL ENGINEER
ROBERT TRAZO
No. 2655
GEOTECHNICAL
STATE OF CALIFORNIA

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1: Site Location Map
Plate 2: Infiltration Test Location Plan
Trench Log Legend and Logs (6 pages)
Infiltration Test Results Spreadsheets (4 pages)
Grainsize Distribution Graphs (4 pages)



SOURCE: USGS TOPOGRAPHIC MAPS OF SAN BERNARDINO NORTH QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP

PROPOSED INDUSTRIAL DEVELOPMENT

MUSCOY, CALIFORNIA

SCALE: 1" = 2000'

DRAWN: RB
CHKD: RGT

SCG PROJECT
23G113-2

PLATE 1

SoCalGeo

SOUTHERN
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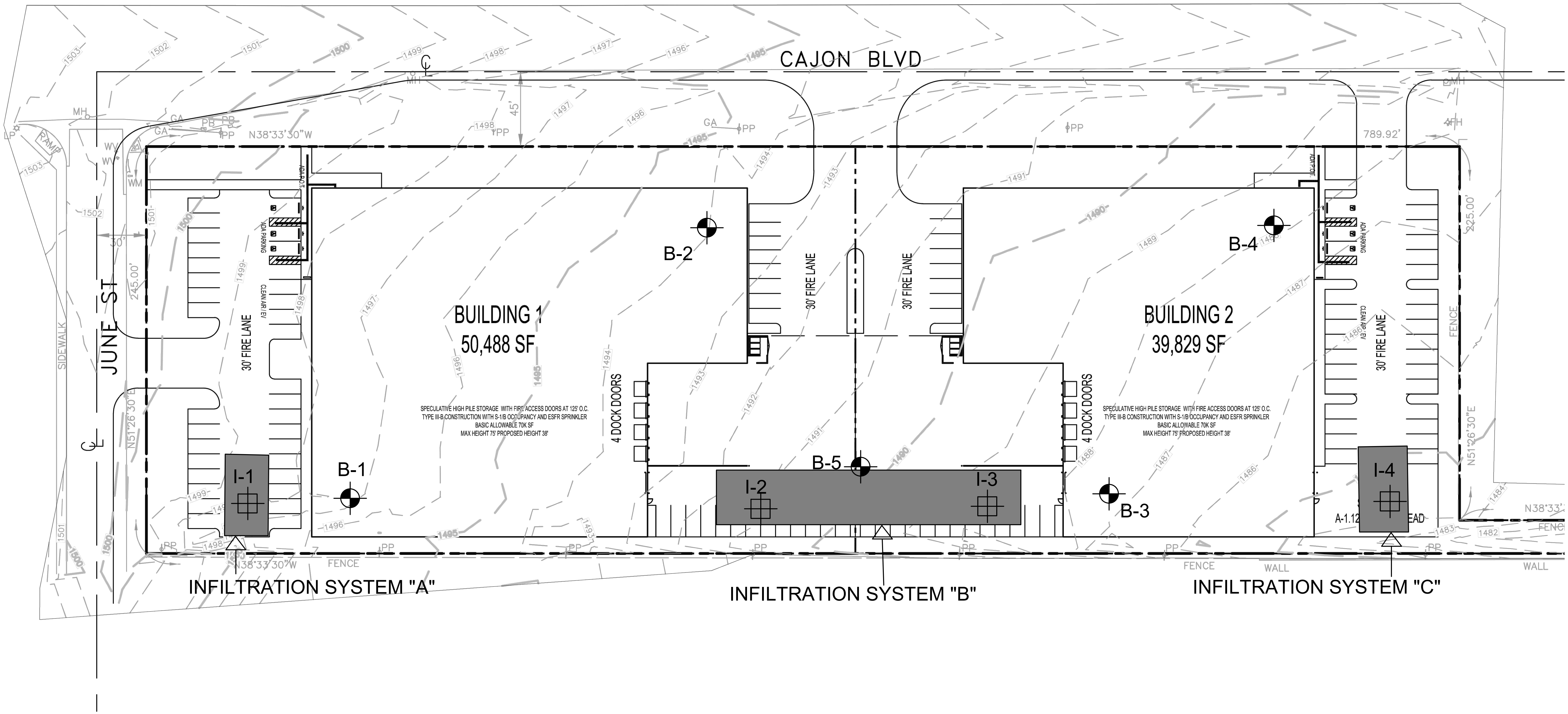


GEOTECHNICAL LEGEND

APPROXIMATE INFILTRATION TEST LOCATION

APPROXIMATE BORING LOCATION
(SCG PROJECT NO. 22G213-1)

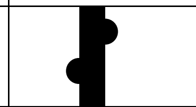
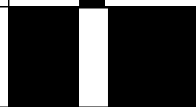
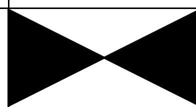
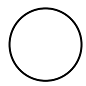
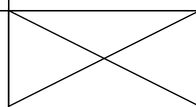
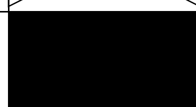
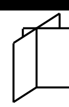
NOTE: SITE PLAN PROVIDED BY RA SMITH, INC.

INFILTRATION TEST LOCATION PLAN
PROPOSED INDUSTRIAL DEVELOPMENT
MUSCOY, CALIFORNIA

SCALE: 1" = 60'
DRAWN: RB
CHKD: RGT
SCG PROJECT 23G113-2
PLATE 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

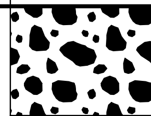
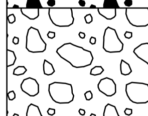
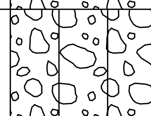
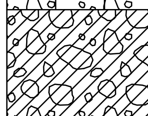
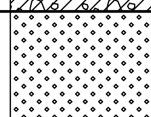
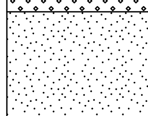
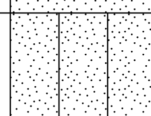
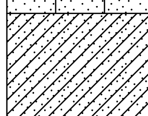
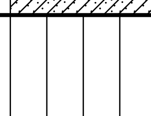
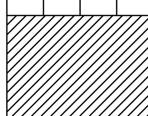
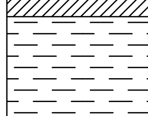
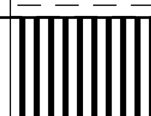
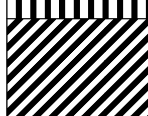
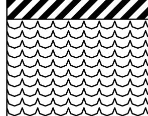
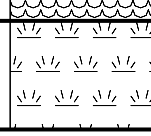
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
SoCalGeo
A California Corporation

TRENCH NO. I-1

JOB NO.: 23G113-2
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

EXCAVATION DATE: 3/13/23
EXCAVATION METHOD: Backhoe
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Dark Brown Silty fine to medium Sand, trace to little coarse Sand, trace fine to coarse Gravel, little fine root fibers, medium dense-moist							
5					ALLUVIUM: Light Brown Gravelly fine to coarse Sand, occasional Cobbles, dense-damp							
10							5			2		
					Trench Terminated at 10'							

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-2

JOB NO.: 23G113-2
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

EXCAVATION DATE: 3/13/23
EXCAVATION METHOD: Backhoe
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Dark Brown Silty fine to coarse Sand, trace to little fine to coarse Gravel, little fine root fibers, medium dense-moist							
5					ALLUVIUM: Light Brown Sandy fine to coarse Gravel, occasional Cobbles, occasional Boulders, dense-damp							
10							4			2		
					Trench Terminated at 10'							

TBL 23G113-2.GPJ SOCALGEO.GDT 4/5/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-3

JOB NO.: 23G113-2
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

EXCAVATION DATE: 3/13/23
EXCAVATION METHOD: Backhoe
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand, trace medium to coarse Sand, trace fine to coarse Gravel, little fine root fibers, medium dense-moist							
					ALLUVIUM: Brown Gravelly fine to coarse Sand, occasional Cobbles, dense-damp							
5												
	(hand sample)						6			2		
10												
					Trench Terminated at 10'							

TBL 23G113-2.GPJ SOCALGEO.GDT 4/5/23

TEST TRENCH LOG **PLATE B-3**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-4

JOB NO.: 23G113-2
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

EXCAVATION DATE: 3/13/23
EXCAVATION METHOD: Backhoe
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					FILL: Brown Silty fine to medium Sand, trace coarse Sand, trace fine to coarse Gravel, medium dense-damp							
5					ALLUVIUM: Light Brown fine to coarse Sand, trace to little fine to coarse Gravel, occasional Cobbles, dense-damp							
10					Brown Gravelly fine to coarse Sand, occasional Cobbles, dense-damp		3			2		
					Trench Terminated at 10'							

TBL 23G113-2.GPJ SOCALGEO.GDT 4/5/23

TEST TRENCH LOG

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Muscoy, California
Project Number	23G113-2
Engineer	Ryan Bremer

Infiltration Test No: I-1

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Spac	2	2.356	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	10:06 AM	5	0	3550	0	10400	58.39	57.01	22.99	22.45
	Final	10:11 AM	**5**	3550		10400					
2	Initial	10:13 AM	5	0	3450	0	10600	56.74	58.11	22.34	22.88
	Final	10:18 AM	**10**	3450		10600					
3	Initial	10:20 AM	5	0	3300	0	10500	54.27	57.56	21.37	22.66
	Final	10:25 AM	**15**	3300		10500					
4	Initial	10:26 AM	5	0	3350	0	10600	55.10	58.11	21.69	22.88
	Final	10:31 AM	**20**	3350		10600					
5	Initial	10:36 AM	5	0	3300	0	10400	54.27	57.01	21.37	22.45
	Final	10:41 AM	**25**	3300		10400					
6	Initial	10:42 AM	5	0	3300	0	10100	54.27	55.37	21.37	21.80
	Final	10:47 AM	**30**	3300		10100					
7	Initial	10:50 AM	5	0	3200	0	9800	52.63	53.73	20.72	21.15
	Final	10:55 AM	**35**	3200		9800					
8	Initial	10:57 AM	5	0	3150	0	9900	51.81	54.27	20.40	21.37
	Final	11:02 AM	**40**	3150		9900					
9	Initial	11:04 AM	5	0	3150	0	9800	51.81	53.73	20.40	21.15
	Final	11:09 AM	**45**	3150		9800					
10	Initial	11:10 AM	5	0	3150	0	9700	51.81	53.18	20.40	20.94
	Final	11:15 AM	**50**	3150		9700					
11	Initial	11:17 AM	5	0	3100	0	9600	50.98	52.63	20.07	20.72
	Final	11:22 AM	**55**	3100		9600					
12	Initial	11:25 AM	5	0	3100	0	9500	50.98	52.08	20.07	20.50
	Final	11:30 AM	**60**	3100		9500					

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Muscoy, California
Project Number	23G113-2
Engineer	Ryan Bremer

Infiltration Test No	I-2

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Spac	2	2.356	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:17 AM	5	0	3200	0	9900	52.63	54.27	20.72	21.37
	Final	8:22 AM	**5**	3200		9900					
2	Initial	8:24 AM	5	0	3200	0	10000	52.63	54.82	20.72	21.58
	Final	8:29 AM	**10**	3200		10000					
3	Initial	8:30 AM	5	0	3100	0	10100	50.98	55.37	20.07	21.80
	Final	8:35 AM	**15**	3100		10100					
4	Initial	8:37 AM	5	0	3150	0	9900	51.81	54.27	20.40	21.37
	Final	8:42 AM	**20**	3150		9900					
5	Initial	8:44 AM	5	0	3100	0	10000	50.98	54.82	20.07	21.58
	Final	8:49 AM	**25**	3100		10000					
6	Initial	8:50 AM	5	0	3000	0	9800	49.34	53.73	19.43	21.15
	Final	8:55 AM	**30**	3000		9800					
7	Initial	8:58 AM	5	0	3000	0	9400	49.34	51.53	19.43	20.29
	Final	9:03 AM	**35**	3000		9400					
8	Initial	9:05 AM	5	0	2950	0	9600	48.52	52.63	19.10	20.72
	Final	9:10 AM	**40**	2950		9600					
9	Initial	9:11 AM	5	0	2900	0	9400	47.70	51.53	18.78	20.29
	Final	9:16 AM	**45**	2900		9400					
10	Initial	9:18 AM	5	0	2800	0	9500	46.05	52.08	18.13	20.50
	Final	9:23 AM	**50**	2800		9500					
11	Initial	9:25 AM	5	0	2850	0	9300	46.87	50.98	18.45	20.07
	Final	9:30 AM	**55**	2850		9300					
12	Initial	9:32 AM	5	0	2800	0	9300	46.05	50.98	18.13	20.07
	Final	9:37 AM	**60**	2800		9300					

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Muscoy, California
Project Number	23G113-2
Engineer	Ryan Bremer

Infiltration Test No: I-3

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Spac	2	2.356	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	10:24 AM	5	0	3800	0	11800	62.50	64.69	24.61	25.47
	Final	10:29 AM	**5**	3800		11800					
2	Initial	10:30 AM	5	0	3800	0	11600	62.50	63.59	24.61	25.04
	Final	10:35 AM	**10**	3800		11600					
3	Initial	10:37 AM	5	0	3800	0	11600	62.50	63.59	24.61	25.04
	Final	10:42 AM	**15**	3800		11600					
4	Initial	10:44 AM	5	0	3750	0	11600	61.67	63.59	24.28	25.04
	Final	10:49 AM	**20**	3750		11600					
5	Initial	10:50 AM	5	0	3600	0	11700	59.21	64.14	23.31	25.25
	Final	10:55 AM	**25**	3600		11700					
6	Initial	10:57 AM	5	0	3650	0	11700	60.03	64.14	23.63	25.25
	Final	11:02 AM	**30**	3650		11700					
7	Initial	11:04 AM	5	0	3450	0	11600	56.74	63.59	22.34	25.04
	Final	11:09 AM	**35**	3450		11600					
8	Initial	11:11 AM	5	0	3400	0	11500	55.92	63.05	22.02	24.82
	Final	11:16 AM	**40**	3400		11500					
9	Initial	11:17 AM	5	0	3300	0	11600	54.27	63.59	21.37	25.04
	Final	11:22 AM	**45**	3300		11600					
10	Initial	11:24 AM	5	0	3350	0	11500	55.10	63.05	21.69	24.82
	Final	11:29 AM	**50**	3350		11500					
11	Initial	11:30 AM	5	0	3300	0	11400	54.27	62.50	21.37	24.61
	Final	11:35 AM	**55**	3300		11400					
12	Initial	11:38 AM	5	0	3250	0	11200	53.45	61.40	21.04	24.17
	Final	11:43 AM	**60**	3250		11200					

INFILTRATION CALCULATIONS

Project Name	Proposed Industrial Development
Project Location	Muscoy, California
Project Number	23G113-2
Engineer	Ryan Bremer

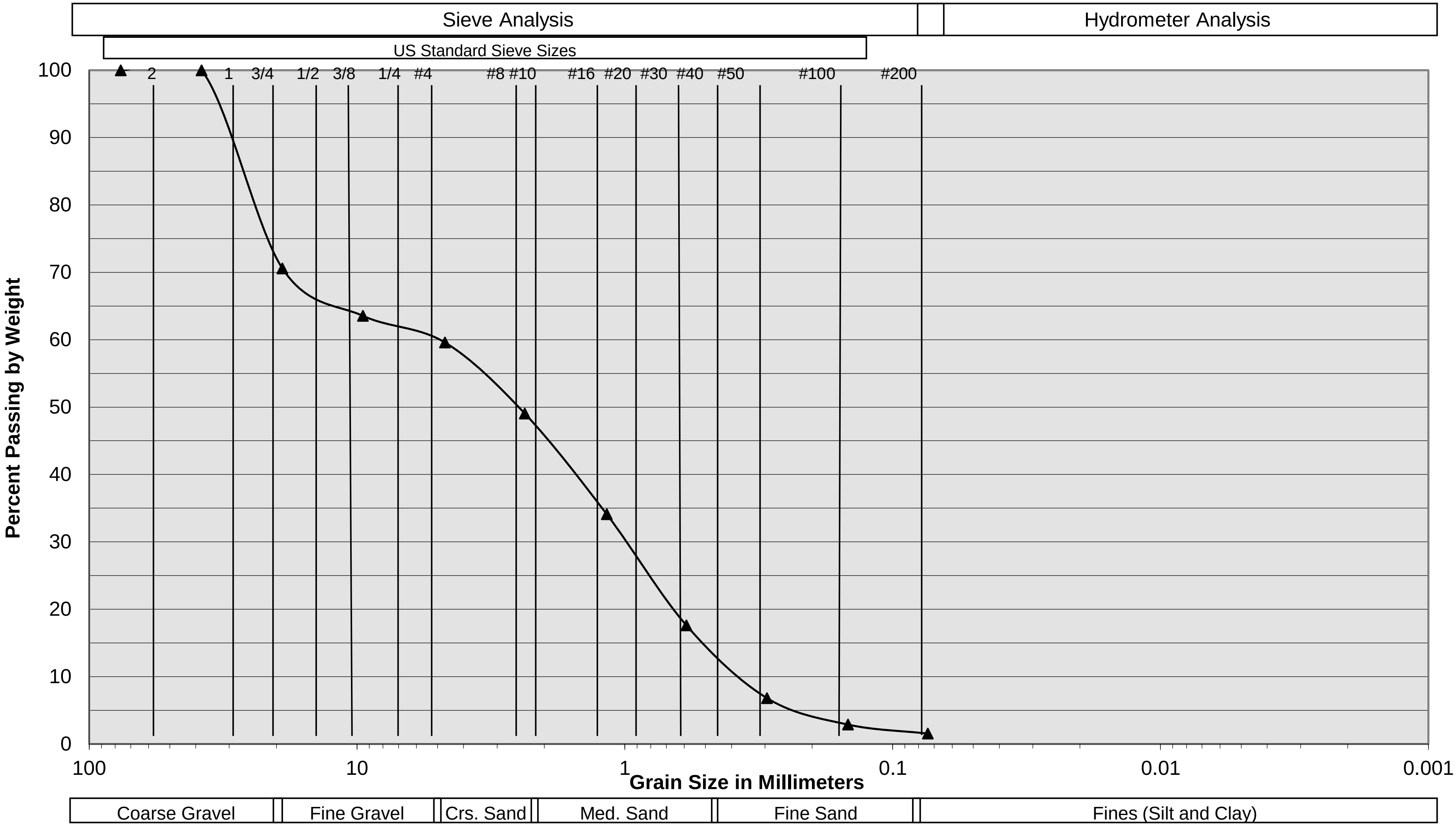
Infiltration Test No: I-4

Constants	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.785	730
Anlr. Spac	2	2.356	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	8:34 AM	5	0	4000	0	12400	65.79	67.98	25.90	26.76
	Final	8:39 AM	**5**	4000		12400					
2	Initial	8:40 AM	5	0	3800	0	12300	62.50	67.43	24.61	26.55
	Final	8:45 AM	**10**	3800		12300					
3	Initial	8:47 AM	5	0	4000	0	12200	65.79	66.88	25.90	26.33
	Final	8:52 AM	**15**	4000		12200					
4	Initial	8:54 AM	5	0	3800	0	12000	62.50	65.79	24.61	25.90
	Final	8:59 AM	**20**	3800		12000					
5	Initial	9:01 AM	5	0	3600	0	12000	59.21	65.79	23.31	25.90
	Final	9:06 AM	**25**	3600		12000					
6	Initial	9:08 AM	5	0	3300	0	11700	54.27	64.14	21.37	25.25
	Final	9:13 AM	**30**	3300		11700					
7	Initial	9:15 AM	5	0	3000	0	11200	49.34	61.40	19.43	24.17
	Final	9:20 AM	**35**	3000		11200					
8	Initial	9:21 AM	5	0	3000	0	10800	49.34	59.21	19.43	23.31
	Final	9:26 AM	**40**	3000		10800					
9	Initial	9:31 AM	5	0	3100	0	10600	50.98	58.11	20.07	22.88
	Final	9:36 AM	**45**	3100		10600					
10	Initial	9:39 AM	5	0	3000	0	10500	49.34	57.56	19.43	22.66
	Final	9:44 AM	**50**	3000		10500					
11	Initial	9:45 AM	5	0	3000	0	10700	49.34	58.66	19.43	23.09
	Final	9:50 AM	**55**	3000		10700					
12	Initial	9:52 AM	5	0	3050	0	10400	50.16	57.01	19.75	22.45
	Final	9:57 AM	**60**	3050		10400					

Grain Size Distribution

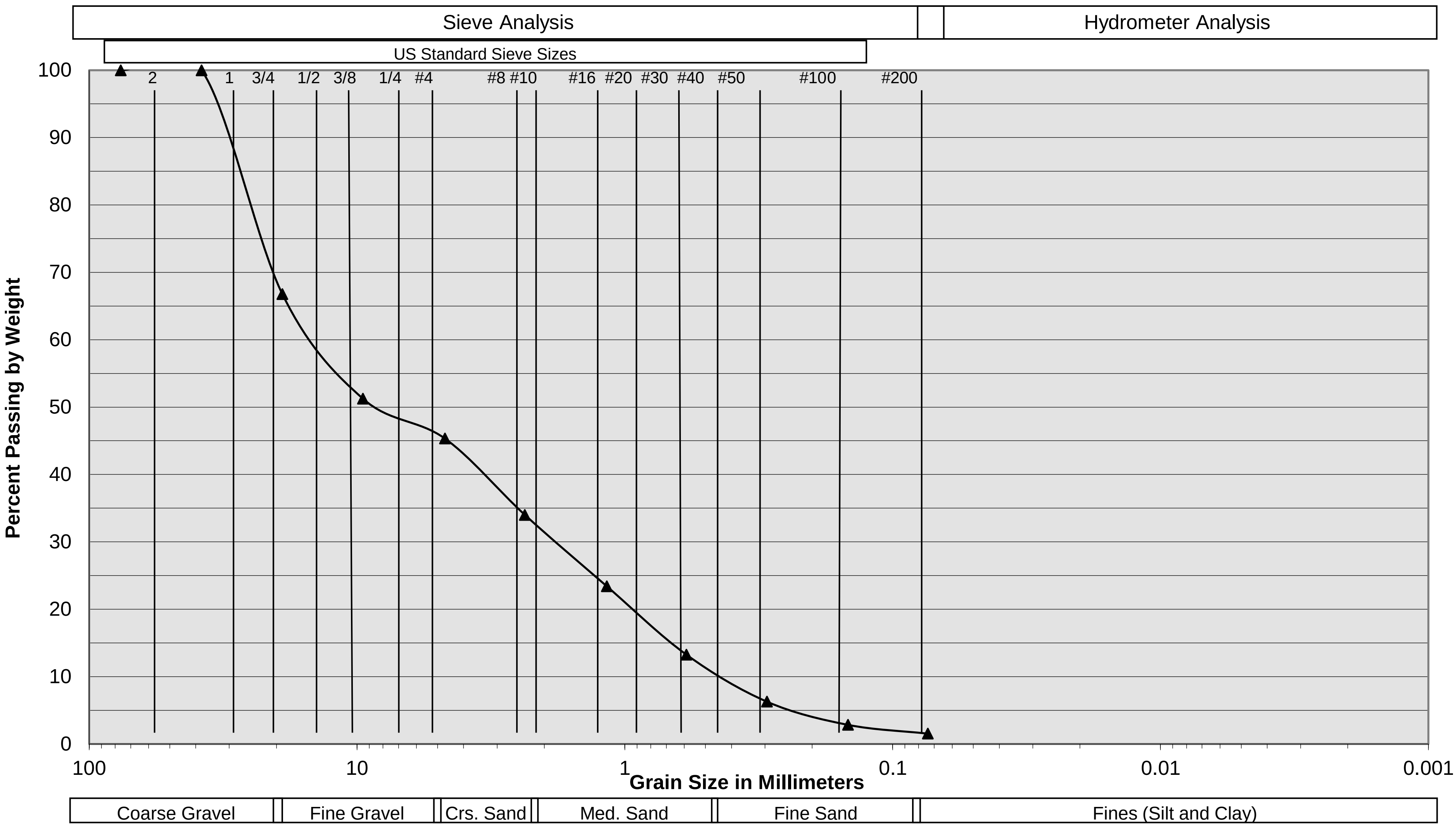


Sample Description	I-1 @ 9 to 10 feet
Soil Classification	Light Brown Gravelly fine to coarse Sand

Proposed Industrial Development
Muscoy, California
Project No. 23G113-2
PLATE C- 1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

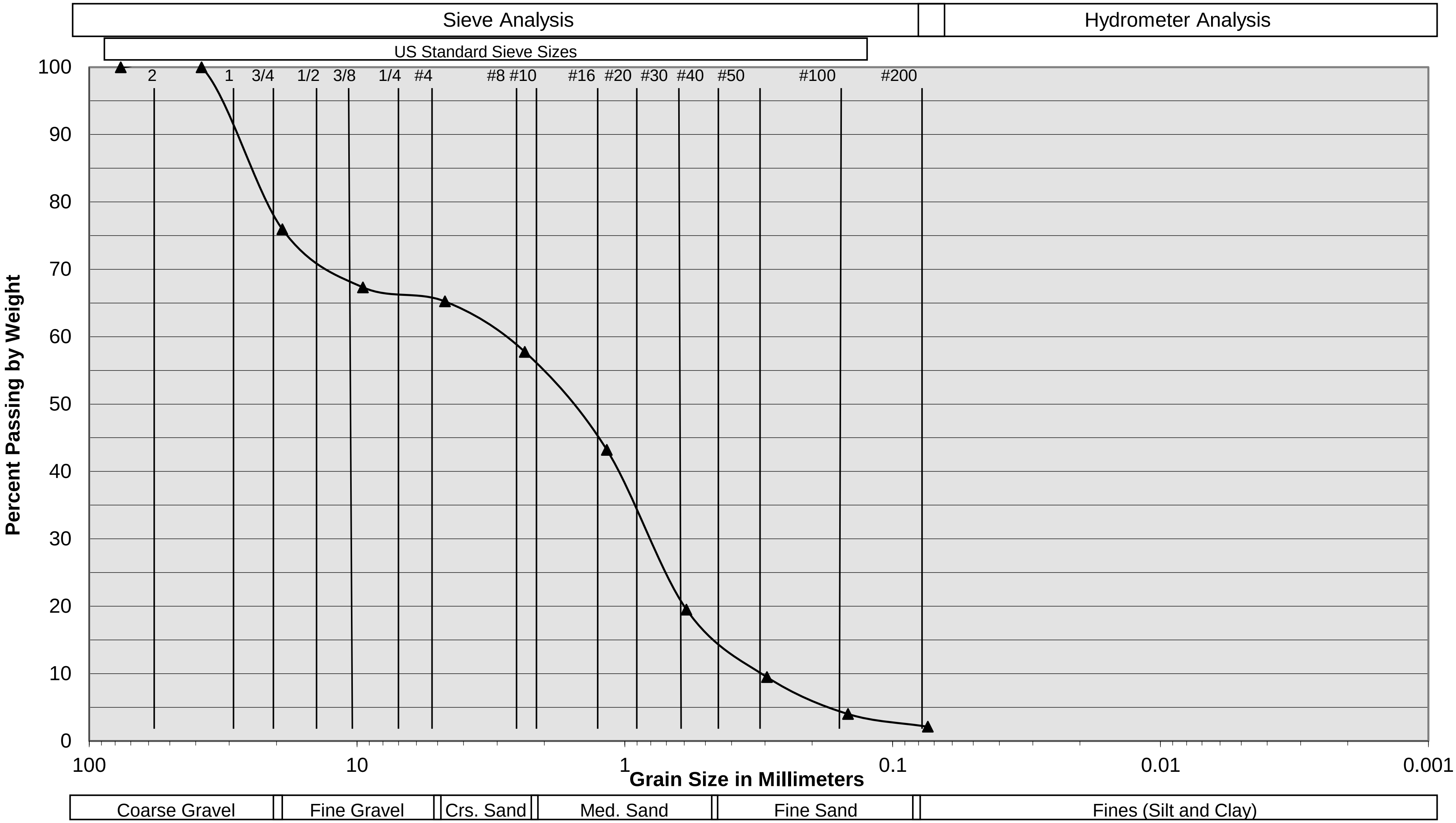


Sample Description	I-2 @ 9 to 10 feet
Soil Classification	Light Brown Sandy fine to coarse Gravel

Proposed Industrial Development
Muscoy, California
Project No. 23G113-2
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

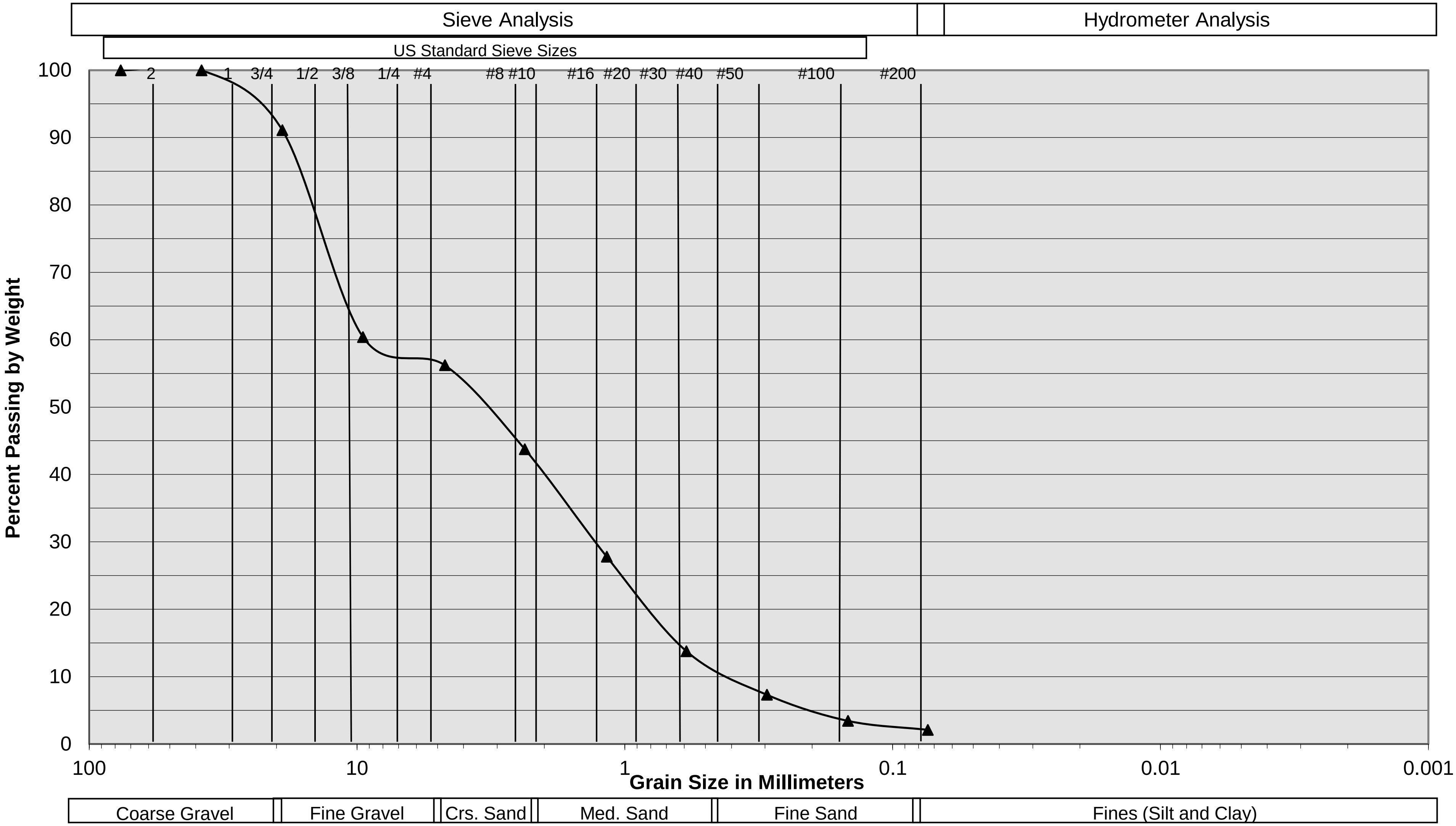


Sample Description	I-3 @ 9 to 10 feet
Soil Classification	Brown Gravelly fine to coarse Sand

Proposed Industrial Development
Muscoy, California
Project No. 23G113-2
PLATE C- 3

SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 9 to 10 feet
Soil Classification	Brown Gravelly fine to coarse Sand

Proposed Industrial Development
Muscoy, California
Project No. 23G113-2
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

GEOTECHNICAL INVESTIGATION
PROPOSED INDUSTRIAL DEVELOPMENT

South Corner of Cajon Boulevard and June Street
Muscoy (San Bernardino County), California
for
NOJ92, LLC

SoCalGeo
SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

April 4, 2023

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

NOJ92, LLC
170 S Beverly Drive, #306
Beverly Hills, California 90212

Attention: Mr. Jack Luu
Principal

Project No.: **23G113-1**

Subject: **Geotechnical Investigation**
Proposed Industrial Development
South Corner of Cajon Boulevard and June Street
Muscoy (San Bernardino County), California

Mr. Luu:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

REGISTERED PROFESSIONAL ENGINEER
DANIEL W. NIELSEN
No. 3166
GEOTECHNICAL
STATE OF CALIFORNIA

Daniel W. Nielsen, GE 3166
Senior Engineer

REGISTERED PROFESSIONAL ENGINEER
ROBERT TRAZO
No. 2655
GEOTECHNICAL
STATE OF CALIFORNIA

Robert G. Trazo, M.Sc., GE 2655
Principal Engineer

Distribution: (1) Addressee

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Site Preparation Recommendations

- Initial site preparation should include stripping of any surficial vegetation. The surficial vegetation and any organic soils should be properly disposed of off-site.
- Remedial grading is recommended to be performed within the proposed building areas, in order to remove the upper portion of the near-surface native alluvial soils. The soils within the proposed building pad areas should be overexcavated to a depth of 3 feet below existing grade and to a depth of at least 3 feet below proposed building pad subgrade elevations, whichever is greater. The proposed foundation influence zones should be overexcavated to a depth of at least 2 feet below proposed foundation bearing grade.
- Following completion of the overexcavation, the exposed soils should be scarified to a depth of at least 12 inches and thoroughly moisture treated to 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The previously excavated soils may then be replaced as compacted structural fill.
- Most of the soils encountered at the boring locations are dry of the optimum moisture content for recompaction. Sandy soils should be thoroughly flooded/moisture conditioned to achieve and maintain the recommended moisture content of 0 to 4 percent above the optimum moisture content.
- Some of the on-site soils contain significant amounts of oversized materials, including cobbles, especially at depths greater than 3 to 4± feet. Where grading will require excavation into these materials, selectively grading cobble-containing soils during rough grading may help facilitate future excavation for foundations and utilities by removing the cobbles and placing them in areas of deeper fills.
- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundation Recommendations

- Spread footing foundations, supported in newly placed structural fill soils.
- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Reinforcement consisting of at least four (4) No. 5 rebars (2 top and 2 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab Recommendations

- Conventional slabs-on-grade, at least 6 inches thick
- Modulus of subgrade reaction: k = 150 psi/in
- Reinforcement is not considered to be necessary for geotechnical considerations.
- The actual thickness and reinforcement of the floor slabs should be determined by the structural engineer, based on the imposed slab loading.

Pavements

ASPHALT PAVEMENTS (R=50)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	3	4	5	5	7
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI =7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 23P159, dated February 24, 2023. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slabs, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The subject site is located at the south corner of Cajon Boulevard and June Street in Muscoy, an unincorporated community in the county of San Bernardino, California. The site is bounded to the northeast by Cajon Boulevard, to the southeast and southwest by existing single-family residences (SFR) and to the northwest by June Street. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The site consists of a rectangular-shaped parcel, 4.67± acres in size and is presently vacant and undeveloped. Ground surface consists of dense native grass and weed growth with areas of exposed soil.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the site topography gently slopes downward to the southwest at a gradient of 2± percent. There appears to be approximately 15± feet of elevation differential throughout the subject site.

3.2 Proposed Development

Based on a conceptual site plan, prepared by SKH, the site will be developed with two (2) industrial buildings identified as Building 1 and Building 2. Building 1 will be 50,488± ft^2 in size, located in the north area of the site. Building 2 will be 39,829± ft^2 in size, located in the south area of the site. Dock-high doors will be constructed along portions one building wall of each of the buildings. The buildings are expected to be surrounded by asphaltic concrete pavements in the parking and drive areas, Portland cement concrete in the truck-court areas and limited areas of landscape planters throughout.

Detailed structural information has not been provided. We assume that the new buildings will be single-story structures of concrete tilt-up construction, typically supported on conventional shallow foundation systems with concrete slab-on-grade floors. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below-grade construction, such as crawl spaces or new basements, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills up to 5 to 6± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of five (5) borings advanced to depths of 10 to 25± feet below the existing site grades. Boring No. B-1, was terminated due to auger refusal conditions at a depth of about 10± feet, which was shallower than the intended depth of about 20 to 25± feet. We expect that the auger refusal conditions encountered at Boring No. B-1 were likely due to the presence of cobbles and boulders, based on the conditions encountered during subsurface exploration (discussed below). All of the borings were logged during the drilling by members of our staff.

In addition to the five borings, 4 trenches were excavated to a depth of 10± feet at the site as a part of a concurrent infiltration testing program. The exploration logs and the results of the infiltration testing will be presented in a separate report.

The borings were advanced with hollow-stem augers, by a truck-mounted drilling rig. Representative bulk and undisturbed soil samples were taken during drilling. Relatively undisturbed samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. Samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Native Alluvium

Native alluvial soils were encountered at the ground surface at all of the boring locations. In general, the soils encountered at the boring locations consist of medium dense to very dense fine to coarse sands with varying fine to coarse gravel content, but some of the borings encountered loose to medium dense silty sands and sands in the upper 3 to 5± feet. Occasional cobbles were observed in the auger spoils during drilling, especially at depts greater than 3 to 5± feet. One of the trenches excavated for the concurrent infiltration testing program encountered a boulder, about 1± foot in diameter at a depth of about 9 to 10± feet. (As discussed above, the trench logs and results of testing for this concurrent study will be presented in a separate report). Native alluvium extends to at least the maximum depth explored of 25± feet below the existing site grades.

Groundwater

Groundwater was not encountered during the drilling of any of the borings. Based on the moisture contents of the recovered soil samples, the depth of the static groundwater table is expected to be greater than the maximum explored depth of 25± feet below existing site grades.

As a part of our research, we reviewed available groundwater data in order to determine groundwater levels for the site. Recent water level data was obtained from the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. The nearest monitoring well on record is located 1,845± feet northwest of the site. Water level readings within this monitoring well indicate a groundwater level 300± feet below the ground surface in December 2022.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. The field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

Selected soil samples were tested to determine their consolidation potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-7 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557 and are presented on Plate C-8 in Appendix C of this report. This test is generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Soluble Sulfates

Representative samples of the near-surface soils were submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	Sulfate Classification
B-2 @ 1 to 5 feet	0.0012	Not Applicable (S0)
B-4 @ 1 to 5 feet	0.0005	Not Applicable (S0)

Corrosivity Testing

Two representative samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory for determination of electrical resistivity, pH, and chloride concentrations as well as other components. The resistivity of the soils is a measure of their potential to attack buried metal improvements such as utility lines. The results of some of these tests are presented below.

Sample Identification	Minimum Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)	Sulfides (mg/kg)	Redox Potential (mV)
B-2 @ 1 to 5 feet	29,480	7.6	11.2	1.3	0.2	122
B-4 @ 1 to 5 feet	30,820	7.8	4.9	0.8	0.6	111

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site-specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structure should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. In addition, our review of the Riverside County RCIT GIS website indicates that the site is not located within a Riverside County fault zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low Therefore, the possibility of significant fault rupture on the site is considered to be low.

Seismic Design Parameters

The 2022 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site. Based on the anticipated adoption of the 2022 California Building Code (CBC) on January 1, 2023, we expect that the proposed development will be designed in accordance with the 2022 CBC.

The 2022 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-16, upon which the 2022 CBC is based. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The table below was created using data obtained from the application. The output generated from this program is attached to this letter.

The 2022 CBC states that for Site Class D sites with a mapped S1 value greater than 0.2, a site-specific ground motion analysis may be required in accordance with Section 11.4.8 of ASCE 7-16. Supplement 3 to ASCE 7-16 modifies Section 11.4.8 of ASCE 7-16 and states that "a ground motion hazard analysis is not required where the value of the parameter SM1 determined by Eq. (11.4-2) is increased by 50% for all applications of SM1 in this Standard. The resulting value of the parameter SD1 determined by Eq. (11.4-4) shall be used for all applications of SD1 in this Standard."

The seismic design parameters presented in the table below were calculated using the site coefficients (Fa and Fv) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2022 CBC. It should be noted that the site coefficient Fv and the parameters SM1 and SD1 were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the ASCE 7-16 standard. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2022 CBC using the value of S1 obtained from the Seismic Design Maps Tool. **The values of SM1 and SD1 tabulated below** were evaluated using equations 11.4-2 and 11.4-4 of ASCE 7-16 (Equations 16-20 and 16-23, respectively, of the 2022 CBC) and **do not include a 50 percent increase.** As discussed above, if a ground motion hazard analysis has not been performed, SM1 and SD1 must be increased by 50 percent for all applications with respect to ASCE 7-16.

2022 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	2.269
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.916
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	2.269
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	1.557*
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.513
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	1.038*

*Note: These values must be increased by 50 percent if a site-specific ground motion hazard analysis has not been performed. However, this increase is not expected to affect the design of the structure type proposed for this site. This assumption should be confirmed by the project structural engineer. The values presented in the table above do not include a 50-percent increase.

Liquefaction

Liquefaction is the loss of the strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and grain size characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Clayey (cohesive) soils or soils which possess clay particles (d<0.005mm) in excess of 20 percent (Seed and Idriss, 1982) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The California Geological Survey (CGS) has not yet conducted detailed seismic hazards mapping in the area of the subject site. The general liquefaction susceptibility of the site was determined by research of the San Bernardino County Official Land Use Plan, General Plan, Geologic Hazard Overlay Map FH22C San Bernardino N Quadrangle, which indicates that the subject site is not located within an area of liquefaction susceptibility. Additionally, the subsurface conditions encountered at the borings drilled at the subject site are not considered to be conducive to liquefaction. These conditions generally consist of medium dense to very dense, well graded, granular soils, and no evidence of a static water table within the upper 25± feet at the boring locations. Based on the mapping performed by the county of San Bernardino and the subsurface conditions encountered at the boring locations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

Native alluvial soils were encountered at the ground surface at all of the boring locations. The near-surface native alluvial soils possess variable densities, with occasional loose soils in the upper 3 to 5± feet. Additionally, the results of laboratory testing indicate that the potential for some minor consolidation settlement when loaded, especially soils located in the upper 3 to 4± feet. Based on these conditions, remedial grading is considered warranted within the proposed building areas, in order to provide more uniform support characteristics throughout the building pads. The recommended remedial grading will remove the loose near-surface soils, and replace these materials as compacted structural fill soils.

Some of the near-surface soils contain cobbles, especially at depths greater than 3 to 4± feet. Additionally, one of the trenches performed for the concurrent infiltration testing report encountered a small boulder. Recommendations for selectively grading cobble- and boulder-containing soils are presented in Section 6.3 of this report.

Settlement

The recommended remedial grading will remove a portion of the near-surface native alluvial soils and replace these materials as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation will not be subject to significant stress increases from the foundations of the new structures. Therefore, following completion of the recommended grading, post-construction settlements are expected to be within tolerable limits.

Expansion

The near-surface soils consist of sands and silty sands with varying fine to coarse gravel content, and occasional cobbles and boulders. Based on their composition, these materials have been classified as non-expansive. Therefore, no design considerations related to expansive soils are considered warranted for this site.

Soluble Sulfates

The results of the laboratory testing indicate that the sulfate concentrations of the selected sample of the on-site soils corresponds to Class S0 with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentration of the soils which are present at pad grade within the building areas.

Corrosion Potential

The results of laboratory testing indicate that representative samples of the on-site soils possess a minimum resistivity values of 29,480 and 30,820 ohm-cm, and pH values of 7.6 and 7.8. These soils possess redox potentials of 122 and 111 mV and trace sulfide concentrations of about 0.2 and 0.6 parts per million. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity, pH, sulfide concentration, redox potential, and moisture content are the five factors that enter into the evaluation procedure. Based on these factors, the on-site soils are considered to be moderately corrosive to ferrous materials including iron pipes. Therefore, corrosion protection is expected to be required for cast iron or ductile iron pipes.

Relatively low chloride concentrations (4.9 and 11.2 mg/kg) were detected in the samples submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on the lack of any significant chlorides in the tested sample, the site is considered to have a C1 chloride exposure in accordance with the American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary. Therefore, a specialized concrete mix design for reinforced concrete for protection against chloride exposure is not considered warranted.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested samples possess nitrate concentrations of 0.8 and 1.3 mg/kg. Based on these test results, the on-site soils are not considered to be corrosive to copper pipe with respect to their nitrate concentrations.

Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation of these test results.

Shrinkage/Subsidence

Removal and recompaction of the near-surface native soils is estimated to result in an average shrinkage of 2 to 10 percent. Shrinkage estimates for the individual samples range between 0 and 12 percent based on the results of density testing and the assumption that the onsite soils will be compacted to about 92 percent of the ASTM D-1557 maximum dry density. It should be noted that the shrinkage estimate is based on the results of dry density testing performed on small-diameter samples of the existing soils taken at the boring locations. It is difficult to obtain undisturbed samples of soils containing gravel and cobbles, such as those on this site, from small-diameter borings, so the data used to estimate the potential shrinkage for the onsite soils was somewhat limited. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.1 feet. This estimate may be used for grading in areas that are underlain by native alluvial soils.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

Grading and foundation plans were not available at the time of this report. It is therefore recommended that we be provided with copies of the preliminary grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations, and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping

Initial site stripping should include removal of any surficial vegetation, as well as any underlying topsoil or other organic materials. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pads

Remedial grading is recommended within the proposed building pad areas to remove a portion of the variable-strength near-surface native alluvium. The overexcavation is recommended to extend to a depth of at least 3 feet below existing grade and 3 feet below proposed building pad elevations, whichever is greater. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 2 feet below the proposed foundation bearing grades.

The overexcavation areas should extend at least 5 feet beyond the building perimeters, and to an extent equal to the depth of fill below the new foundations. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the building areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. This evaluation should include proofrolling and probing to identify any soft, loose, or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if loose, porous, or low-density native soils are encountered at the base of the overexcavation.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and thoroughly flooded/moisture conditioned to achieve a moisture content of 0 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. The building pad areas may then be raised to grade with previously excavated soils or imported structural fill.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of any proposed retaining walls and site walls should be overexcavated to a depth of 2 feet below foundation bearing grade and replaced as compacted structural fill as discussed above for the proposed building pads. Any undocumented fill soils or disturbed native alluvium within any of these foundation areas, if encountered, should be removed in their entirety. The overexcavation areas should extend at least 3 feet beyond the foundation perimeters, and to an extent equal to the depth of fill below the new foundations. Any erection pads for tilt-up concrete walls are considered to be part of the foundation system. Therefore, these overexcavation recommendations are applicable to erection pads. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning to within 0 to 4 percent above the optimum moisture content, and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral recommended remedial grading cannot be completed for new walls located along property lines, the foundations for those walls should be designed using a reduced allowable bearing pressure. Furthermore, the contractor should take necessary precautions to protect the adjacent improvements during rough grading. Specialized grading techniques, such as A-B-C slot cuts, may be required during remedial grading. The geotechnical engineer of record should be contacted if additional recommendations, such as shoring design recommendations, are required during grading.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing near-surface existing soils in the new flatwork, parking and drive areas is not considered warranted, with the exception of areas where lower strength or unstable soils are identified by the geotechnical engineer during grading. Subgrade preparation in the new flatwork, parking and drive areas should initially consist of removal of all soils disturbed during stripping and demolition operations.

The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. Any such materials should be removed to a level of firm and unyielding soil. The exposed subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above the optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength surficial soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed flatwork, parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within these areas. The grading recommendations presented above may not mitigate the extent of loose native alluvium in the flatwork, parking and drive areas. As such, some settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the flatwork, parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, thoroughly moisture conditioned to 0 to 4 percent above the optimum moisture content, and compacted. Most of the soils encountered at the boring locations are dry of the optimum moisture content for recompaction. Sandy soils should be flooded to help achieve and maintain the moisture content within the recommended range.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2022 CBC and the grading code of the county of San Bernardino.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Optional Selective Grading and Oversized Material Placement

Soil strata containing cobbles were encountered at the boring locations and especially at depths greater than 3 to 4± feet below the existing site grades. We also note that one of the trenches excavated for the concurrent infiltration testing study encountered a small boulder with a diameter of about 1± foot. It is expected that large scrapers (Caterpillar 657 or equivalent) will be adequate to move the cobble-containing soils as well as small boulders with diameters of about 2 feet of less.

Since the proposed grading will require excavation of cobble-containing soils, and possibly boulders, it may be desirable to selectively grade the proposed building pad areas. The presence of particles greater than 3 inches in diameter within the upper 1 to 3 feet of the building pad subgrades will impact the utility and foundation excavations. Depending on the depths of fills required within the proposed parking areas, it may be feasible to sort the on-site soils, placing the materials greater than 6 inches in diameter within the lower depths of the fills, and limiting the upper 1 to 3 feet of soils to materials less than 3 inches in size. Oversized materials could also be placed within the lower depths of the recommended overexcavations. In order to achieve this grading, it would likely be necessary to use rock buckets and/or rock sieves to separate the oversized materials from the remaining soil. Although such selective grading will facilitate further construction activities, it is not considered mandatory and a suitable subgrade could be achieved without such extensive sorting. However, in any case, it is recommended that all materials greater than 6 inches in size be excluded from the upper 1 foot of the surface of any compacted fills.

The placement of any oversized materials should be performed in accordance with the Grading Guide Specifications included in Appendix D of this report. If disposal of oversized materials is required, rock blankets or windrows should be used and such areas should be observed during construction and placement by a representative of the geotechnical engineer.

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. As an alternative, a clean sand (minimum Sand Equivalent of 30) may be placed within trenches and compacted in place (jetting or flooding is not recommended). Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the county of San Bernardino. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v (horizontal to vertical) plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

Any soils used to backfill voids around subsurface utility structures, such as manholes or vaults, should be placed as compacted structural fill. If it is not practical to place compacted fill in these areas, then such void spaces may be backfilled with lean concrete slurry. Uncompacted pea gravel or sand is not recommended for backfilling these voids since these materials have a potential to settle and thereby cause distress of pavements placed around these subterranean structures.

6.4 Construction Considerations

Excavation Considerations

The near-surface soils are predominately granular in composition. These materials will likely be subject to caving within shallow excavations. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 2h:1v. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Moisture Sensitive Subgrade Soils

Some of the near-surface soils possess appreciable silt content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Groundwater

roundwater was not encountered at any of the borings, which were advanced to depths of up to 25± feet below the existing site grades. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pads will be underlain by structural fill soils. These new structural fill soils are expected to extend to a depth of at least 2 feet below proposed foundation bearing grades, underlain by 1± foot of additional soil that has been densified and moisture conditioned in place. Based on this subsurface profile, the proposed structure may be supported on conventional shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Four (4) No. 5 rebars (2 top and 2 bottom).
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on geotechnical considerations; additional reinforcement may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils suitable for direct foundation support should consist of newly placed structural fill, compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 0 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft^3
- Friction Coefficient: 0.30

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill. The maximum allowable passive pressure is 2,500 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrade soils which will support the new floor slabs should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floors of the new structures may be constructed as a conventional slabs-on-grade, supported on newly placed structural fill soils. These fill soils are expected to extend to a depth of at least 3 feet below the finished pad grades. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 6 inches.

- Modulus of subgrade reaction: k = 150 psi/in

- Minimum slab reinforcement: Reinforcement is not required for geotechnical conditions. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire area of the proposed slab where such moisture sensitive floor coverings are anticipated. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as a 15-mil Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 0 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slabs should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Retaining Wall Design and Construction

Small retaining walls are expected to be necessary in the dock-high areas of the buildings, and some retaining walls may also be required to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. We have provided parameters assuming the use of on-site soils for retaining wall backfill. The on-site soils generally consist of silty sands, sands, and gravelly sands with occasional cobble content. Based on their classification, these materials are expected to possess a friction angle of at least 30 degrees when compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		Soil Type: On-Site Silty Sands, Sands, and Gravelly Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		130 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	44 lbs/ft^3
	Active Condition (2h:1v backfill)	70 lbs/ft^3
	At-Rest Condition (level backfill)	65 lbs/ft^3

The walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 300 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Retaining Wall Foundation Design

The retaining wall foundations should be underlain by at least 2 feet of newly placed structural fill. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Seismic Lateral Earth Pressures

In accordance with the 2022 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back-wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a minimum 1-foot thick layer of free-draining granular material (less than 5 percent passing the No. 200 sieve) be placed against the face of the retaining walls. This material should extend from the top of the retaining wall footing to within 1 foot of the ground surface on the back side of the retaining wall. This material should be approved by the geotechnical engineer. In lieu of the 1-foot thick layer of free-draining material, a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls, may be used. If the layer of free-draining material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The layer of free draining granular material should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557-91). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, the weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

6.8 Pavement Design Parameters

Site preparation in the pavement areas should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of silty sands, sands, and gravelly sands. Based on their classification, these materials are expected to possess good pavement support characteristics, with R-values in the range of 50 to 60. Since R-value testing was not included in the scope of services for this project, the subsequent pavement design is based upon an assumed R-value of 50. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI’s) indicated. The client and/or civil engineer should verify that these TI’s are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35
9.0	93

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALT PAVEMENTS (R = 50)					
Materials	Thickness (inches)				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	3	4	5	5	7
Compacted Subgrade	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the batch plant-reported maximum density. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 50)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 6.0)	Truck Traffic		
		TI =7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness. Any reinforcement within the PCC pavements should be determined by the project structural engineer.

7.0 GENERAL COMMENTS

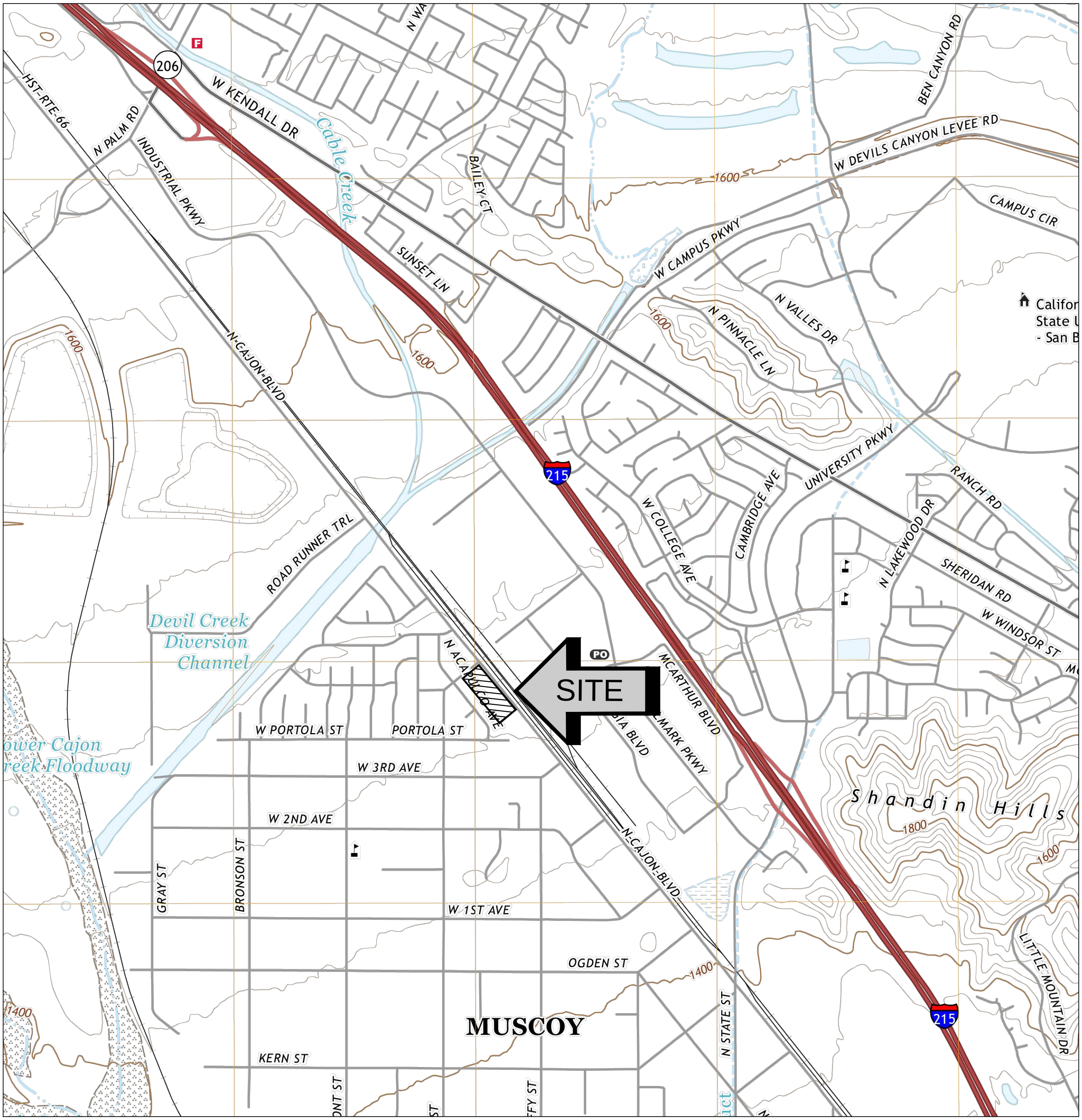
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAPS OF SAN BERNARDINO NORTH QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA, 2021.

SITE LOCATION MAP

PROPOSED INDUSTRIAL DEVELOPMENT

MUSCOY (SAN BERNARDINO COUNTY), CALIFORNIA

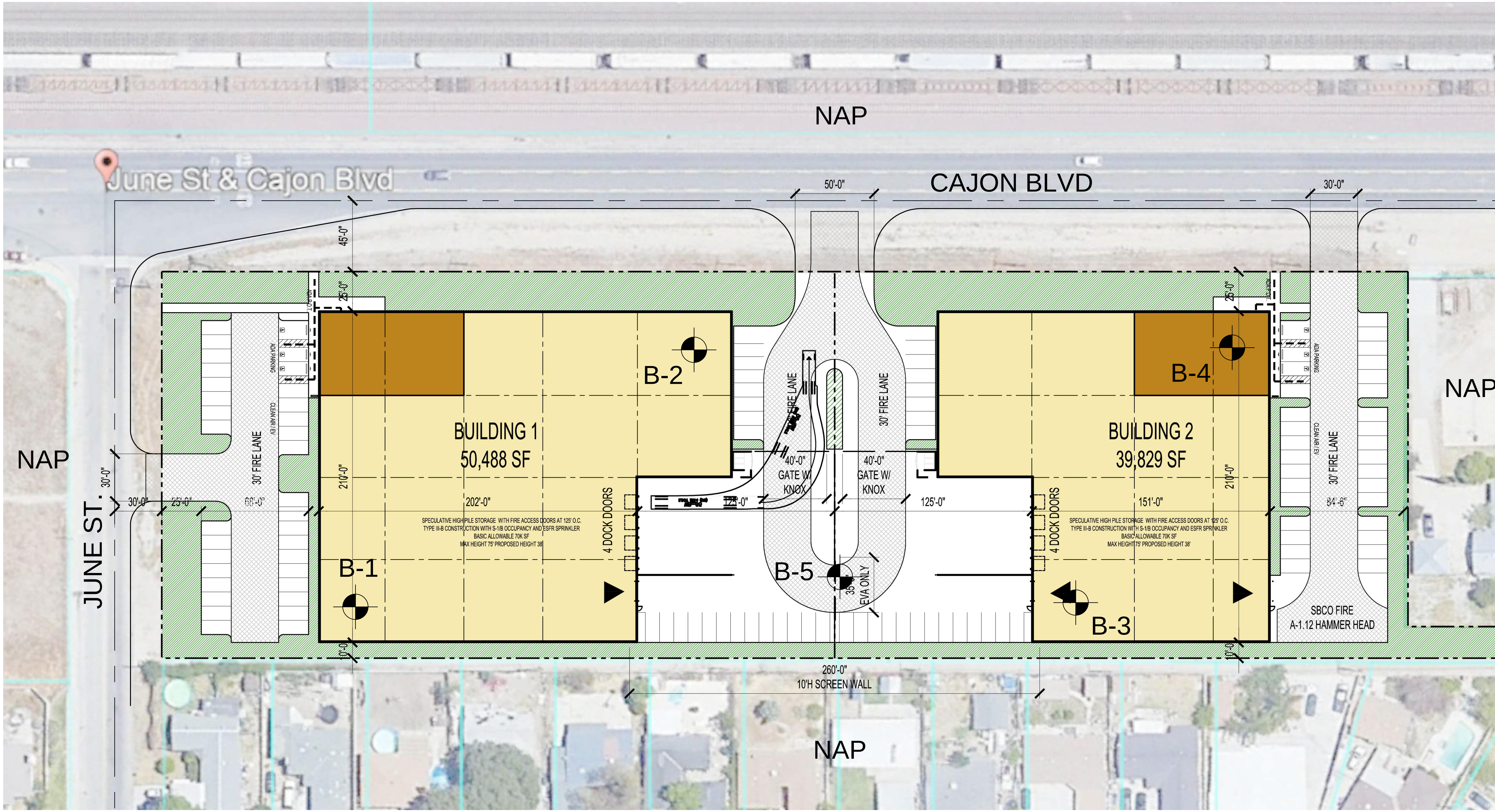
SCALE: 1" = 2000'

DRAWN: JJH
CHKD: DF

SCG PROJECT
23G113-1

PLATE 1

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

APPROXIMATE BORING LOCATION

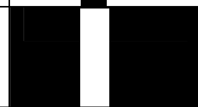
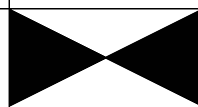
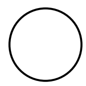
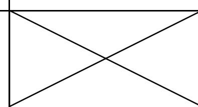
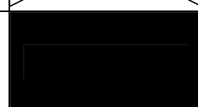
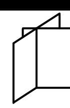
NORTH
SoCalGeo

AIR PHOTO OBTAINED FROM GOOGLE EARTH
SITE PLAN PROVIDED BY SKH

BORING LOCATION PLAN	
PROPOSED INDUSTRIAL DEVELOPMENT	
MUSCOY (SAN BERNARDINO COUNTY), CALIFORNIA	
SCALE: 1" = 60'	SoCalGeo SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JJH CHKD: DN	
SCG PROJECT 23G113-1	
PLATE 2	

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO 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 (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 23G113-1
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

DRILLING DATE: 3/6/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: 3 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						COMMENTS
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	
					ALLUVIUM: Brown fine to coarse Sand, little fine to coarse Gravel, medium dense-damp							
	X	21				111	4					
	X	19				109	5					
5	X	21				109	4					Occasional Cobbles in Auger Spoils
	X	63/11"			@ 7 to 10 feet, very dense	118	4					
	X	50/1"										@ 9 feet, No Sample Recovery
10												
					Boring Terminated at 10' Due to Auger Refusal							

TBL 23G113-1.GPJ SOCALGEO.GDT 4/4/23

BORING NO. B-2

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G113-1
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

DRILLING DATE: 3/6/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION — SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine to coarse Sand, trace Silt, little fine to coarse Gravel, medium dense to very dense-damp							
		15				106	4					
		22				103	4					
5		40				133	3					Occasional Cobbles in Auger Spoils
		67/11"					3					@ 7 feet, Disturbed Sample
		23				93	6					
10												
		29			@ 13½ to 20 feet, Gray Brown		4					
15												
		38					4					
20												
					Boring Terminated at 20'							

TBL 23G113-1.GPJ SOCALGEO.GDT 4/4/23

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 23G113-1
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

DRILLING DATE: 3/6/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS | LABORATORY RESULTS

SURFACE ELEVATION: --- MSL

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Dark Brown Silty fine Sand, little medium Sand, little fine root fibers, medium dense-moist							
		16				104	11					
					Brown fine to coarse Sand, trace Silt, trace fine Gravel, loose to dense-damp							
		14				101	4					
5		27				111	5					Occasional Cobbles in Auger Spoils
		36				115	4					
10		38				112	5					
		37					3					
15												
					Gray Brown fine Sand, trace Silt, little medium to coarse Sand, little fine to coarse Gravel, dense-damp							
		39					4					
20												

Boring Terminated at 20'

TBL 23G113-1.GPJ SOCALGEO.GDT 4/4/23

TEST BORING LOG

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 23G113-1
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

DRILLING DATE: 3/6/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, trace fine Gravel, loose-moist							
	X	7					10					
	X	21			@ 3½ feet, medium dense-damp		6					
5					Gray Brown fine to medium Sand, little coarse Sand, little fine to coarse Gravel, medium dense to very dense-damp							
	X	21					5					Occasional Cobbles in Auger Spoils
	X	17					4					
10												
	X	43					6					
15												
	X	50/5"					4					
20												
	X	50/5"										@ 23½ feet, No Sample Recovery
25					Boring Terminated at 25'							

TBL 23G113-1.GPJ SOCALGEO.GDT 4/4/23

BORING NO. B-5

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

JOB NO.: 23G113-1
PROJECT: Proposed Industrial Development
LOCATION: Muscoy, California

DRILLING DATE: 3/6/23
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Joey Hernandez

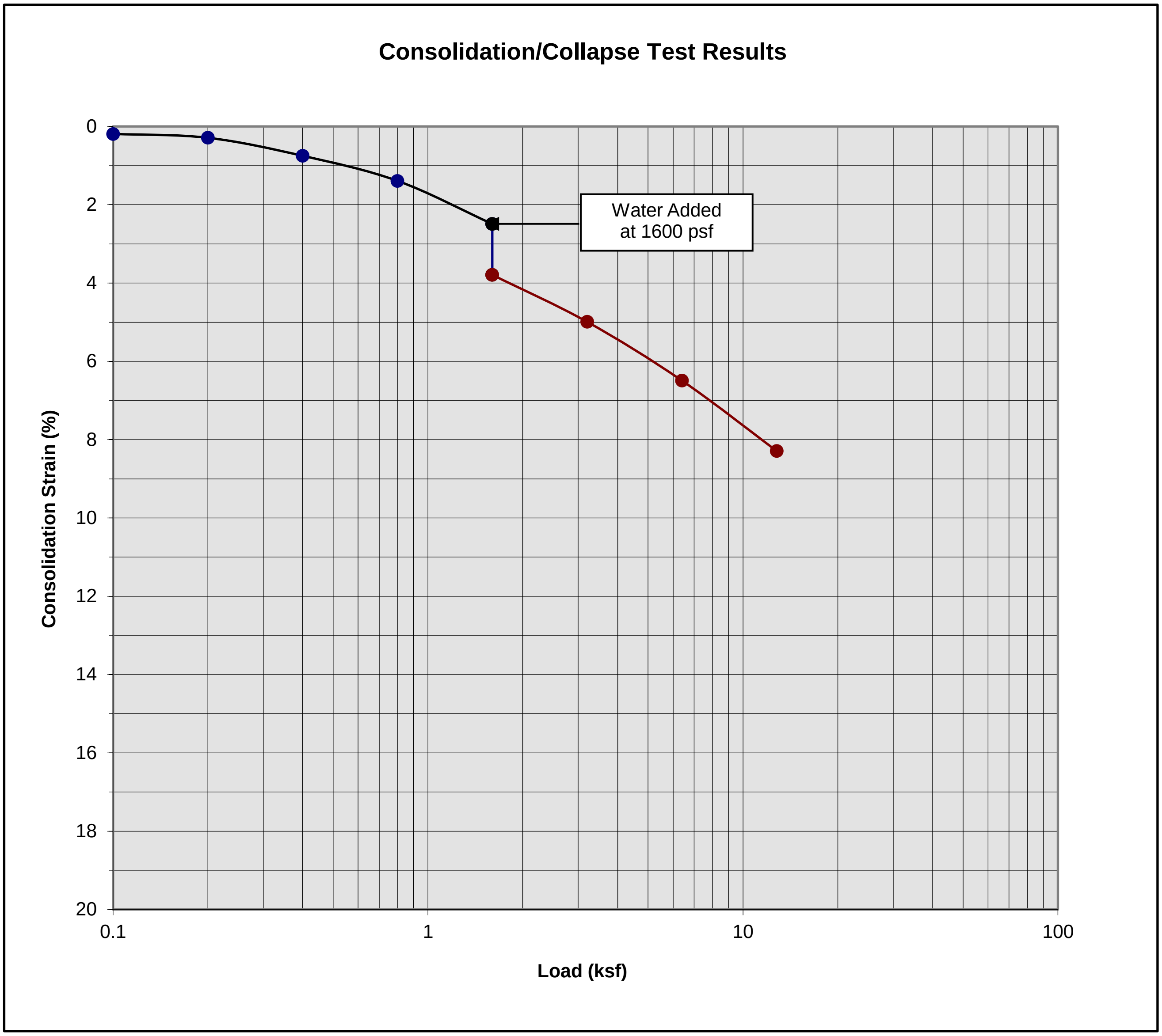
WATER DEPTH: Dry
CAVE DEPTH: 14 feet
READING TAKEN: At Completion

DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine to coarse Sand, trace Silt, little fine to coarse Gravel, medium dense-damp							
	X	12					4					
	X	17					6					
5												
	X	19					4					Occasional Cobbles in Auger Spoils
	X	24					6					
10												
	X	35			@ 13½ to 20 feet, Gray Brown, dense to very dense		6					
15												
	X	70/11"					4					
20												
					Boring Terminated at 20'							

TBL 23G113-1.GPJ SOCALGEO.GDT 4/4/23

TEST BORING LOG

APPENDIX C



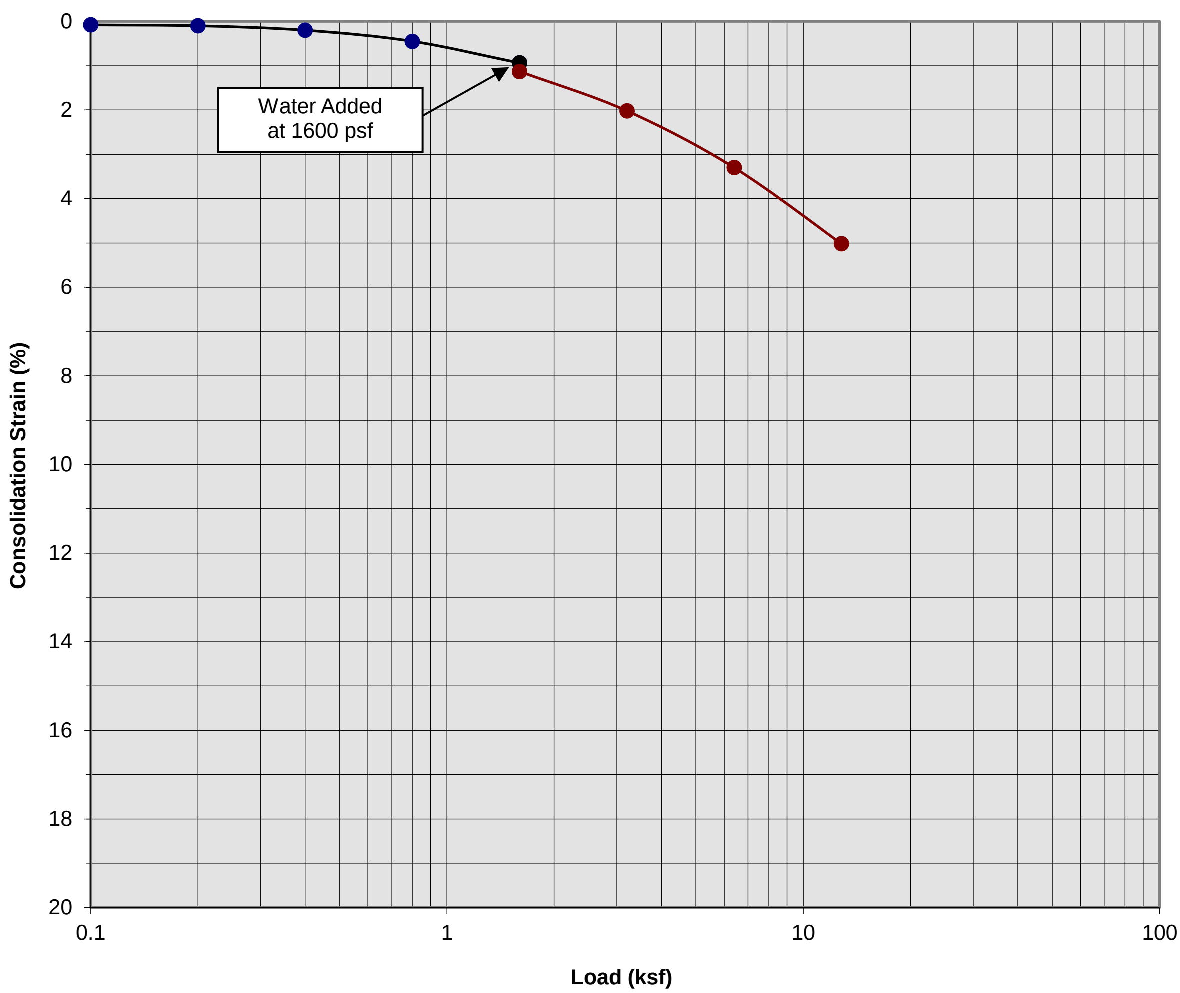
Classification: Brown fine to coarse Sand, little fine to coarse Gravel

Boring Number:	B-1	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	3 to 4	Initial Dry Density (pcf)	108.1
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	117.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.30

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



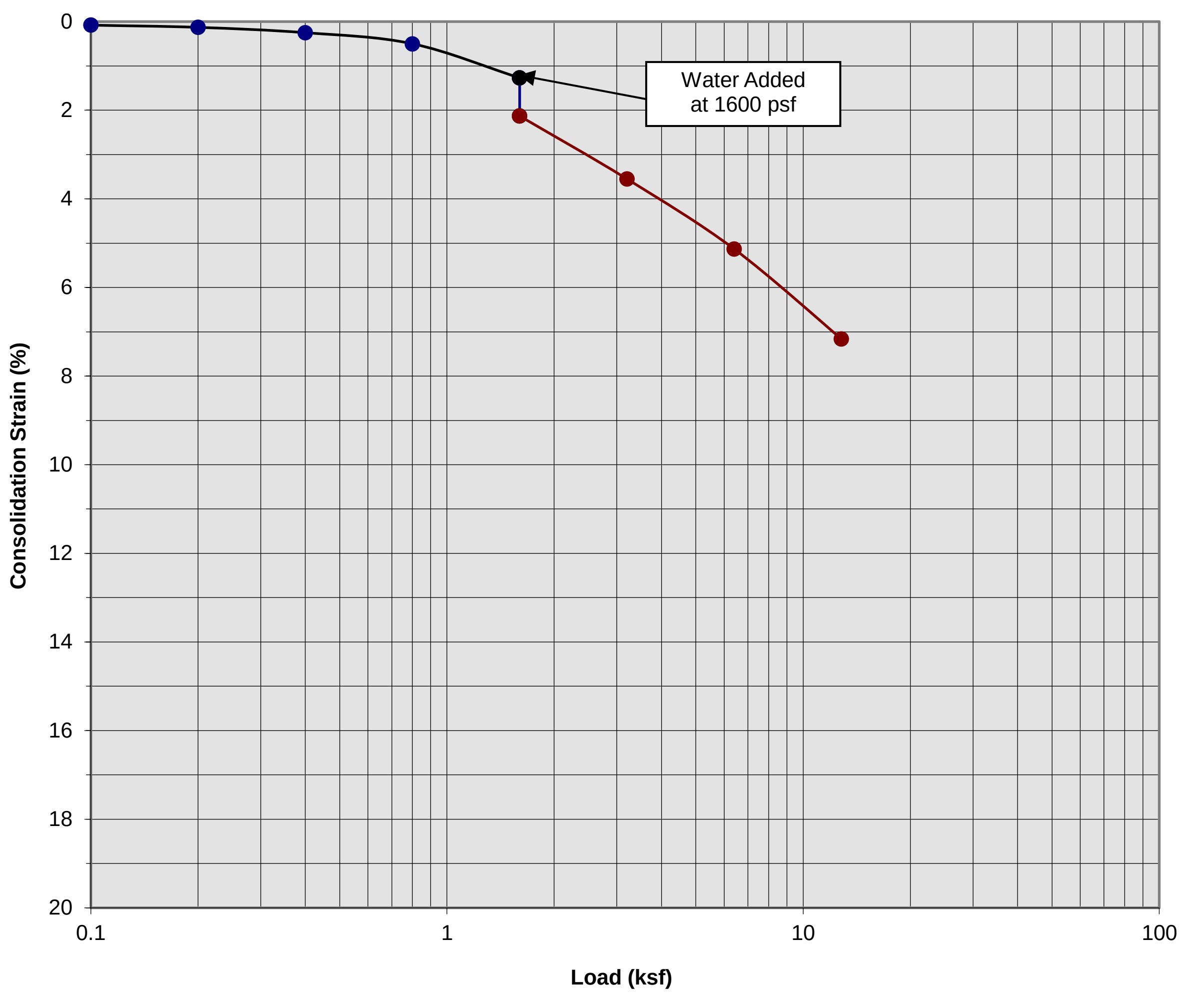
Classification: Brown fine to coarse Sand, little fine to coarse Gravel

Boring Number:	B-1	Initial Moisture Content (%)	3
Sample Number:	---	Final Moisture Content (%)	17
Depth (ft)	5 to 6	Initial Dry Density (pcf)	108.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	114.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.19

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

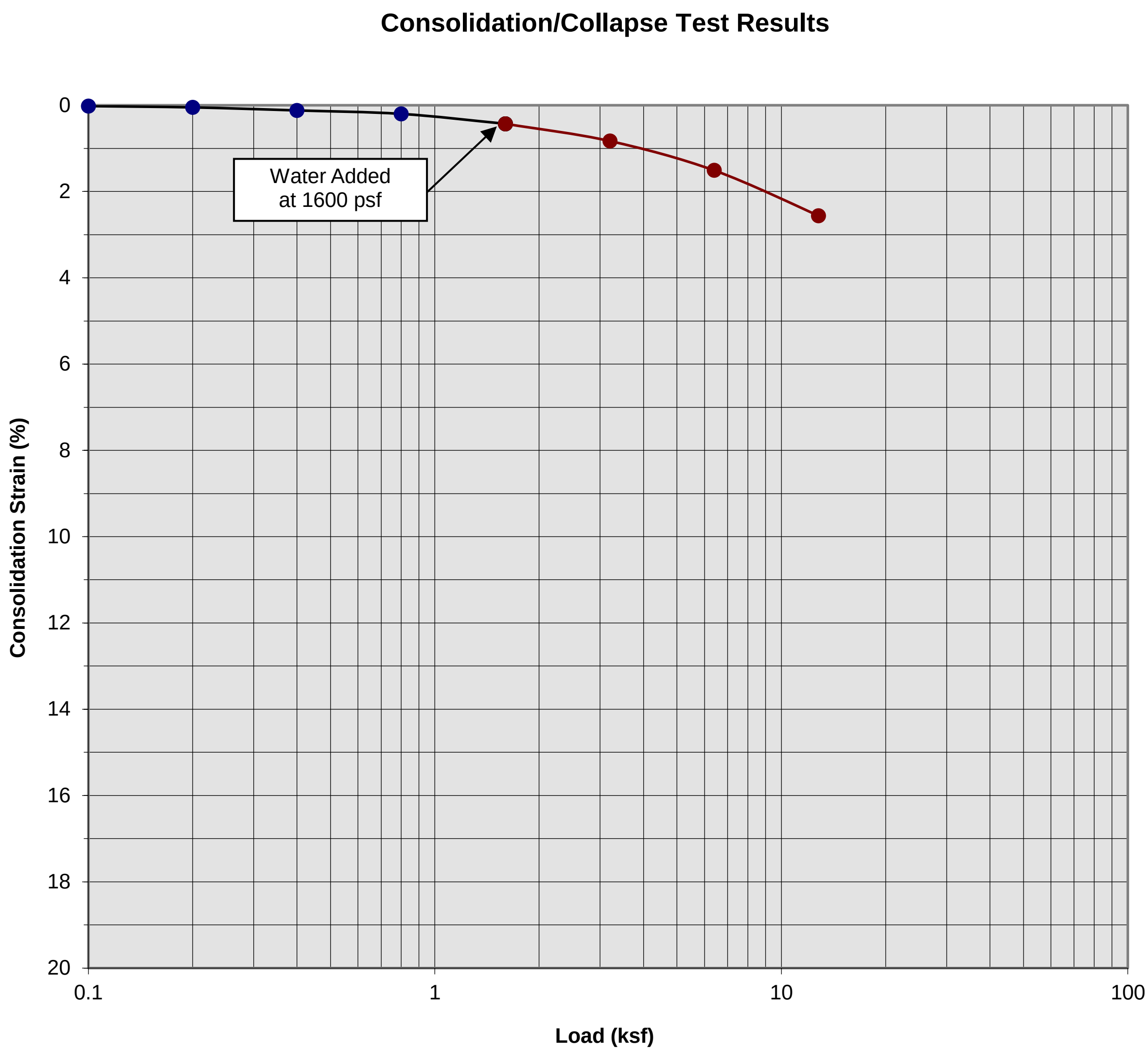


Classification: Brown fine to coarse Sand, trace Silt

Boring Number:	B-2	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	1 to 2	Initial Dry Density (pcf)	106.7
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.1
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.86

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



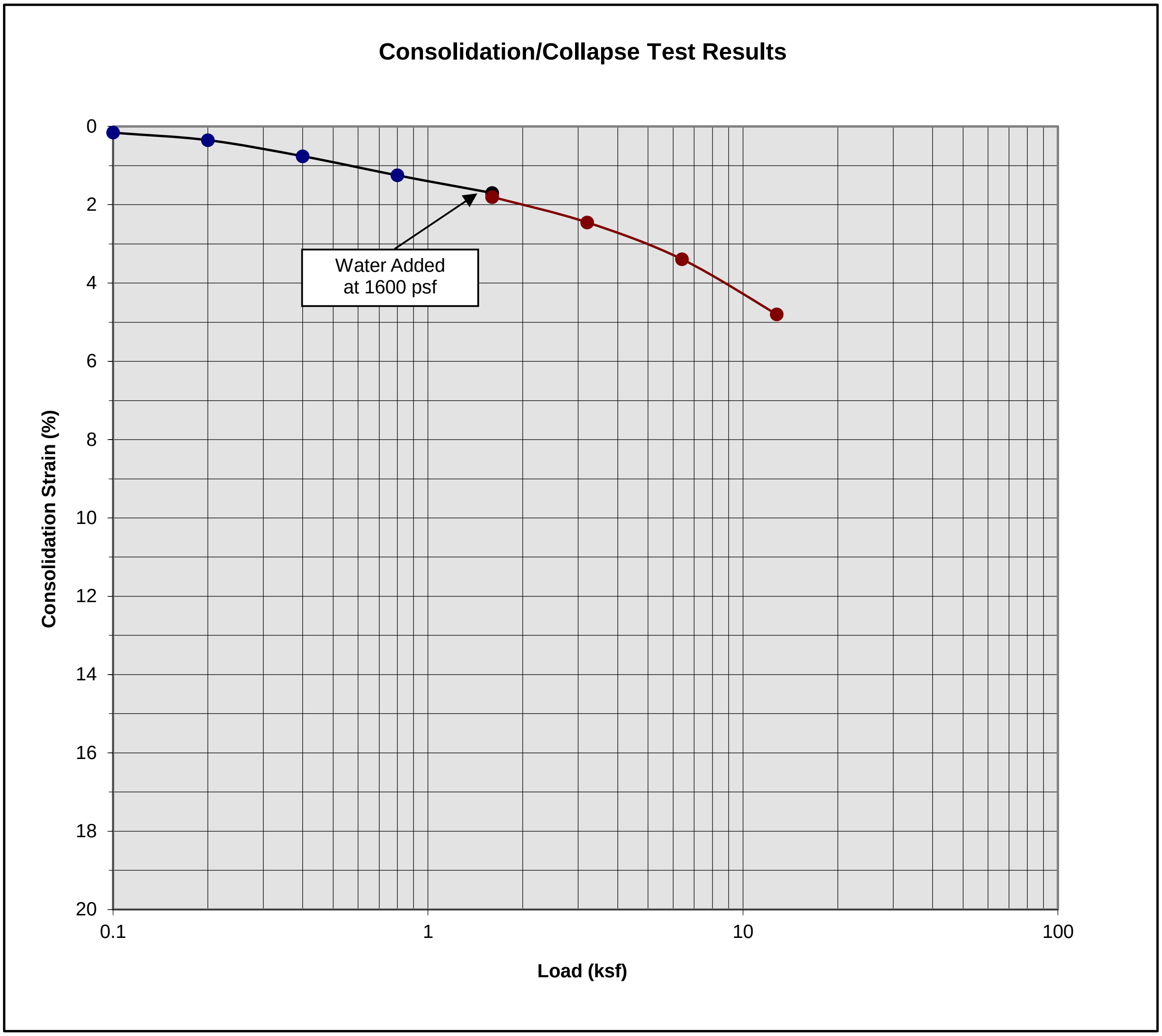
Classification: Brown fine to coarse Sand, trace Silt, trace fine Gravel

Boring Number:	B-3
Sample Number:	---
Depth (ft)	3 to 4
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

Initial Moisture Content (%)	4
Final Moisture Content (%)	15
Initial Dry Density (pcf)	101.7
Final Dry Density (pcf)	104.0
Percent Collapse (%)	0.00

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



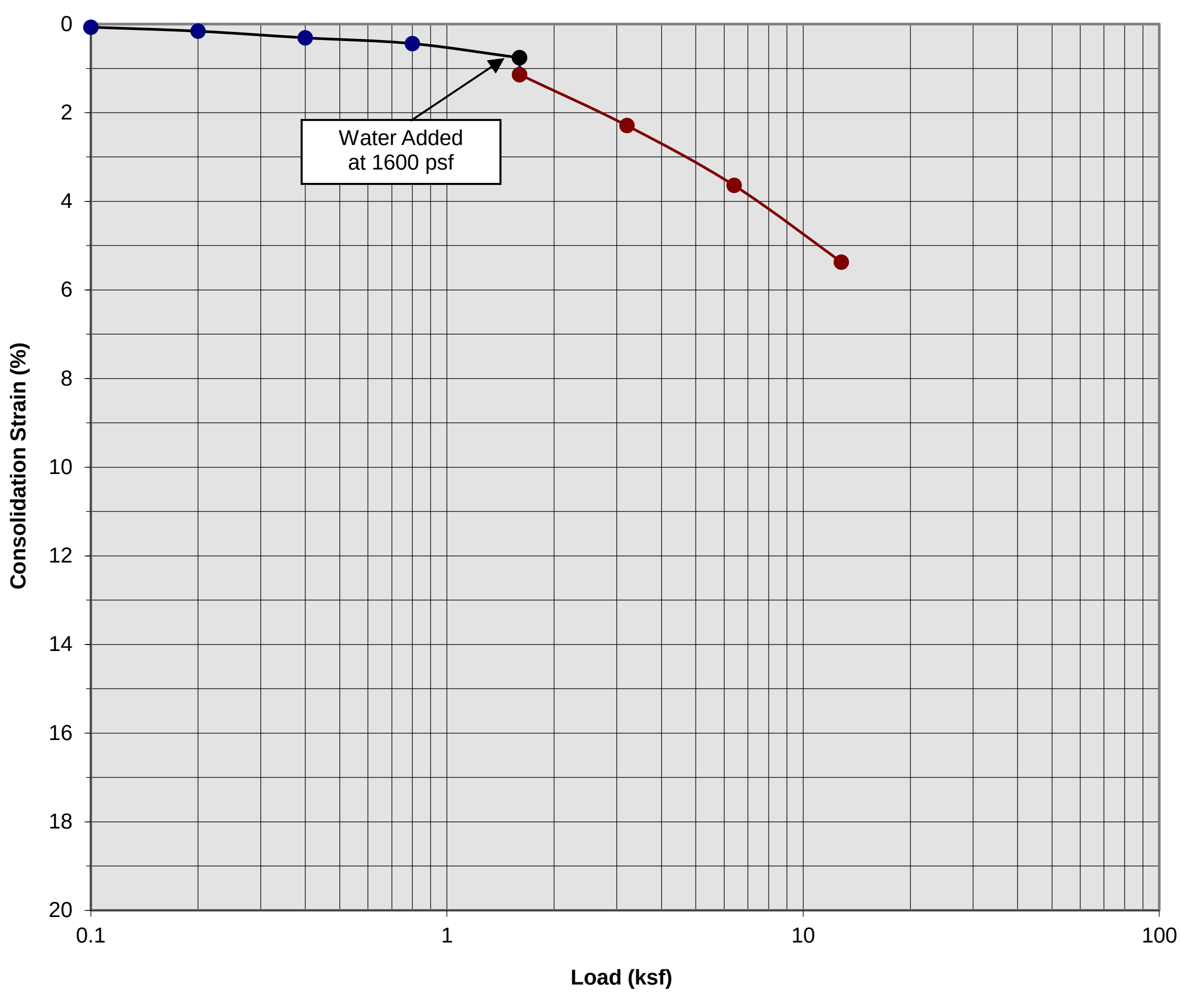
Classification: Brown fine to coarse Sand, trace Silt, trace fine Gravel

Boring Number:	B-3	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	5 to 6	Initial Dry Density (pcf)	111.2
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	116.7
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.10

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results

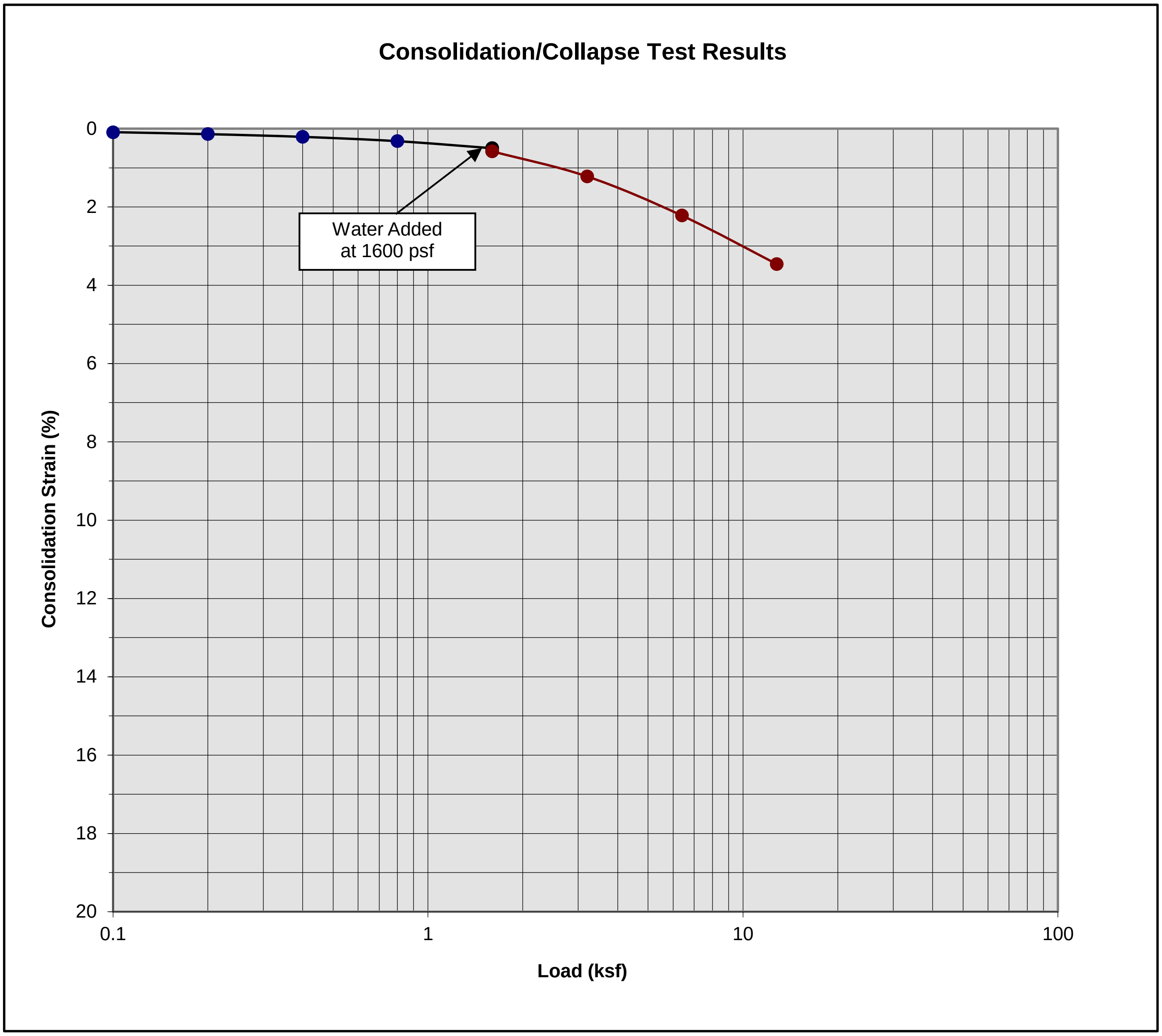


Classification: Brown fine to coarse Sand, trace Silt, trace fine Gravel

Boring Number:	B-3	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	13
Depth (ft)	7 to 8	Initial Dry Density (pcf)	114.8
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	121.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.38

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

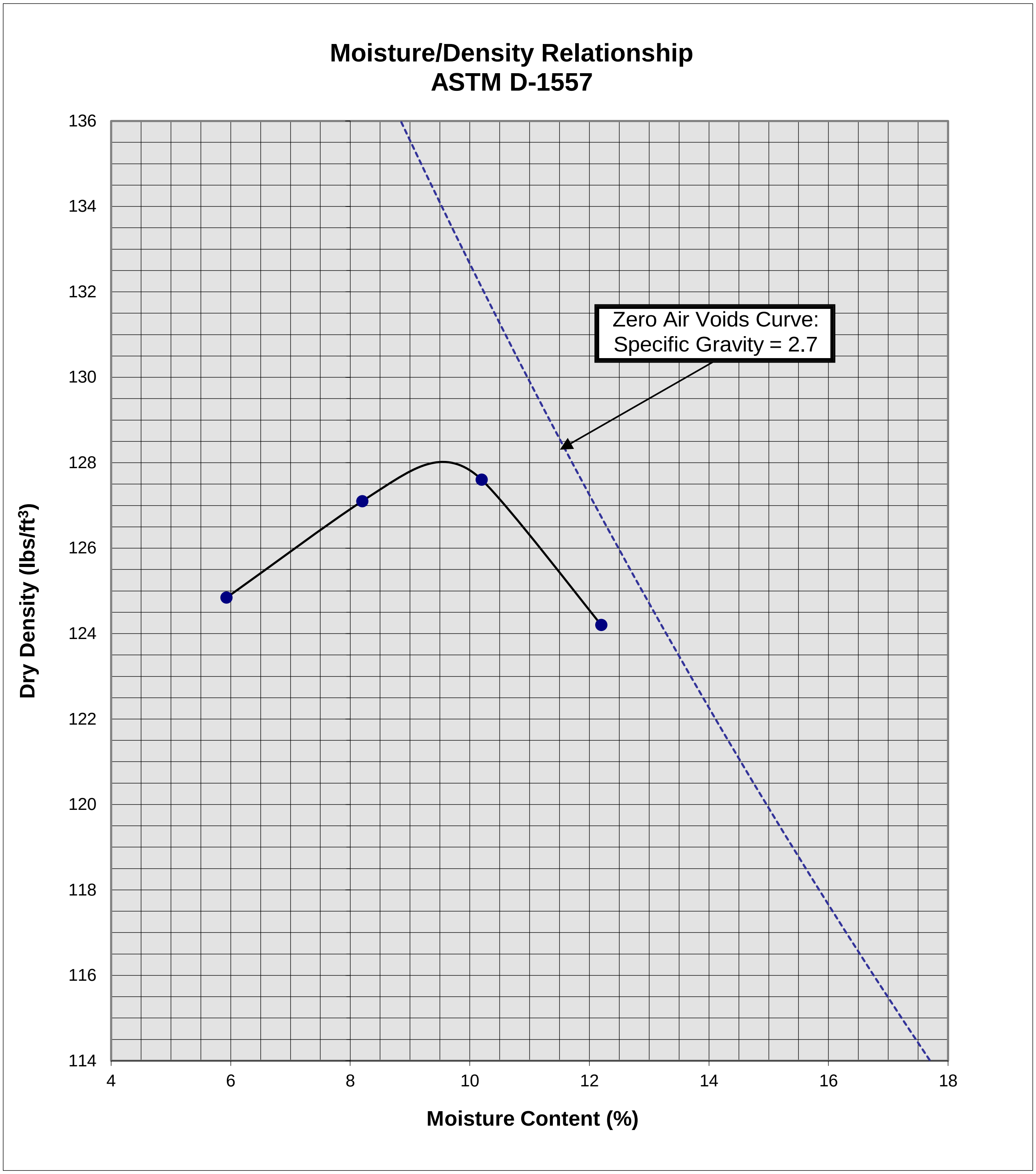


Classification: Brown fine to coarse Sand, trace Silt, trace fine Gravel

Boring Number:	B-3	Initial Moisture Content (%)	4
Sample Number:	---	Final Moisture Content (%)	15
Depth (ft)	9 to 10	Initial Dry Density (pcf)	111.3
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	115.0
Specimen Thickness (in)	1.0	Percent Collapse (%)	0.08

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C- 7

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation



Soil ID Number	B-2 @ 1-5'
Optimum Moisture (%)	9.5
Maximum Dry Density (pcf)	128
Soil Classification	Brown fine to coarse Sand trace Silt, little fine to coarse Gravel

Proposed Industrial Development
Muscoy, California
Project No. 23G113-1
PLATE C-8

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

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- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

<u>Compacted Fills</u>

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated," and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

  - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

  - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

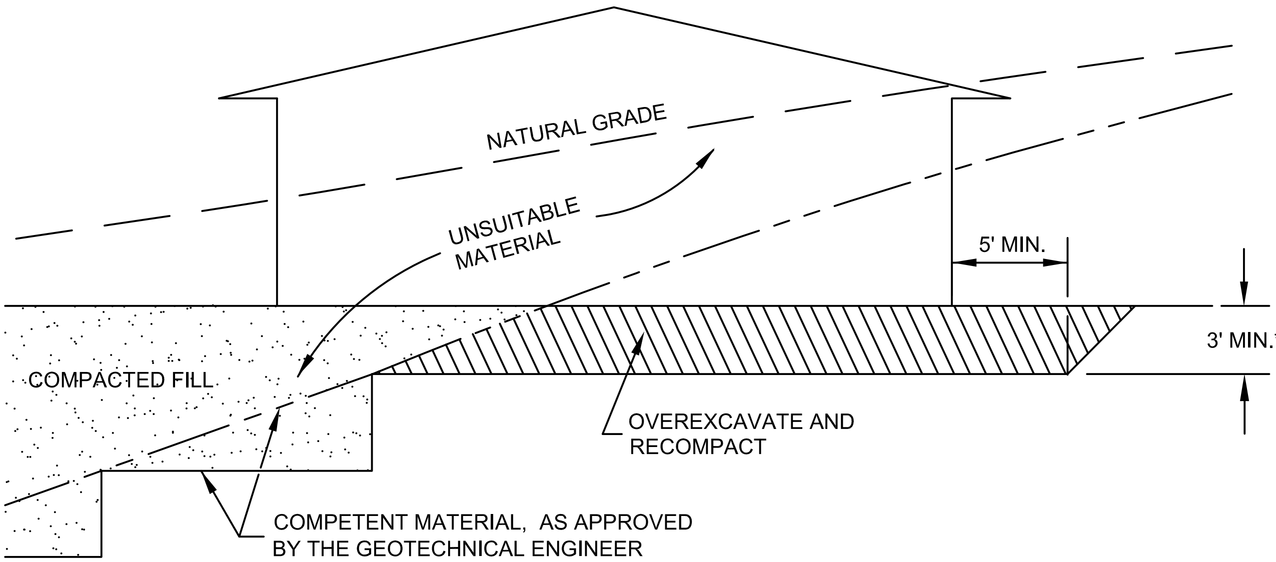
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

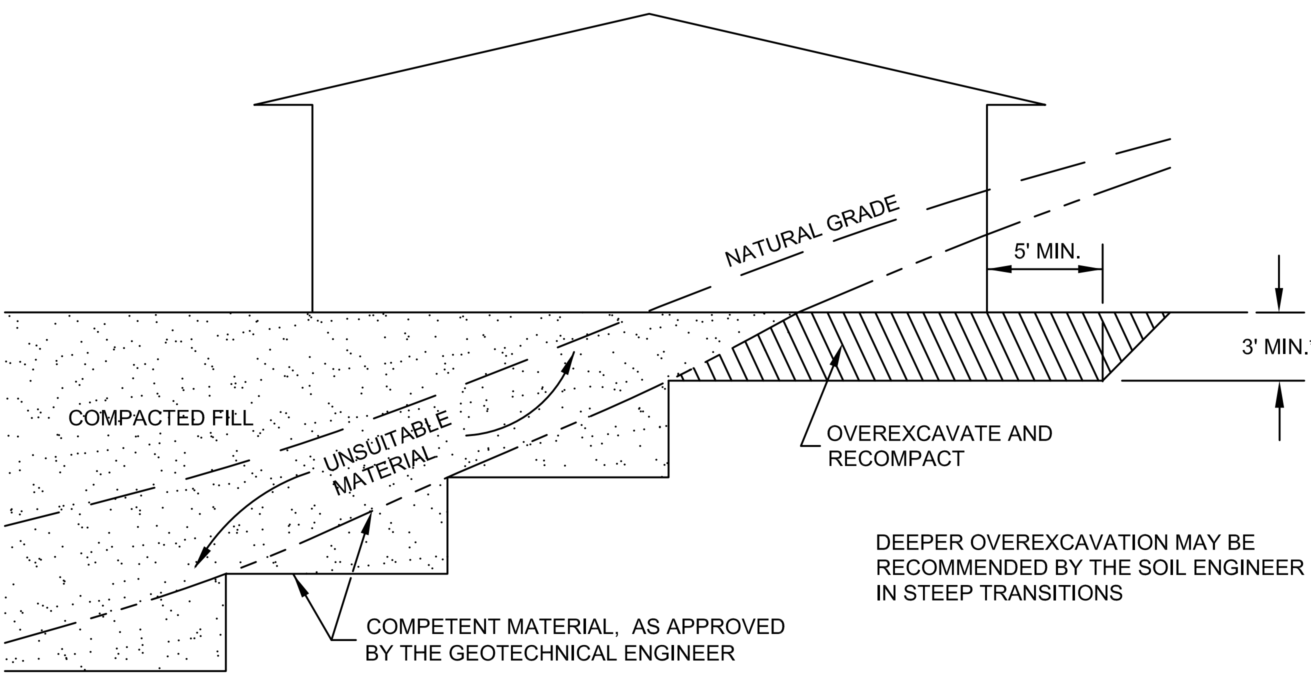
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION.
ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

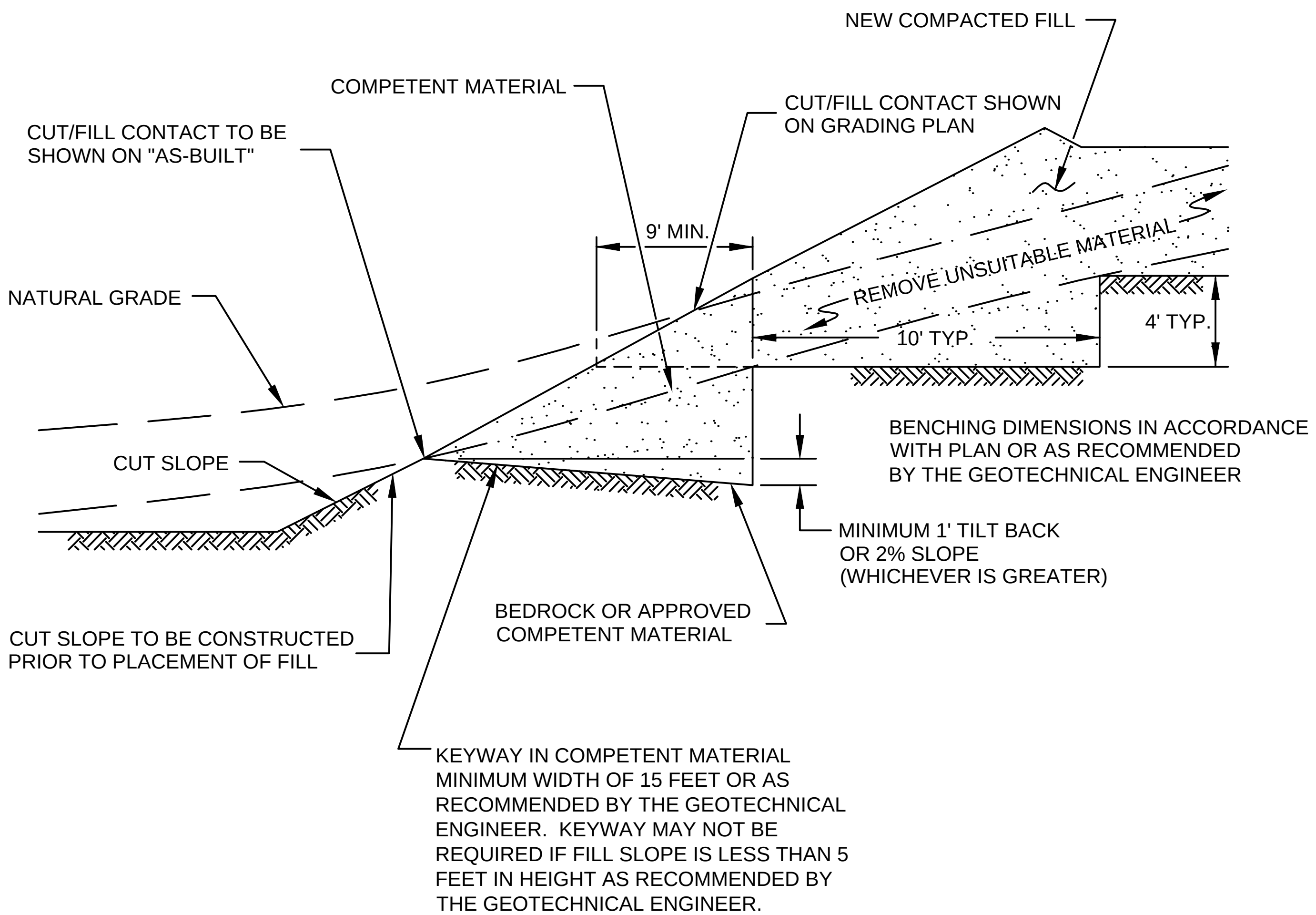
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

GRADING GUIDE SPECIFICATIONS

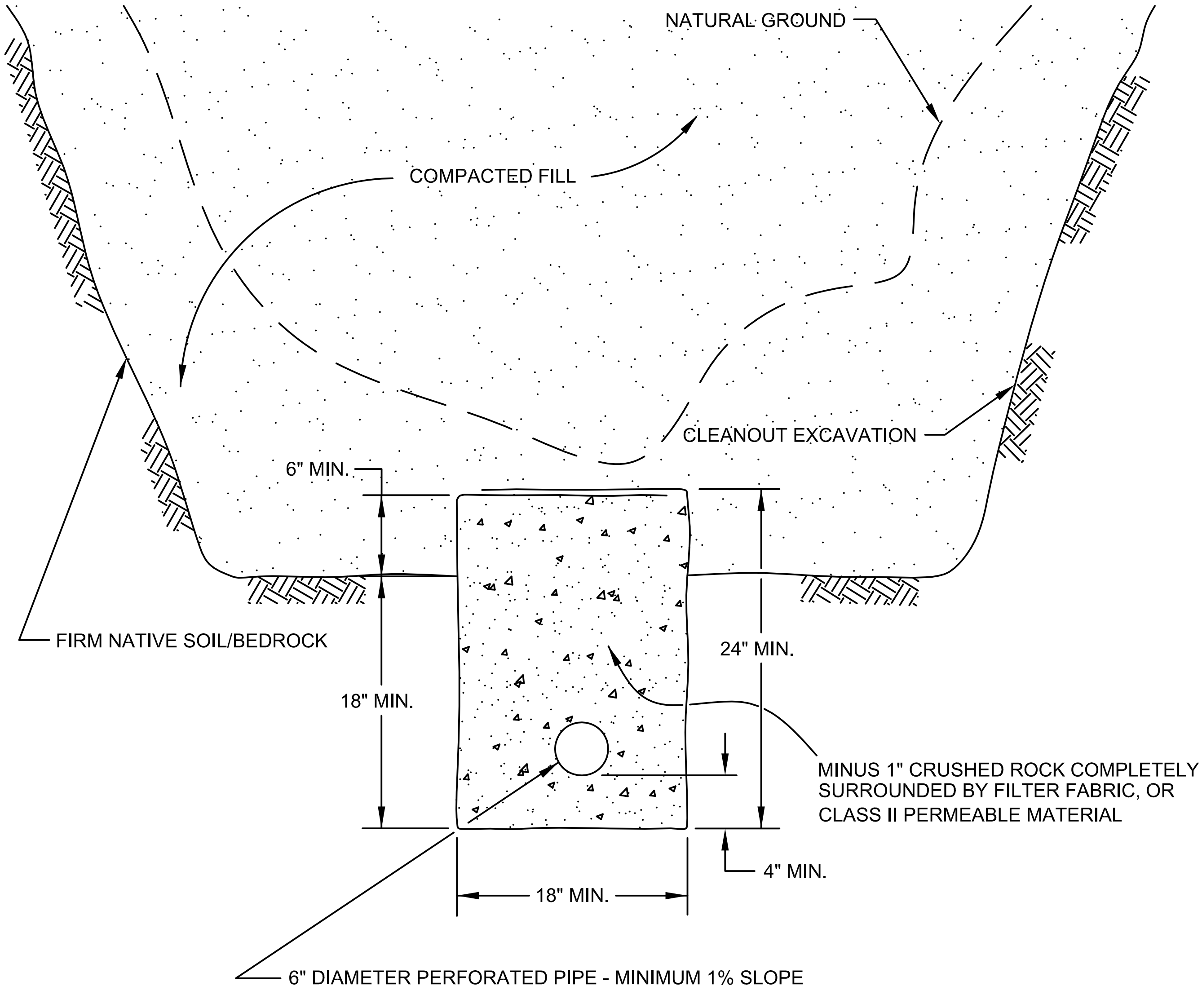
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

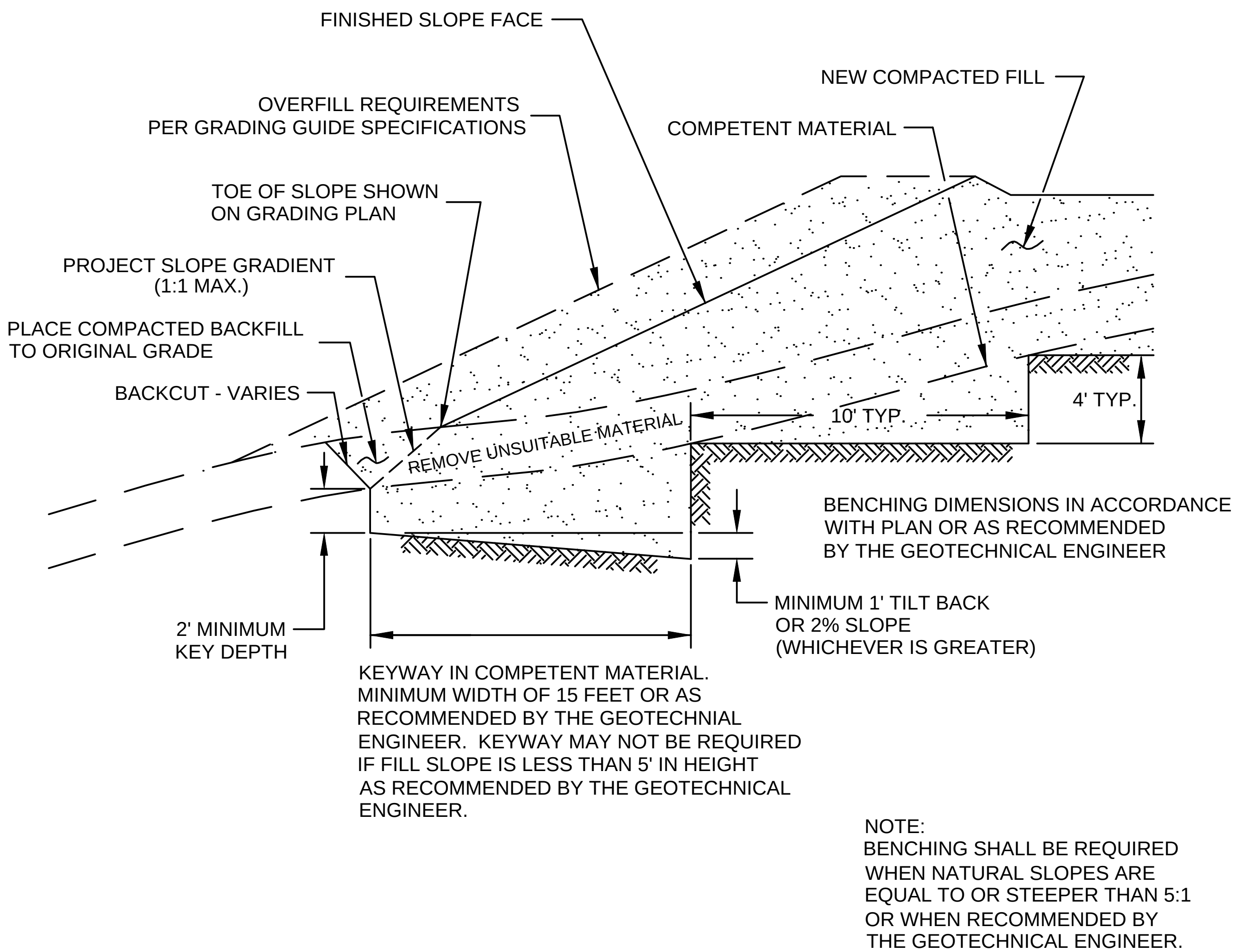
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE NATURAL SLOPE DETAIL

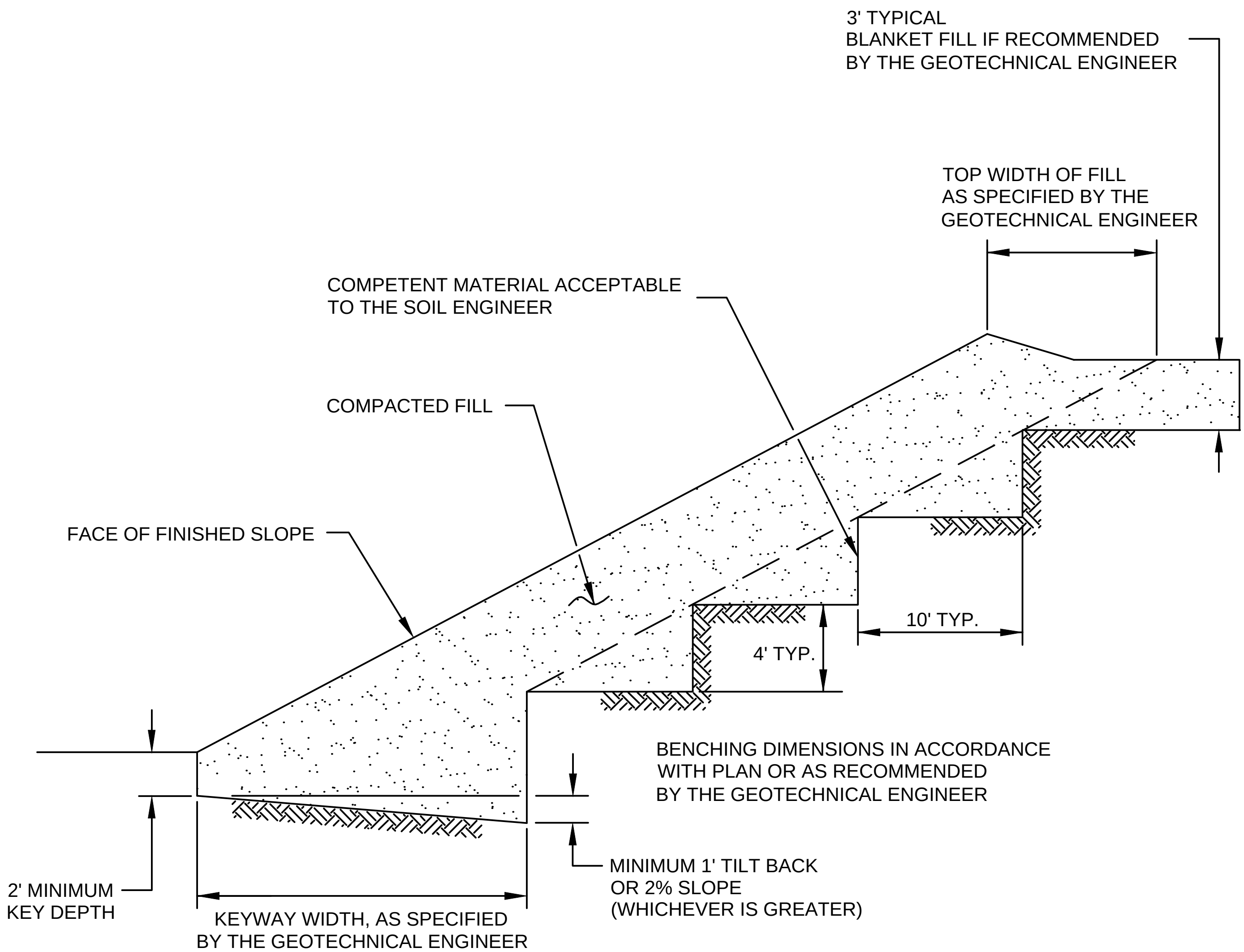
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

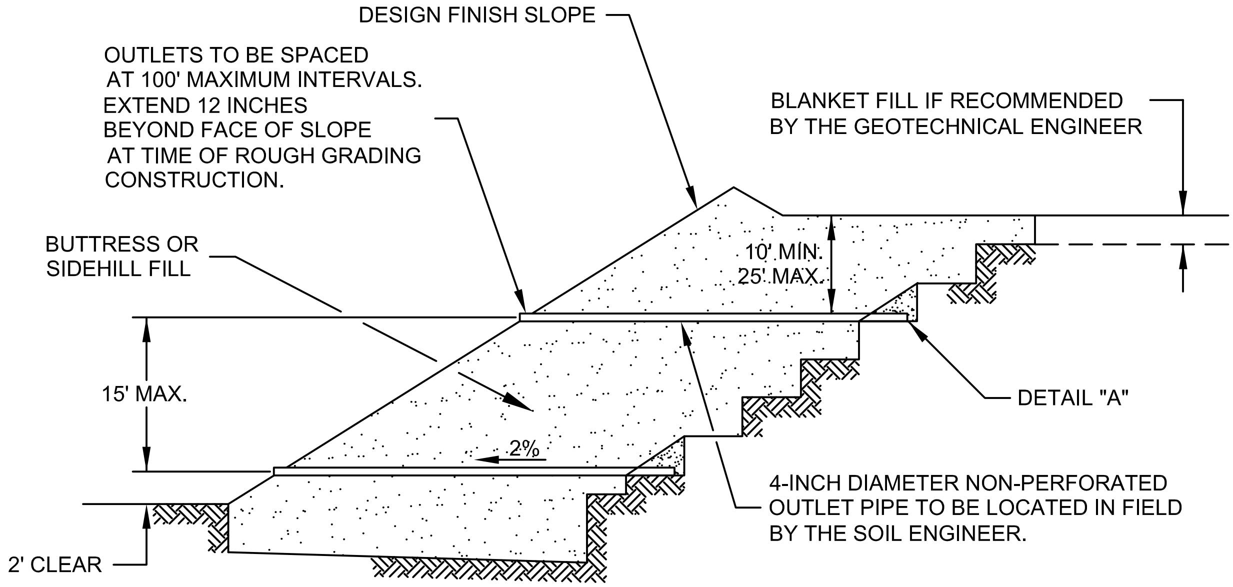
PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: JAS CHKD: GKM	
PLATE D-5	



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

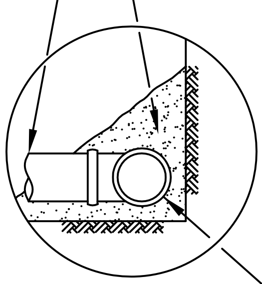
SAND EQUIVALENT = MINIMUM OF 50

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW

FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.



MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

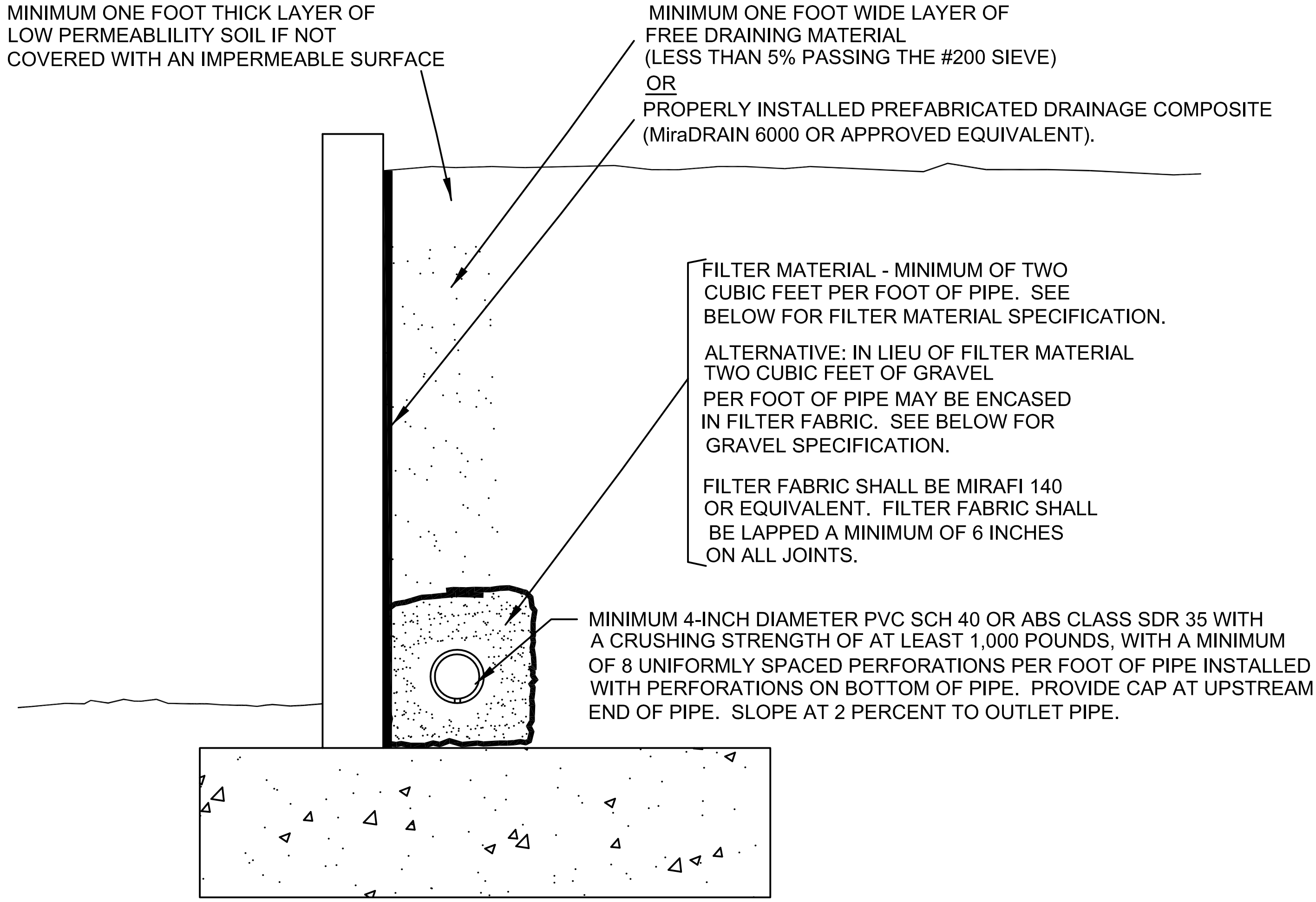
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

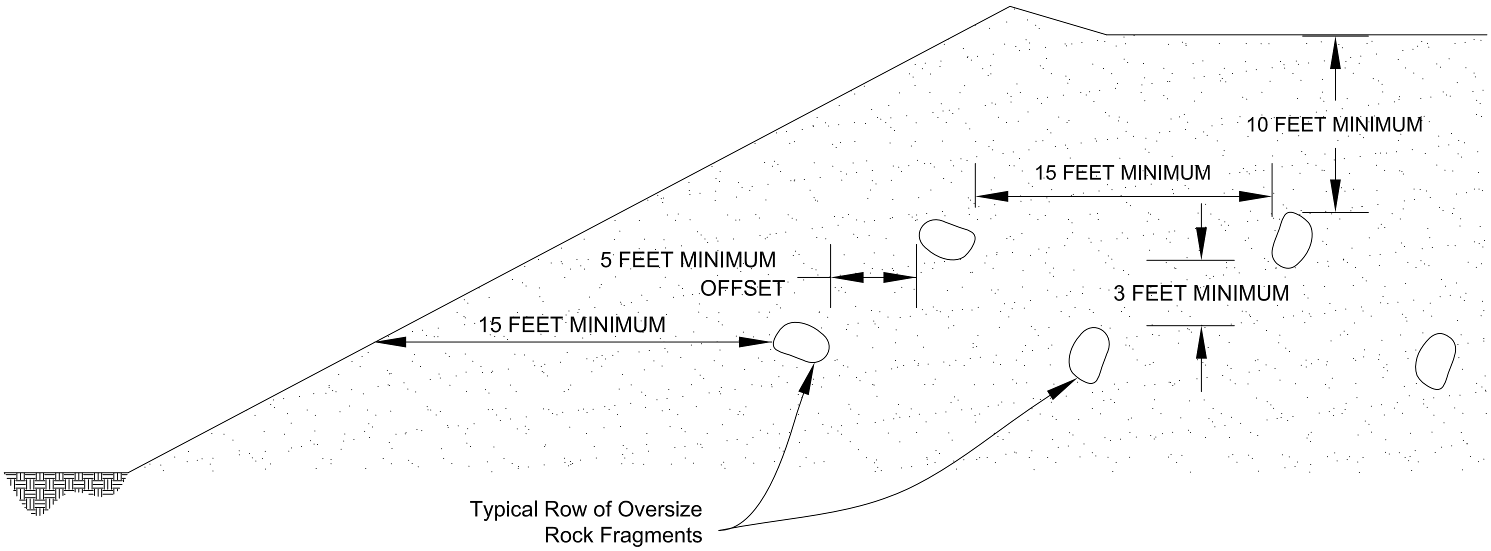
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

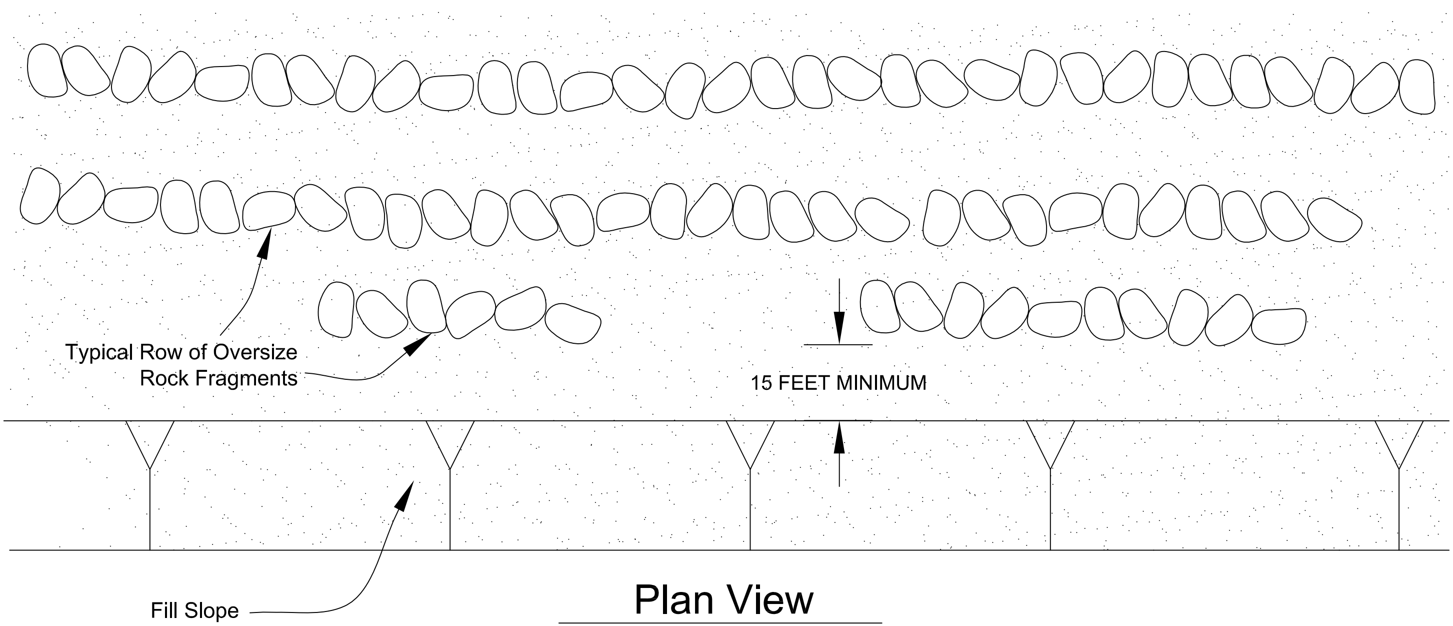
DRAWN: JAS
CHKD: GKM

PLATE D-7

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

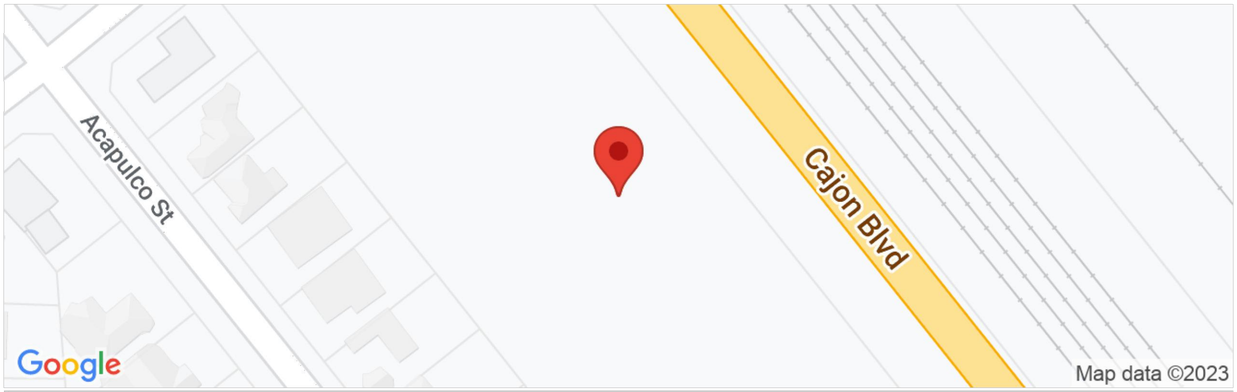
PLATE D-8

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

OSHPD

Latitude, Longitude: 34.16834077, -117.34653129



Date	3/9/2023, 9:59:11 AM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.269	MCE_R ground motion. (for 0.2 second period)
S_1	0.916	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.269	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.513	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.957	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	1.052	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	2.967	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	3.279	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.269	Factored deterministic acceleration value. (0.2 second)
S1RT	1.214	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.373	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.916	Factored deterministic acceleration value. (1.0 second)
PGAd	0.957	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	1.296	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.905	Mapped value of the risk coefficient at short periods
C_{R1}	0.884	Mapped value of the risk coefficient at a period of 1 s
C_V	1.5	Vertical coefficient

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2022 CBC

PROPOSED INDUSTRIAL DEVELOPMENT

MUSCOY (SAN BERNARDINO COUNTY), CALIFORNIA

DRAWN: JJH
CHKD: DN

SCG PROJECT
23G113-1

PLATE E-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

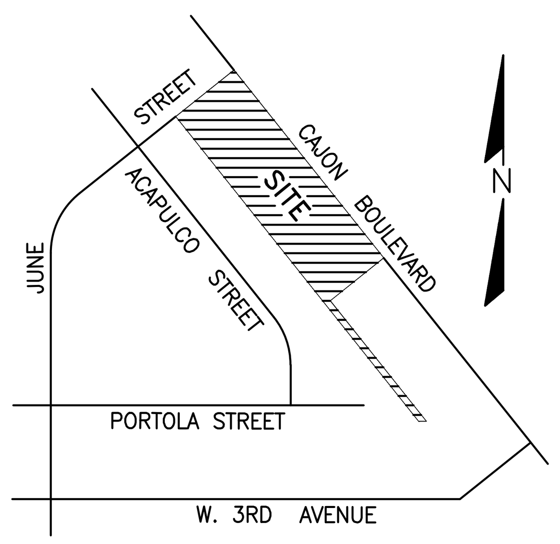
TENTATIVE PARCEL MAP NO. 20798

IN THE COUNTY OF SAN BERNARDINO
STATE OF CALIFORNIA

OFFICIAL USE ONLY

UTILITY PROVIDERS

WATER	CITY OF SAN BERNARDINO MUNICIPAL WATER DEPARTMENT 1350 SOUTH E STREET SAN BERNARDINO, CA 92408 PHONE (909) 384-5141
ELECTRIC	SOUTHERN CALIFORNIA EDISON CO. P.O. BOX 788 RIALTO, CA 92376 PHONE (909) 875-6420
SEWER	CITY OF SAN BERNARDINO MUNICIPAL WATER DEPARTMENT 1350 SOUTH E STREET SAN BERNARDINO, CA 92408 PHONE (909) 384-5141
GAS	SOUTHERN CALIFORNIA GAS CO. 1231 VALLEY BLVD. FONTANA, CA 92335 PHONE (909) 428-8407
TELEPHONE	AT&T
CABLE	NONE



VICINITY MAP

NOT TO SCALE

LEGAL DESCRIPTION

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

ALL THAT PORTION OF THE RANCHO MUSCUPLABE, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, AS PER PLAT RECORDED IN BOOK 7, OF MAPS, PAGE 23, RECORDS OF SAID COUNT, BEING A PORTION OF SECTION 18 TOWNSHIP 1 NORTH, RANGE 4 WEST, SAN BERNARDINO BASE AND MERIDIAN, IF SAID SECTION LINES WERE EXTENDED ACROSS SAID RANCHO, DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHEAST CORNER OF LOT 17, TRACT NO. 3238, AS PER PLAT RECORDED IN BOOK 60 OF MAPS, PAGES 14 AND 15, RECORDS OF SAID COUNTY; THENCE ALONG THE NORTH LINE OF SAID LOT 59, TRACT NO. 2946, AS PER PLAT RECORDED IN BOOK 40 OF MAPS, PAGES 82, 83 AND 84 RECORDS OF SAID COUNTY, SOUTH 89° 45'EAST, 25.67 FEET TO AN ANGLE POINT THEREIN; THENCE NORTH 38° 32'WEST, 507.19 FEET (NORTH 38° 33' 30'WEST, 507.46 FEET, DEED); THENCE NORTH 51° 26' 30"EAST, 225 FEET TO A POINT IN THE SOUTHWESTERLY LINE OF 90 FOOT WIDE CAJON BOULEVARD; THENCE ALONG SAID SOUTHWESTERLY LINE OF CAJON BOULEVARD, NORTH 38"33' 30"WEST, 789.92 FEET TO THE INTERSECTION WITH THE SOUTHEASTERLY LINE OF JUNE STREET, SOUTH 51° 26' 30"WEST, 245 FEET TO THE MOST NORTHERLY CORNER OF LOT 1 OF SAID TRACT NO. 3238; THENCE ALONG THE NORTHEASTERLY LINE SAID TRACT NO. 3238, SOUTH 38° 33'30"EAST 1,280.99 FEET TO THE POINT OF BEGINNING.

EASEMENT NOTES

○ INDICATES EASEMENT PLOTTED HEREON.

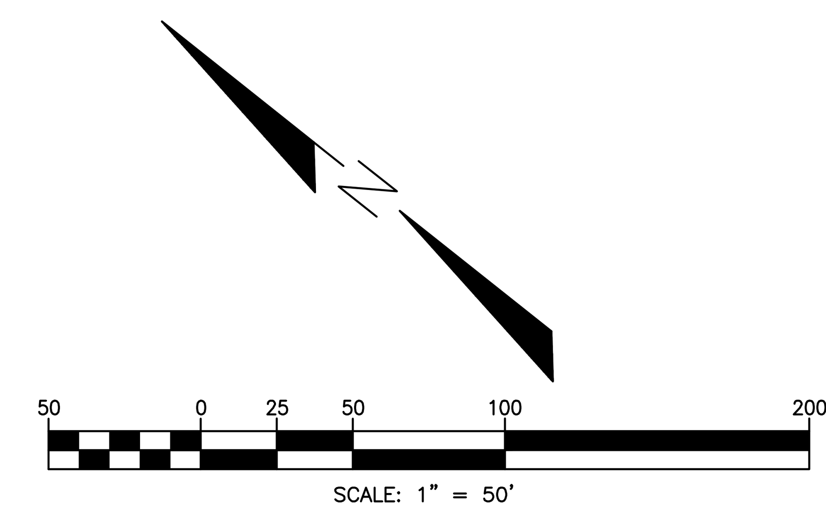
THE FOLLOWING EASEMENT NUMBERS CORRESPOND TO EXCEPTION NUMBERS OF PRELIMINARY REPORT, ORDER NO. 995-30105281-2AA, DATED JULY 6,, 2023 PREPARED BY FIDELITY NATIONAL TITLE COMPANY, UNLESS OTHERWISE NOTED.

(3) AN EASEMENT FOR FLOOD CONTROL AND WATER CONSERVATION PURPOSES, RECORDED DECEMBER 7, 1953 IN BOOK 3289, PAGE 356 OF OFFICIAL RECORDS.

(4) AN EASEMENT FOR POLE LINES, CABLES, UNDERGROUND CONDUITS AND APPURTENANCES FOR THE TRANSMISSION OF ELECTRIC ENERGY FOR COMMUNICATION AND OTHER PURPOSES, RECORDED JUNE 1, 1956 IN BOOK 6637, PAGE 556 OF OFFICIAL RECORDS.

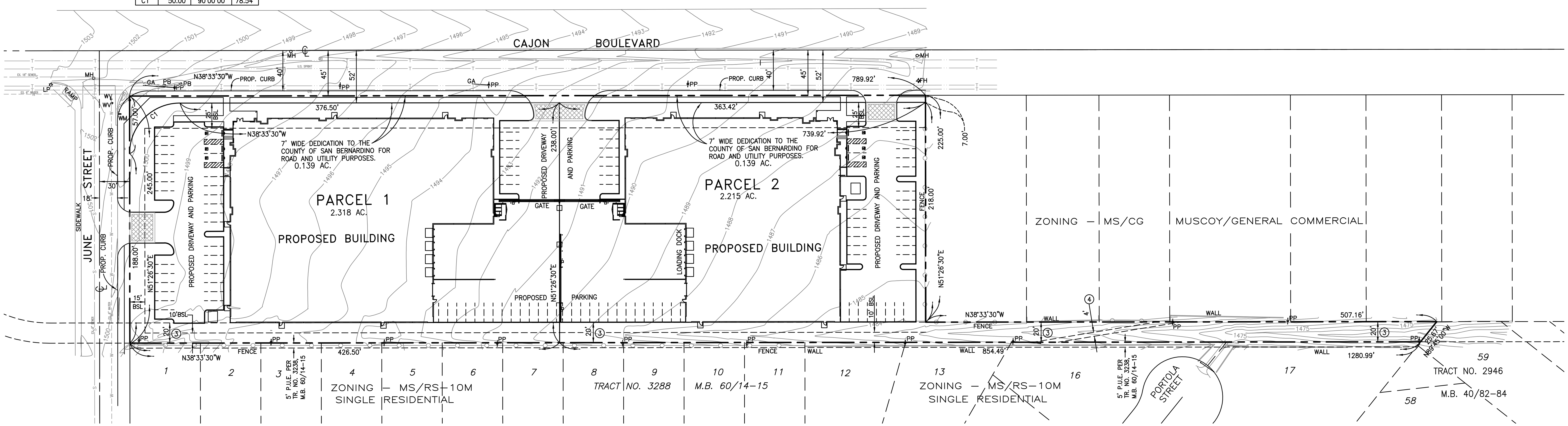
LEGEND

BSL	BUILDING SETBACK LINE
FH	EXISTING FIRE HYDRANT
GA	EXISTING GUY ANCHOR
LP	EXISTING LIGHT POLE
MH	EXISTING MANHOLE
PB	EXISTING PULLBOX
PP	EXISTING POWER POLE
WM	EXISTING WATER METER
WV	EXISTING WATER VALVE
—S—	EXISTING SEWER LINE
—W—	EXISTING WATER LINE
—T—	EXISTING COMMUNICATION LINE



CURVE DATA

NO.	RADIUS	DELTA	ARC
C1	50.00'	90°00'00"	78.54'



BENCHMARK

USGS

DESIGNATION: B 40
PID: EV1296

DESCRIBED BY COAST AND GEODETIC SURVEY 1961
3.2 MI NW FROM SAN BERNARDINO.
3.15 MILES NORTHWEST ALONG THE ATCHISON, TOPEKA AND SANTA FE RAILWAY FROM THE HIGHLAND AVENUE OVERPASS AT SAN BERNARDINO, IN THE TOP OF THE NORTHEAST END OF THE NORTHWEST CONCRETE ABUTMENT OF WOODEN BRIDGE 75.5, BETWEEN THE MAIN TRACK AND A SIDE TRACK, 111 1/2 FEET NORTHWEST OF THE CENTER OF THE CROSSING OF AN ABANDONED PAVED ROAD LEADING NORTHEAST, 92.7 FEET NORTHEAST OF THE CENTER LINE OF CAJON BOULEVARD, 8.5 FEET SOUTHWEST OF THE SOUTHWEST RAIL OF THE SIDE TRACK, 5.5 FEET NORTHEAST OF THE NORTHEAST RAIL OF THE CENTER TRACK, ABOUT 1/2 FOOT LOWER THAN THE RAILS AND FLUSH WITH THE GROUND.

ELEV: 1516.40 (NAVD 88)

LAND USE / ZONING INFORMATION

LAND USE — EXISTING: VACANT
PROPOSED: COMMERCIAL

ZONING — EXISTING: MS/CG – MUSCOY/GENERAL COMMERCIAL
PROPOSED: MS/CG – MUSCOY/GENERAL COMMERCIAL

AREA — EXISTING PARCEL: 4.672 ACRES

PROPOSED PARCEL 1: 2.399 ACRES
PROPOSED PARCEL 2: 2.273 ACRES

GROSS — 4.672 ACRES

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED ON THE CENTERLINE OF JUNE STREET BEING NORTH 51°26'30" EAST PER TRACT NO. 3238 M.B. 61-14-15

AREAS

PARCEL 1: 2.318 AC.
PARCEL 2: 2.215 AC.
DEDICATION: 0.139 AC.

TOTAL: 4.672 AC.

PREPARED UNDER THE SUPERVISION OF:

KENT COOPER, P.L.S. 9322
LICENSE EXPIRES 3-31-25

PROFESSIONAL LAND SURVEYOR
KENT COOPER
NO. 9322
STATE OF CALIFORNIA

OWNER/SUBDIVIDER

NOJ92, LLC
269 S. BEVERLY DRIVE
SUITE 1674
BEVERLY HILLS, CA 90212
(213) 545-0454

DEVELOPER BUILD-OUT

DATE	DESCRIPTION	
--	--	
--	--	
--	--	
--	--	
--	--	
--	--	
--	--	
--	--	

ENGINEER/REPRESENTATIVE/MAP PREPARER: ERIC ROBLES

raSmith
CREATIVITY BEYOND ENGINEERING

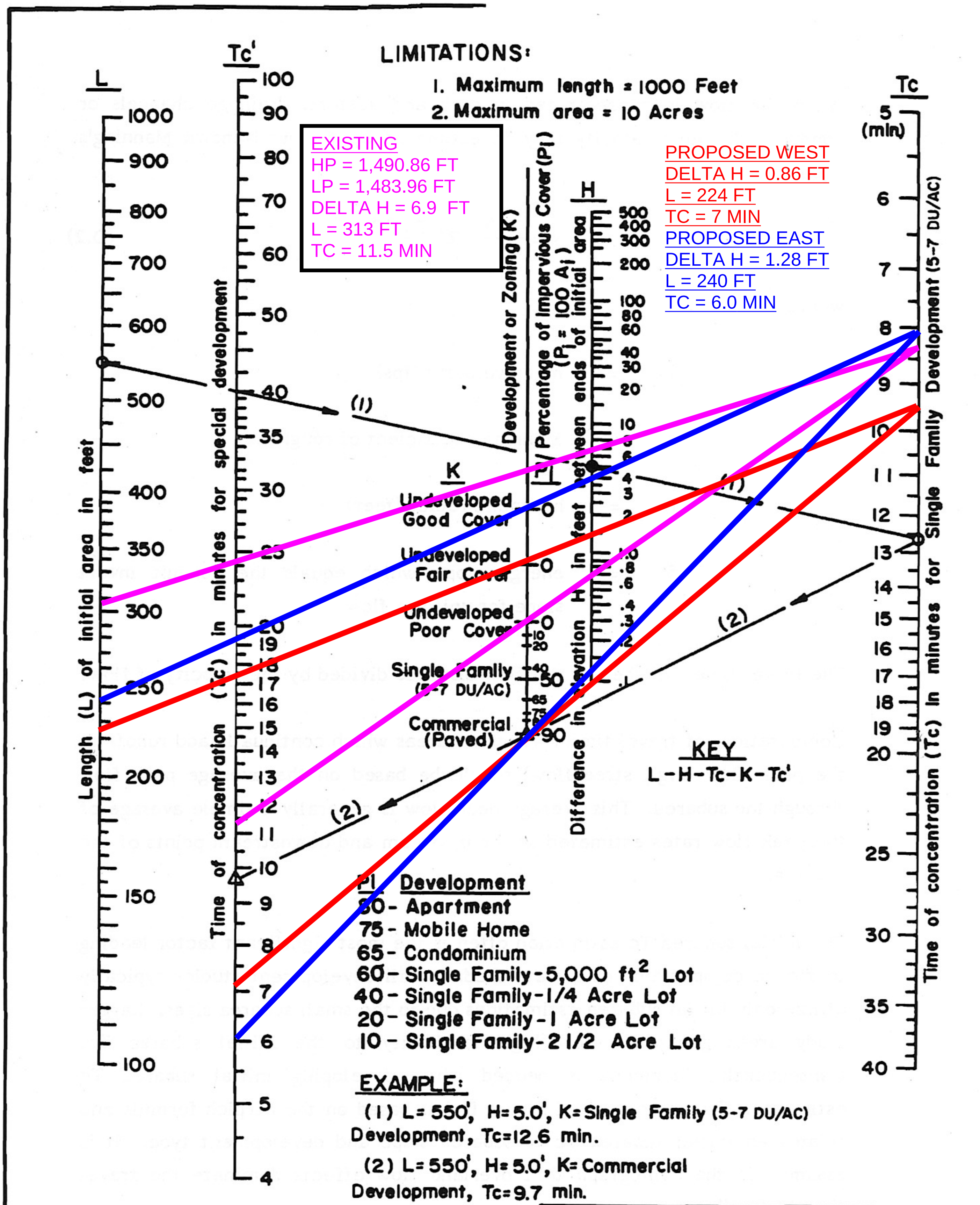
8911 Research Drive
Irvine, CA 92618-4237
(949) 872-2378
rasmith.com

TENTATIVE PARCEL MAP NO. 20798

4088 CAJON BOULEVARD
SAN BERNARDINO, CALIFORNIA 92407

ASSESSOR'S PARCEL NO. 0267-012-09

DATE: 9/14/23
SCALE: 50
JOB NO. 3230032
PROJECT MANAGER: ERIC ROBLES
DESIGNED BY: TFW
CHECKED BY: KEC
SHEET 1 OF 1



SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

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	2.0	0.5
		Predominant soil texture	0.25	1.0	0.25
		Site soil variability	0.25	2.0	0.5
		Depth to groundwater / impervious layer	0.25	1.0	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.5
B	Design	Tributary area size	0.25	1.0	0.25
		Level of pretreatment/ expected sediment loads	0.25	3.0	0.75
		Redundancy	0.25	3.0	0.75
		Compaction during construction	0.25	2.0	0.50
		Design Safety Factor, $S_B = \Sigma p$			2.25
Combined Safety Factor, $S_{TOT} = S_A \times S_B$				3.375	
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)				DA-S-1, I-1, 21.0 DA-S-2, I-2, 19.8	
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$				DA-S-1 = 6.22 DA-S-2 = 5.87	
Supporting Data					
Briefly describe infiltration test and provide reference to test forms:					

The Geotechnical Report prepared by Southern California Geotechnical. dated 04/05/23, included four infiltration tests throughout the site. All tests were conducted in accordance with the guidelines established by the County of San Bernardino via the falling head test. Each hole was pre-saturated before testing commenced. Rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval. The tests yielded rates of I-3 21.0in/hr, I-4 19.8 in/hr. Test I-4 measured rate of 19.8 in/hr is the lowest rate measured on the site so as a additional factor of safety it will be used for the infiltration calculations and was used in the calculations above. See Geotechnical Report in Attachment 6.6 of this WQMP.

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

EXISTING 2YR STORM DA 1

```
        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  02/22/24

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

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


Program License Serial Number 6458

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

        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 2
             1.82            1           0.77
--------------------------------------------------------------------
Rainfall data for year 2
             1.82            6           1.82
--------------------------------------------------------------------
Rainfall data for year 2
             1.82           24           2.98
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** 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)
 67.0      47.4          1.82      1.000     0.840    1.000    0.840

Area-averaged adjusted loss rate Fm (In/Hr) =  0.840

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     1.82   1.000         67.0      47.4      11.10     0.016

Area-averaged catchment yield fraction, Y =  0.016
Area-averaged low loss fraction, Yb =  0.984
Direct entry of lag time by user
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.82(Ac.)
Catchment Lag time =   0.192 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 43.4028
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.840(In/Hr)
Average low loss rate fraction (Yb) = 0.984 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.284(In)
Computed peak 30-minute rainfall =  0.581(In)
Specified peak 1-hour rainfall =  0.766(In)
Computed peak 3-hour rainfall =  1.302(In)
Specified peak 6-hour rainfall =  1.820(In)
Specified peak 24-hour rainfall =  2.980(In)


Rainfall depth area reduction factors:
Using a total area of       1.82(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.283(In)
30-minute factor = 1.000    Adjusted rainfall =  0.580(In)
1-hour factor = 1.000       Adjusted rainfall =  0.766(In)
3-hour factor = 1.000       Adjusted rainfall =  1.302(In)
6-hour factor = 1.000       Adjusted rainfall =  1.820(In)
24-hour factor = 1.000      Adjusted rainfall =  2.980(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 =        22.01 (CFS))
```

1	3.509	0.772
2	22.844	4.256
3	56.917	7.500
4	82.930	5.725
5	93.799	2.392
6	97.837	0.889
7	98.878	0.229
8	99.652	0.170
9	100.000	0.077

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2835	0.2835
2	0.3741	0.0906
3	0.4399	0.0659
4	0.4936	0.0536
5	0.5396	0.0461
6	0.5805	0.0408
7	0.6174	0.0369
8	0.6513	0.0339
9	0.6827	0.0314
10	0.7121	0.0294
11	0.7397	0.0277
12	0.7659	0.0262
13	0.7961	0.0302
14	0.8251	0.0290
15	0.8531	0.0280
16	0.8801	0.0270
17	0.9063	0.0262
18	0.9317	0.0254
19	0.9563	0.0247
20	0.9803	0.0240
21	1.0037	0.0234
22	1.0265	0.0228
23	1.0488	0.0223
24	1.0706	0.0218
25	1.0919	0.0213
26	1.1128	0.0209
27	1.1332	0.0205
28	1.1533	0.0201
29	1.1730	0.0197
30	1.1924	0.0194
31	1.2114	0.0190
32	1.2302	0.0187
33	1.2486	0.0184
34	1.2667	0.0181
35	1.2846	0.0179
36	1.3022	0.0176
37	1.3195	0.0173
38	1.3366	0.0171

39	1.3535	0.0169
40	1.3702	0.0167
41	1.3866	0.0164
42	1.4028	0.0162
43	1.4189	0.0160
44	1.4347	0.0158
45	1.4504	0.0157
46	1.4658	0.0155
47	1.4812	0.0153
48	1.4963	0.0151
49	1.5113	0.0150
50	1.5261	0.0148
51	1.5408	0.0147
52	1.5553	0.0145
53	1.5696	0.0144
54	1.5839	0.0142
55	1.5980	0.0141
56	1.6120	0.0140
57	1.6258	0.0138
58	1.6395	0.0137
59	1.6531	0.0136
60	1.6666	0.0135
61	1.6799	0.0134
62	1.6932	0.0132
63	1.7063	0.0131
64	1.7193	0.0130
65	1.7323	0.0129
66	1.7451	0.0128
67	1.7578	0.0127
68	1.7704	0.0126
69	1.7830	0.0125
70	1.7954	0.0124
71	1.8077	0.0123
72	1.8200	0.0123
73	1.8289	0.0090
74	1.8378	0.0089
75	1.8466	0.0088
76	1.8553	0.0087
77	1.8640	0.0086
78	1.8726	0.0086
79	1.8811	0.0085
80	1.8895	0.0084
81	1.8979	0.0084
82	1.9062	0.0083
83	1.9144	0.0082
84	1.9226	0.0082
85	1.9307	0.0081
86	1.9387	0.0080
87	1.9467	0.0080
88	1.9546	0.0079

89	1.9625	0.0079
90	1.9703	0.0078
91	1.9781	0.0078
92	1.9858	0.0077
93	1.9934	0.0077
94	2.0010	0.0076
95	2.0086	0.0075
96	2.0161	0.0075
97	2.0235	0.0074
98	2.0309	0.0074
99	2.0383	0.0073
100	2.0456	0.0073
101	2.0528	0.0073
102	2.0600	0.0072
103	2.0672	0.0072
104	2.0743	0.0071
105	2.0814	0.0071
106	2.0884	0.0070
107	2.0954	0.0070
108	2.1023	0.0069
109	2.1092	0.0069
110	2.1161	0.0069
111	2.1229	0.0068
112	2.1297	0.0068
113	2.1365	0.0067
114	2.1432	0.0067
115	2.1498	0.0067
116	2.1565	0.0066
117	2.1631	0.0066
118	2.1696	0.0066
119	2.1761	0.0065
120	2.1826	0.0065
121	2.1891	0.0065
122	2.1955	0.0064
123	2.2019	0.0064
124	2.2082	0.0064
125	2.2145	0.0063
126	2.2208	0.0063
127	2.2271	0.0063
128	2.2333	0.0062
129	2.2395	0.0062
130	2.2457	0.0062
131	2.2518	0.0061
132	2.2579	0.0061
133	2.2640	0.0061
134	2.2700	0.0060
135	2.2760	0.0060
136	2.2820	0.0060
137	2.2879	0.0060
138	2.2939	0.0059

139	2.2998	0.0059
140	2.3056	0.0059
141	2.3115	0.0058
142	2.3173	0.0058
143	2.3231	0.0058
144	2.3289	0.0058
145	2.3346	0.0057
146	2.3403	0.0057
147	2.3460	0.0057
148	2.3517	0.0057
149	2.3573	0.0056
150	2.3629	0.0056
151	2.3685	0.0056
152	2.3741	0.0056
153	2.3796	0.0055
154	2.3851	0.0055
155	2.3906	0.0055
156	2.3961	0.0055
157	2.4016	0.0055
158	2.4070	0.0054
159	2.4124	0.0054
160	2.4178	0.0054
161	2.4231	0.0054
162	2.4285	0.0053
163	2.4338	0.0053
164	2.4391	0.0053
165	2.4444	0.0053
166	2.4497	0.0053
167	2.4549	0.0052
168	2.4601	0.0052
169	2.4653	0.0052
170	2.4705	0.0052
171	2.4756	0.0052
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173	2.4859	0.0051
174	2.4910	0.0051
175	2.4961	0.0051
176	2.5012	0.0051
177	2.5062	0.0050
178	2.5112	0.0050
179	2.5162	0.0050
180	2.5212	0.0050
181	2.5262	0.0050
182	2.5312	0.0050
183	2.5361	0.0049
184	2.5410	0.0049
185	2.5459	0.0049
186	2.5508	0.0049
187	2.5557	0.0049
188	2.5605	0.0049

189	2.5654	0.0048
190	2.5702	0.0048
191	2.5750	0.0048
192	2.5798	0.0048
193	2.5845	0.0048
194	2.5893	0.0048
195	2.5940	0.0047
196	2.5988	0.0047
197	2.6035	0.0047
198	2.6082	0.0047
199	2.6128	0.0047
200	2.6175	0.0047
201	2.6222	0.0046
202	2.6268	0.0046
203	2.6314	0.0046
204	2.6360	0.0046
205	2.6406	0.0046
206	2.6452	0.0046
207	2.6497	0.0046
208	2.6543	0.0045
209	2.6588	0.0045
210	2.6633	0.0045
211	2.6678	0.0045
212	2.6723	0.0045
213	2.6768	0.0045
214	2.6813	0.0045
215	2.6857	0.0044
216	2.6901	0.0044
217	2.6946	0.0044
218	2.6990	0.0044
219	2.7034	0.0044
220	2.7078	0.0044
221	2.7121	0.0044
222	2.7165	0.0044
223	2.7208	0.0043
224	2.7252	0.0043
225	2.7295	0.0043
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227	2.7381	0.0043
228	2.7424	0.0043
229	2.7467	0.0043
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231	2.7552	0.0042
232	2.7594	0.0042
233	2.7636	0.0042
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236	2.7762	0.0042
237	2.7804	0.0042
238	2.7846	0.0042

239	2.7887	0.0042
240	2.7929	0.0041
241	2.7970	0.0041
242	2.8011	0.0041
243	2.8052	0.0041
244	2.8093	0.0041
245	2.8134	0.0041
246	2.8175	0.0041
247	2.8216	0.0041
248	2.8256	0.0041
249	2.8297	0.0040
250	2.8337	0.0040
251	2.8377	0.0040
252	2.8418	0.0040
253	2.8458	0.0040
254	2.8498	0.0040
255	2.8538	0.0040
256	2.8577	0.0040
257	2.8617	0.0040
258	2.8656	0.0040
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260	2.8735	0.0039
261	2.8775	0.0039
262	2.8814	0.0039
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264	2.8892	0.0039
265	2.8931	0.0039
266	2.8969	0.0039
267	2.9008	0.0039
268	2.9047	0.0039
269	2.9085	0.0039
270	2.9124	0.0038
271	2.9162	0.0038
272	2.9200	0.0038
273	2.9238	0.0038
274	2.9276	0.0038
275	2.9314	0.0038
276	2.9352	0.0038
277	2.9390	0.0038
278	2.9428	0.0038
279	2.9465	0.0038
280	2.9503	0.0038
281	2.9540	0.0037
282	2.9578	0.0037
283	2.9615	0.0037
284	2.9652	0.0037
285	2.9689	0.0037
286	2.9726	0.0037
287	2.9763	0.0037
288	2.9800	0.0037

Unit Period (number)	Unit Rainfall (In)	Unit Soil-Loss (In)	Effective Rainfall (In)
1	0.0037	0.0036	0.0001
2	0.0037	0.0036	0.0001
3	0.0037	0.0036	0.0001
4	0.0037	0.0037	0.0001
5	0.0037	0.0037	0.0001
6	0.0037	0.0037	0.0001
7	0.0038	0.0037	0.0001
8	0.0038	0.0037	0.0001
9	0.0038	0.0037	0.0001
10	0.0038	0.0037	0.0001
11	0.0038	0.0038	0.0001
12	0.0038	0.0038	0.0001
13	0.0038	0.0038	0.0001
14	0.0039	0.0038	0.0001
15	0.0039	0.0038	0.0001
16	0.0039	0.0038	0.0001
17	0.0039	0.0038	0.0001
18	0.0039	0.0038	0.0001
19	0.0039	0.0039	0.0001
20	0.0039	0.0039	0.0001
21	0.0040	0.0039	0.0001
22	0.0040	0.0039	0.0001
23	0.0040	0.0039	0.0001
24	0.0040	0.0039	0.0001
25	0.0040	0.0040	0.0001
26	0.0040	0.0040	0.0001
27	0.0040	0.0040	0.0001
28	0.0041	0.0040	0.0001
29	0.0041	0.0040	0.0001
30	0.0041	0.0040	0.0001
31	0.0041	0.0040	0.0001
32	0.0041	0.0041	0.0001
33	0.0041	0.0041	0.0001
34	0.0042	0.0041	0.0001
35	0.0042	0.0041	0.0001
36	0.0042	0.0041	0.0001
37	0.0042	0.0041	0.0001
38	0.0042	0.0042	0.0001
39	0.0042	0.0042	0.0001
40	0.0043	0.0042	0.0001
41	0.0043	0.0042	0.0001
42	0.0043	0.0042	0.0001
43	0.0043	0.0043	0.0001
44	0.0043	0.0043	0.0001
45	0.0044	0.0043	0.0001

46	0.0044	0.0043	0.0001
47	0.0044	0.0043	0.0001
48	0.0044	0.0043	0.0001
49	0.0044	0.0044	0.0001
50	0.0044	0.0044	0.0001
51	0.0045	0.0044	0.0001
52	0.0045	0.0044	0.0001
53	0.0045	0.0044	0.0001
54	0.0045	0.0045	0.0001
55	0.0046	0.0045	0.0001
56	0.0046	0.0045	0.0001
57	0.0046	0.0045	0.0001
58	0.0046	0.0045	0.0001
59	0.0046	0.0046	0.0001
60	0.0047	0.0046	0.0001
61	0.0047	0.0046	0.0001
62	0.0047	0.0046	0.0001
63	0.0047	0.0047	0.0001
64	0.0048	0.0047	0.0001
65	0.0048	0.0047	0.0001
66	0.0048	0.0047	0.0001
67	0.0048	0.0048	0.0001
68	0.0049	0.0048	0.0001
69	0.0049	0.0048	0.0001
70	0.0049	0.0048	0.0001
71	0.0049	0.0049	0.0001
72	0.0050	0.0049	0.0001
73	0.0050	0.0049	0.0001
74	0.0050	0.0049	0.0001
75	0.0050	0.0050	0.0001
76	0.0051	0.0050	0.0001
77	0.0051	0.0050	0.0001
78	0.0051	0.0050	0.0001
79	0.0052	0.0051	0.0001
80	0.0052	0.0051	0.0001
81	0.0052	0.0051	0.0001
82	0.0052	0.0052	0.0001
83	0.0053	0.0052	0.0001
84	0.0053	0.0052	0.0001
85	0.0053	0.0053	0.0001
86	0.0054	0.0053	0.0001
87	0.0054	0.0053	0.0001
88	0.0054	0.0053	0.0001
89	0.0055	0.0054	0.0001
90	0.0055	0.0054	0.0001
91	0.0055	0.0055	0.0001
92	0.0056	0.0055	0.0001
93	0.0056	0.0055	0.0001
94	0.0056	0.0055	0.0001
95	0.0057	0.0056	0.0001

96	0.0057	0.0056	0.0001
97	0.0058	0.0057	0.0001
98	0.0058	0.0057	0.0001
99	0.0058	0.0057	0.0001
100	0.0059	0.0058	0.0001
101	0.0059	0.0058	0.0001
102	0.0060	0.0059	0.0001
103	0.0060	0.0059	0.0001
104	0.0060	0.0059	0.0001
105	0.0061	0.0060	0.0001
106	0.0061	0.0060	0.0001
107	0.0062	0.0061	0.0001
108	0.0062	0.0061	0.0001
109	0.0063	0.0062	0.0001
110	0.0063	0.0062	0.0001
111	0.0064	0.0063	0.0001
112	0.0064	0.0063	0.0001
113	0.0065	0.0064	0.0001
114	0.0065	0.0064	0.0001
115	0.0066	0.0065	0.0001
116	0.0066	0.0065	0.0001
117	0.0067	0.0066	0.0001
118	0.0067	0.0066	0.0001
119	0.0068	0.0067	0.0001
120	0.0069	0.0068	0.0001
121	0.0069	0.0068	0.0001
122	0.0070	0.0069	0.0001
123	0.0071	0.0070	0.0001
124	0.0071	0.0070	0.0001
125	0.0072	0.0071	0.0001
126	0.0073	0.0071	0.0001
127	0.0073	0.0072	0.0001
128	0.0074	0.0073	0.0001
129	0.0075	0.0074	0.0001
130	0.0075	0.0074	0.0001
131	0.0077	0.0075	0.0001
132	0.0077	0.0076	0.0001
133	0.0078	0.0077	0.0001
134	0.0079	0.0077	0.0001
135	0.0080	0.0079	0.0001
136	0.0080	0.0079	0.0001
137	0.0082	0.0080	0.0001
138	0.0082	0.0081	0.0001
139	0.0084	0.0082	0.0001
140	0.0084	0.0083	0.0001
141	0.0086	0.0084	0.0001
142	0.0086	0.0085	0.0001
143	0.0088	0.0087	0.0001
144	0.0089	0.0087	0.0001
145	0.0123	0.0121	0.0002

146	0.0123	0.0121	0.0002
147	0.0125	0.0123	0.0002
148	0.0126	0.0124	0.0002
149	0.0128	0.0126	0.0002
150	0.0129	0.0127	0.0002
151	0.0131	0.0129	0.0002
152	0.0132	0.0130	0.0002
153	0.0135	0.0133	0.0002
154	0.0136	0.0134	0.0002
155	0.0138	0.0136	0.0002
156	0.0140	0.0137	0.0002
157	0.0142	0.0140	0.0002
158	0.0144	0.0141	0.0002
159	0.0147	0.0144	0.0002
160	0.0148	0.0146	0.0002
161	0.0151	0.0149	0.0002
162	0.0153	0.0151	0.0003
163	0.0157	0.0154	0.0003
164	0.0158	0.0156	0.0003
165	0.0162	0.0160	0.0003
166	0.0164	0.0162	0.0003
167	0.0169	0.0166	0.0003
168	0.0171	0.0168	0.0003
169	0.0176	0.0173	0.0003
170	0.0179	0.0176	0.0003
171	0.0184	0.0181	0.0003
172	0.0187	0.0184	0.0003
173	0.0194	0.0191	0.0003
174	0.0197	0.0194	0.0003
175	0.0205	0.0201	0.0003
176	0.0209	0.0205	0.0003
177	0.0218	0.0214	0.0004
178	0.0223	0.0219	0.0004
179	0.0234	0.0230	0.0004
180	0.0240	0.0236	0.0004
181	0.0254	0.0250	0.0004
182	0.0262	0.0257	0.0004
183	0.0280	0.0275	0.0005
184	0.0290	0.0285	0.0005
185	0.0262	0.0258	0.0004
186	0.0277	0.0272	0.0005
187	0.0314	0.0309	0.0005
188	0.0339	0.0333	0.0006
189	0.0408	0.0402	0.0007
190	0.0461	0.0453	0.0008
191	0.0659	0.0648	0.0011
192	0.0906	0.0700	0.0206
193	0.2835	0.0700	0.2135
194	0.0536	0.0528	0.0009
195	0.0369	0.0363	0.0006

196	0.0294	0.0289	0.0005
197	0.0302	0.0297	0.0005
198	0.0270	0.0266	0.0004
199	0.0247	0.0242	0.0004
200	0.0228	0.0224	0.0004
201	0.0213	0.0210	0.0003
202	0.0201	0.0198	0.0003
203	0.0190	0.0187	0.0003
204	0.0181	0.0178	0.0003
205	0.0173	0.0171	0.0003
206	0.0167	0.0164	0.0003
207	0.0160	0.0158	0.0003
208	0.0155	0.0152	0.0003
209	0.0150	0.0147	0.0002
210	0.0145	0.0143	0.0002
211	0.0141	0.0139	0.0002
212	0.0137	0.0135	0.0002
213	0.0134	0.0131	0.0002
214	0.0130	0.0128	0.0002
215	0.0127	0.0125	0.0002
216	0.0124	0.0122	0.0002
217	0.0090	0.0088	0.0001
218	0.0087	0.0086	0.0001
219	0.0085	0.0084	0.0001
220	0.0083	0.0082	0.0001
221	0.0081	0.0080	0.0001
222	0.0079	0.0078	0.0001
223	0.0078	0.0076	0.0001
224	0.0076	0.0075	0.0001
225	0.0074	0.0073	0.0001
226	0.0073	0.0072	0.0001
227	0.0072	0.0070	0.0001
228	0.0070	0.0069	0.0001
229	0.0069	0.0068	0.0001
230	0.0068	0.0067	0.0001
231	0.0067	0.0066	0.0001
232	0.0066	0.0065	0.0001
233	0.0065	0.0063	0.0001
234	0.0064	0.0062	0.0001
235	0.0063	0.0062	0.0001
236	0.0062	0.0061	0.0001
237	0.0061	0.0060	0.0001
238	0.0060	0.0059	0.0001
239	0.0059	0.0058	0.0001
240	0.0058	0.0057	0.0001
241	0.0057	0.0056	0.0001
242	0.0057	0.0056	0.0001
243	0.0056	0.0055	0.0001
244	0.0055	0.0054	0.0001
245	0.0055	0.0054	0.0001

246	0.0054	0.0053	0.0001
247	0.0053	0.0052	0.0001
248	0.0053	0.0052	0.0001
249	0.0052	0.0051	0.0001
250	0.0051	0.0051	0.0001
251	0.0051	0.0050	0.0001
252	0.0050	0.0049	0.0001
253	0.0050	0.0049	0.0001
254	0.0049	0.0048	0.0001
255	0.0049	0.0048	0.0001
256	0.0048	0.0047	0.0001
257	0.0048	0.0047	0.0001
258	0.0047	0.0046	0.0001
259	0.0047	0.0046	0.0001
260	0.0046	0.0046	0.0001
261	0.0046	0.0045	0.0001
262	0.0045	0.0045	0.0001
263	0.0045	0.0044	0.0001
264	0.0045	0.0044	0.0001
265	0.0044	0.0044	0.0001
266	0.0044	0.0043	0.0001
267	0.0043	0.0043	0.0001
268	0.0043	0.0042	0.0001
269	0.0043	0.0042	0.0001
270	0.0042	0.0042	0.0001
271	0.0042	0.0041	0.0001
272	0.0042	0.0041	0.0001
273	0.0041	0.0041	0.0001
274	0.0041	0.0040	0.0001
275	0.0041	0.0040	0.0001
276	0.0040	0.0040	0.0001
277	0.0040	0.0039	0.0001
278	0.0040	0.0039	0.0001
279	0.0039	0.0039	0.0001
280	0.0039	0.0039	0.0001
281	0.0039	0.0038	0.0001
282	0.0039	0.0038	0.0001
283	0.0038	0.0038	0.0001
284	0.0038	0.0037	0.0001
285	0.0038	0.0037	0.0001
286	0.0038	0.0037	0.0001
287	0.0037	0.0037	0.0001
288	0.0037	0.0036	0.0001

Total soil rain loss = 2.70(In)
Total effective rainfall = 0.28(In)
Peak flow rate in flood hydrograph = 1.73(CFS)

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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	0.0001	0.00	Q	|	|	|	|
0+45	0.0001	0.00	Q	|	|	|	|
0+50	0.0001	0.00	Q	|	|	|	|
0+55	0.0001	0.00	Q	|	|	|	|
1+ 0	0.0001	0.00	Q	|	|	|	|
1+ 5	0.0001	0.00	Q	|	|	|	|
1+10	0.0001	0.00	Q	|	|	|	|
1+15	0.0001	0.00	Q	|	|	|	|
1+20	0.0001	0.00	Q	|	|	|	|
1+25	0.0001	0.00	Q	|	|	|	|
1+30	0.0001	0.00	Q	|	|	|	|
1+35	0.0002	0.00	Q	|	|	|	|
1+40	0.0002	0.00	Q	|	|	|	|
1+45	0.0002	0.00	Q	|	|	|	|
1+50	0.0002	0.00	Q	|	|	|	|
1+55	0.0002	0.00	Q	|	|	|	|
2+ 0	0.0002	0.00	Q	|	|	|	|
2+ 5	0.0002	0.00	Q	|	|	|	|
2+10	0.0002	0.00	Q	|	|	|	|
2+15	0.0002	0.00	Q	|	|	|	|
2+20	0.0002	0.00	Q	|	|	|	|
2+25	0.0003	0.00	Q	|	|	|	|
2+30	0.0003	0.00	Q	|	|	|	|
2+35	0.0003	0.00	Q	|	|	|	|
2+40	0.0003	0.00	Q	|	|	|	|
2+45	0.0003	0.00	Q	|	|	|	|
2+50	0.0003	0.00	Q	|	|	|	|
2+55	0.0003	0.00	Q	|	|	|	|
3+ 0	0.0003	0.00	Q	|	|	|	|
3+ 5	0.0003	0.00	Q	|	|	|	|
3+10	0.0003	0.00	Q	|	|	|	|
3+15	0.0004	0.00	Q	|	|	|	|
3+20	0.0004	0.00	Q	|	|	|	|
3+25	0.0004	0.00	Q	|	|	|	|
3+30	0.0004	0.00	Q	|	|	|	|

3+35	0.0004	0.00	Q	|	|	|	|
3+40	0.0004	0.00	Q	|	|	|	|
3+45	0.0004	0.00	Q	|	|	|	|
3+50	0.0004	0.00	Q	|	|	|	|
3+55	0.0004	0.00	Q	|	|	|	|
4+ 0	0.0005	0.00	Q	|	|	|	|
4+ 5	0.0005	0.00	Q	|	|	|	|
4+10	0.0005	0.00	Q	|	|	|	|
4+15	0.0005	0.00	Q	|	|	|	|
4+20	0.0005	0.00	Q	|	|	|	|
4+25	0.0005	0.00	Q	|	|	|	|
4+30	0.0005	0.00	Q	|	|	|	|
4+35	0.0005	0.00	Q	|	|	|	|
4+40	0.0005	0.00	Q	|	|	|	|
4+45	0.0006	0.00	Q	|	|	|	|
4+50	0.0006	0.00	Q	|	|	|	|
4+55	0.0006	0.00	Q	|	|	|	|
5+ 0	0.0006	0.00	Q	|	|	|	|
5+ 5	0.0006	0.00	Q	|	|	|	|
5+10	0.0006	0.00	Q	|	|	|	|
5+15	0.0006	0.00	Q	|	|	|	|
5+20	0.0006	0.00	Q	|	|	|	|
5+25	0.0006	0.00	Q	|	|	|	|
5+30	0.0007	0.00	Q	|	|	|	|
5+35	0.0007	0.00	Q	|	|	|	|
5+40	0.0007	0.00	Q	|	|	|	|
5+45	0.0007	0.00	Q	|	|	|	|
5+50	0.0007	0.00	Q	|	|	|	|
5+55	0.0007	0.00	Q	|	|	|	|
6+ 0	0.0007	0.00	Q	|	|	|	|
6+ 5	0.0007	0.00	Q	|	|	|	|
6+10	0.0008	0.00	Q	|	|	|	|
6+15	0.0008	0.00	Q	|	|	|	|
6+20	0.0008	0.00	Q	|	|	|	|
6+25	0.0008	0.00	Q	|	|	|	|
6+30	0.0008	0.00	Q	|	|	|	|
6+35	0.0008	0.00	Q	|	|	|	|
6+40	0.0008	0.00	Q	|	|	|	|
6+45	0.0008	0.00	Q	|	|	|	|
6+50	0.0009	0.00	Q	|	|	|	|
6+55	0.0009	0.00	Q	|	|	|	|
7+ 0	0.0009	0.00	Q	|	|	|	|
7+ 5	0.0009	0.00	Q	|	|	|	|
7+10	0.0009	0.00	Q	|	|	|	|
7+15	0.0009	0.00	Q	|	|	|	|
7+20	0.0009	0.00	Q	|	|	|	|
7+25	0.0009	0.00	Q	|	|	|	|
7+30	0.0010	0.00	Q	|	|	|	|
7+35	0.0010	0.00	Q	|	|	|	|
7+40	0.0010	0.00	Q	|	|	|	|

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  7+45         0.0010       0.00  Q         |         |         |         |
  7+50         0.0010       0.00  Q         |         |         |         |
  7+55         0.0010       0.00  Q         |         |         |         |
  8+ 0         0.0010       0.00  Q         |         |         |         |
  8+ 5         0.0011       0.00  QV        |         |         |         |
  8+10         0.0011       0.00  QV        |         |         |         |
  8+15         0.0011       0.00  QV        |         |         |         |
  8+20         0.0011       0.00  QV        |         |         |         |
  8+25         0.0011       0.00  QV        |         |         |         |
  8+30         0.0011       0.00  QV        |         |         |         |
  8+35         0.0011       0.00  QV        |         |         |         |
  8+40         0.0012       0.00  QV        |         |         |         |
  8+45         0.0012       0.00  QV        |         |         |         |
  8+50         0.0012       0.00  QV        |         |         |         |
  8+55         0.0012       0.00  QV        |         |         |         |
  9+ 0         0.0012       0.00  QV        |         |         |         |
  9+ 5         0.0012       0.00  QV        |         |         |         |
  9+10         0.0012       0.00  QV        |         |         |         |
  9+15         0.0013       0.00  QV        |         |         |         |
  9+20         0.0013       0.00  QV        |         |         |         |
  9+25         0.0013       0.00  QV        |         |         |         |
  9+30         0.0013       0.00  QV        |         |         |         |
  9+35         0.0013       0.00  QV        |         |         |         |
  9+40         0.0013       0.00  QV        |         |         |         |
  9+45         0.0014       0.00  QV        |         |         |         |
  9+50         0.0014       0.00  QV        |         |         |         |
  9+55         0.0014       0.00  QV        |         |         |         |
 10+ 0         0.0014       0.00  QV        |         |         |         |
 10+ 5         0.0014       0.00  QV        |         |         |         |
 10+10         0.0014       0.00  QV        |         |         |         |
 10+15         0.0015       0.00  QV        |         |         |         |
 10+20         0.0015       0.00  QV        |         |         |         |
 10+25         0.0015       0.00  QV        |         |         |         |
 10+30         0.0015       0.00  QV        |         |         |         |
 10+35         0.0015       0.00  QV        |         |         |         |
 10+40         0.0015       0.00  QV        |         |         |         |
 10+45         0.0016       0.00  QV        |         |         |         |
 10+50         0.0016       0.00  QV        |         |         |         |
 10+55         0.0016       0.00  QV        |         |         |         |
 11+ 0         0.0016       0.00  QV        |         |         |         |
 11+ 5         0.0016       0.00  QV        |         |         |         |
 11+10         0.0017       0.00  QV        |         |         |         |
 11+15         0.0017       0.00  QV        |         |         |         |
 11+20         0.0017       0.00  QV        |         |         |         |
 11+25         0.0017       0.00  QV        |         |         |         |
 11+30         0.0017       0.00  QV        |         |         |         |
 11+35         0.0018       0.00  QV        |         |         |         |
 11+40         0.0018       0.00  QV        |         |         |         |
 11+45         0.0018       0.00  QV        |         |         |         |
 11+50         0.0018       0.00  QV        |         |         |         |
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 11+55        0.0018       0.00  QV         |         |         |         |
 12+ 0        0.0019       0.00  QV         |         |         |         |
 12+ 5        0.0019       0.00  QV         |         |         |         |
 12+10        0.0019       0.00  QV         |         |         |         |
 12+15        0.0019       0.00  QV         |         |         |         |
 12+20        0.0020       0.00  QV         |         |         |         |
 12+25        0.0020       0.00  QV         |         |         |         |
 12+30        0.0020       0.00  QV         |         |         |         |
 12+35        0.0021       0.00  QV         |         |         |         |
 12+40        0.0021       0.00  QV         |         |         |         |
 12+45        0.0021       0.00  Q V        |         |         |         |
 12+50        0.0022       0.00  Q V        |         |         |         |
 12+55        0.0022       0.00  Q V        |         |         |         |
 13+ 0        0.0022       0.00  Q V        |         |         |         |
 13+ 5        0.0023       0.00  Q V        |         |         |         |
 13+10        0.0023       0.01  Q V        |         |         |         |
 13+15        0.0023       0.01  Q V        |         |         |         |
 13+20        0.0024       0.01  Q V        |         |         |         |
 13+25        0.0024       0.01  Q V        |         |         |         |
 13+30        0.0024       0.01  Q V        |         |         |         |
 13+35        0.0025       0.01  Q V        |         |         |         |
 13+40        0.0025       0.01  Q V        |         |         |         |
 13+45        0.0025       0.01  Q V        |         |         |         |
 13+50        0.0026       0.01  Q V        |         |         |         |
 13+55        0.0026       0.01  Q V        |         |         |         |
 14+ 0        0.0027       0.01  Q V        |         |         |         |
 14+ 5        0.0027       0.01  Q V        |         |         |         |
 14+10        0.0027       0.01  Q V        |         |         |         |
 14+15        0.0028       0.01  Q V        |         |         |         |
 14+20        0.0028       0.01  Q V        |         |         |         |
 14+25        0.0029       0.01  Q V        |         |         |         |
 14+30        0.0029       0.01  Q V        |         |         |         |
 14+35        0.0030       0.01  Q V        |         |         |         |
 14+40        0.0030       0.01  Q V        |         |         |         |
 14+45        0.0031       0.01  Q V        |         |         |         |
 14+50        0.0031       0.01  Q V        |         |         |         |
 14+55        0.0032       0.01  Q  V       |         |         |         |
 15+ 0        0.0032       0.01  Q  V       |         |         |         |
 15+ 5        0.0033       0.01  Q  V       |         |         |         |
 15+10        0.0033       0.01  Q  V       |         |         |         |
 15+15        0.0034       0.01  Q  V       |         |         |         |
 15+20        0.0035       0.01  Q  V       |         |         |         |
 15+25        0.0035       0.01  Q  V       |         |         |         |
 15+30        0.0036       0.01  Q  V       |         |         |         |
 15+35        0.0037       0.01  Q  V       |         |         |         |
 15+40        0.0038       0.01  Q  V       |         |         |         |
 15+45        0.0038       0.01  Q  V       |         |         |         |
 15+50        0.0039       0.01  Q  V       |         |         |         |
 15+55        0.0040       0.01  Q  V       |         |         |         |
 16+ 0        0.0042       0.03  Q   V      |         |         |         |
```

```
16+ 5       0.0061      0.27  |Q   V    |         |         |         |
16+10       0.0135      1.07  |   Q     | V       |         |         |
16+15       0.0253      1.73  |     Q   |         |   V     |         |
16+20       0.0342      1.28  |    Q    |         |         | V       |
16+25       0.0379      0.54  | Q       |         |         |     V   |
16+30       0.0393      0.21  Q         |         |         |      V  |
16+35       0.0398      0.06  Q         |         |         |      V  |
16+40       0.0401      0.05  Q         |         |         |       V |
16+45       0.0403      0.03  Q         |         |         |       V |
16+50       0.0403      0.01  Q         |         |         |       V |
16+55       0.0404      0.01  Q         |         |         |       V |
17+ 0       0.0404      0.01  Q         |         |         |       V |
17+ 5       0.0405      0.01  Q         |         |         |       V |
17+10       0.0405      0.01  Q         |         |         |       V |
17+15       0.0406      0.01  Q         |         |         |       V |
17+20       0.0406      0.01  Q         |         |         |       V |
17+25       0.0407      0.01  Q         |         |         |       V |
17+30       0.0407      0.01  Q         |         |         |       V |
17+35       0.0407      0.01  Q         |         |         |       V |
17+40       0.0408      0.01  Q         |         |         |       V |
17+45       0.0408      0.01  Q         |         |         |       V |
17+50       0.0408      0.01  Q         |         |         |       V |
17+55       0.0409      0.00  Q         |         |         |       V |
18+ 0       0.0409      0.00  Q         |         |         |        V|
18+ 5       0.0409      0.00  Q         |         |         |        V|
18+10       0.0410      0.00  Q         |         |         |        V|
18+15       0.0410      0.00  Q         |         |         |        V|
18+20       0.0410      0.00  Q         |         |         |        V|
18+25       0.0410      0.00  Q         |         |         |        V|
18+30       0.0411      0.00  Q         |         |         |        V|
18+35       0.0411      0.00  Q         |         |         |        V|
18+40       0.0411      0.00  Q         |         |         |        V|
18+45       0.0411      0.00  Q         |         |         |        V|
18+50       0.0411      0.00  Q         |         |         |        V|
18+55       0.0412      0.00  Q         |         |         |        V|
19+ 0       0.0412      0.00  Q         |         |         |        V|
19+ 5       0.0412      0.00  Q         |         |         |        V|
19+10       0.0412      0.00  Q         |         |         |        V|
19+15       0.0412      0.00  Q         |         |         |        V|
19+20       0.0412      0.00  Q         |         |         |        V|
19+25       0.0413      0.00  Q         |         |         |        V|
19+30       0.0413      0.00  Q         |         |         |        V|
19+35       0.0413      0.00  Q         |         |         |        V|
19+40       0.0413      0.00  Q         |         |         |        V|
19+45       0.0413      0.00  Q         |         |         |        V|
19+50       0.0413      0.00  Q         |         |         |        V|
19+55       0.0414      0.00  Q         |         |         |        V|
20+ 0       0.0414      0.00  Q         |         |         |        V|
20+ 5       0.0414      0.00  Q         |         |         |        V|
20+10       0.0414      0.00  Q         |         |         |        V|
```

```
20+15      0.0414     0.00  Q         |         |         |        V|
20+20      0.0414     0.00  Q         |         |         |        V|
20+25      0.0414     0.00  Q         |         |         |        V|
20+30      0.0415     0.00  Q         |         |         |        V|
20+35      0.0415     0.00  Q         |         |         |        V|
20+40      0.0415     0.00  Q         |         |         |        V|
20+45      0.0415     0.00  Q         |         |         |        V|
20+50      0.0415     0.00  Q         |         |         |        V|
20+55      0.0415     0.00  Q         |         |         |        V|
21+ 0      0.0415     0.00  Q         |         |         |        V|
21+ 5      0.0416     0.00  Q         |         |         |        V|
21+10      0.0416     0.00  Q         |         |         |        V|
21+15      0.0416     0.00  Q         |         |         |        V|
21+20      0.0416     0.00  Q         |         |         |        V|
21+25      0.0416     0.00  Q         |         |         |        V|
21+30      0.0416     0.00  Q         |         |         |        V|
21+35      0.0416     0.00  Q         |         |         |        V|
21+40      0.0416     0.00  Q         |         |         |        V|
21+45      0.0416     0.00  Q         |         |         |        V|
21+50      0.0417     0.00  Q         |         |         |        V|
21+55      0.0417     0.00  Q         |         |         |        V|
22+ 0      0.0417     0.00  Q         |         |         |        V|
22+ 5      0.0417     0.00  Q         |         |         |        V|
22+10      0.0417     0.00  Q         |         |         |        V|
22+15      0.0417     0.00  Q         |         |         |        V|
22+20      0.0417     0.00  Q         |         |         |        V|
22+25      0.0417     0.00  Q         |         |         |        V|
22+30      0.0417     0.00  Q         |         |         |        V|
22+35      0.0418     0.00  Q         |         |         |        V|
22+40      0.0418     0.00  Q         |         |         |        V|
22+45      0.0418     0.00  Q         |         |         |        V|
22+50      0.0418     0.00  Q         |         |         |        V|
22+55      0.0418     0.00  Q         |         |         |        V|
23+ 0      0.0418     0.00  Q         |         |         |        V|
23+ 5      0.0418     0.00  Q         |         |         |        V|
23+10      0.0418     0.00  Q         |         |         |        V|
23+15      0.0418     0.00  Q         |         |         |        V|
23+20      0.0419     0.00  Q         |         |         |        V|
23+25      0.0419     0.00  Q         |         |         |        V|
23+30      0.0419     0.00  Q         |         |         |        V|
23+35      0.0419     0.00  Q         |         |         |        V|
23+40      0.0419     0.00  Q         |         |         |        V|
23+45      0.0419     0.00  Q         |         |         |        V|
23+50      0.0419     0.00  Q         |         |         |        V|
23+55      0.0419     0.00  Q         |         |         |        V|
24+ 0      0.0419     0.00  Q         |         |         |        V|
24+ 5      0.0419     0.00  Q         |         |         |        V|
24+10      0.0419     0.00  Q         |         |         |        V|
24+15      0.0419     0.00  Q         |         |         |        V|
24+20      0.0419     0.00  Q         |         |         |        V|
```

```
   24+25        0.0419       0.00  Q          |          |          |        V|
   24+30        0.0419       0.00  Q          |          |          |        V|
   24+35        0.0419       0.00  Q          |          |          |        V|
   24+40        0.0419       0.00  Q          |          |          |        V|
-----------------------------------------------------------------------
```

PROPOSED 2YR STORM DA-S-1

```
        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  02/23/24

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


Program License Serial Number 6458

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

        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 2
             1.01            1           0.77
--------------------------------------------------------------------
Rainfall data for year 2
             1.01            6           1.82
--------------------------------------------------------------------
Rainfall data for year 2
             1.01           24           2.98
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** 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)
 90.0      78.0          1.01      1.000     0.404    0.080    0.032

Area-averaged adjusted loss rate Fm (In/Hr) =  0.032

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     0.08   0.080         90.0      78.0       2.82     0.374
     0.93   0.920         98.0      98.0       0.20     0.922

Area-averaged catchment yield fraction, Y =  0.878
Area-averaged low loss fraction, Yb =  0.122
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       1.01(Ac.)
Catchment Lag time =   0.117 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 71.2251
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.032(In/Hr)
Average low loss rate fraction (Yb) = 0.122 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.284(In)
Computed peak 30-minute rainfall =  0.581(In)
Specified peak 1-hour rainfall =  0.766(In)
Computed peak 3-hour rainfall =  1.302(In)
Specified peak 6-hour rainfall =  1.820(In)
Specified peak 24-hour rainfall =  2.980(In)


Rainfall depth area reduction factors:
Using a total area of       1.01(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.283(In)
30-minute factor = 1.000    Adjusted rainfall =  0.580(In)
1-hour factor = 1.000       Adjusted rainfall =  0.766(In)
3-hour factor = 1.000       Adjusted rainfall =  1.302(In)
6-hour factor = 1.000       Adjusted rainfall =  1.820(In)
24-hour factor = 1.000      Adjusted rainfall =  2.980(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 =        12.21 (CFS))
```

1	9.072	1.108
2	54.804	5.586
3	90.038	4.304
4	98.072	0.981
5	100.000	0.235

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2835	0.2835
2	0.3741	0.0906
3	0.4399	0.0659
4	0.4936	0.0537
5	0.5397	0.0461
6	0.5805	0.0408
7	0.6174	0.0369
8	0.6513	0.0339
9	0.6827	0.0314
10	0.7121	0.0294
11	0.7398	0.0277
12	0.7660	0.0262
13	0.7962	0.0302
14	0.8252	0.0290
15	0.8531	0.0280
16	0.8802	0.0270
17	0.9063	0.0262
18	0.9317	0.0254
19	0.9563	0.0247
20	0.9803	0.0240
21	1.0037	0.0234
22	1.0265	0.0228
23	1.0488	0.0223
24	1.0706	0.0218
25	1.0919	0.0213
26	1.1128	0.0209
27	1.1332	0.0205
28	1.1533	0.0201
29	1.1730	0.0197
30	1.1924	0.0194
31	1.2114	0.0190
32	1.2302	0.0187
33	1.2486	0.0184
34	1.2667	0.0181
35	1.2846	0.0179
36	1.3022	0.0176
37	1.3195	0.0173
38	1.3366	0.0171
39	1.3535	0.0169
40	1.3702	0.0167
41	1.3866	0.0164

42	1.4028	0.0162
43	1.4189	0.0160
44	1.4347	0.0158
45	1.4504	0.0157
46	1.4659	0.0155
47	1.4812	0.0153
48	1.4963	0.0151
49	1.5113	0.0150
50	1.5261	0.0148
51	1.5408	0.0147
52	1.5553	0.0145
53	1.5697	0.0144
54	1.5839	0.0142
55	1.5980	0.0141
56	1.6120	0.0140
57	1.6258	0.0138
58	1.6395	0.0137
59	1.6531	0.0136
60	1.6666	0.0135
61	1.6799	0.0134
62	1.6932	0.0132
63	1.7063	0.0131
64	1.7193	0.0130
65	1.7323	0.0129
66	1.7451	0.0128
67	1.7578	0.0127
68	1.7704	0.0126
69	1.7830	0.0125
70	1.7954	0.0124
71	1.8077	0.0123
72	1.8200	0.0123
73	1.8289	0.0090
74	1.8378	0.0089
75	1.8466	0.0088
76	1.8553	0.0087
77	1.8640	0.0086
78	1.8726	0.0086
79	1.8811	0.0085
80	1.8895	0.0084
81	1.8979	0.0084
82	1.9062	0.0083
83	1.9144	0.0082
84	1.9226	0.0082
85	1.9307	0.0081
86	1.9387	0.0080
87	1.9467	0.0080
88	1.9546	0.0079
89	1.9625	0.0079
90	1.9703	0.0078
91	1.9781	0.0078

92	1.9858	0.0077
93	1.9934	0.0077
94	2.0010	0.0076
95	2.0086	0.0075
96	2.0161	0.0075
97	2.0235	0.0074
98	2.0309	0.0074
99	2.0383	0.0073
100	2.0456	0.0073
101	2.0528	0.0073
102	2.0600	0.0072
103	2.0672	0.0072
104	2.0743	0.0071
105	2.0814	0.0071
106	2.0884	0.0070
107	2.0954	0.0070
108	2.1023	0.0069
109	2.1092	0.0069
110	2.1161	0.0069
111	2.1229	0.0068
112	2.1297	0.0068
113	2.1365	0.0067
114	2.1432	0.0067
115	2.1498	0.0067
116	2.1565	0.0066
117	2.1631	0.0066
118	2.1696	0.0066
119	2.1761	0.0065
120	2.1826	0.0065
121	2.1891	0.0065
122	2.1955	0.0064
123	2.2019	0.0064
124	2.2082	0.0064
125	2.2145	0.0063
126	2.2208	0.0063
127	2.2271	0.0063
128	2.2333	0.0062
129	2.2395	0.0062
130	2.2457	0.0062
131	2.2518	0.0061
132	2.2579	0.0061
133	2.2640	0.0061
134	2.2700	0.0060
135	2.2760	0.0060
136	2.2820	0.0060
137	2.2879	0.0060
138	2.2939	0.0059
139	2.2998	0.0059
140	2.3056	0.0059
141	2.3115	0.0058

142	2.3173	0.0058
143	2.3231	0.0058
144	2.3289	0.0058
145	2.3346	0.0057
146	2.3403	0.0057
147	2.3460	0.0057
148	2.3517	0.0057
149	2.3573	0.0056
150	2.3629	0.0056
151	2.3685	0.0056
152	2.3741	0.0056
153	2.3796	0.0055
154	2.3851	0.0055
155	2.3906	0.0055
156	2.3961	0.0055
157	2.4016	0.0055
158	2.4070	0.0054
159	2.4124	0.0054
160	2.4178	0.0054
161	2.4232	0.0054
162	2.4285	0.0053
163	2.4338	0.0053
164	2.4391	0.0053
165	2.4444	0.0053
166	2.4497	0.0053
167	2.4549	0.0052
168	2.4601	0.0052
169	2.4653	0.0052
170	2.4705	0.0052
171	2.4756	0.0052
172	2.4808	0.0051
173	2.4859	0.0051
174	2.4910	0.0051
175	2.4961	0.0051
176	2.5012	0.0051
177	2.5062	0.0050
178	2.5112	0.0050
179	2.5162	0.0050
180	2.5212	0.0050
181	2.5262	0.0050
182	2.5312	0.0050
183	2.5361	0.0049
184	2.5410	0.0049
185	2.5459	0.0049
186	2.5508	0.0049
187	2.5557	0.0049
188	2.5605	0.0049
189	2.5654	0.0048
190	2.5702	0.0048
191	2.5750	0.0048

192	2.5798	0.0048
193	2.5845	0.0048
194	2.5893	0.0048
195	2.5940	0.0047
196	2.5988	0.0047
197	2.6035	0.0047
198	2.6082	0.0047
199	2.6128	0.0047
200	2.6175	0.0047
201	2.6222	0.0046
202	2.6268	0.0046
203	2.6314	0.0046
204	2.6360	0.0046
205	2.6406	0.0046
206	2.6452	0.0046
207	2.6497	0.0046
208	2.6543	0.0045
209	2.6588	0.0045
210	2.6633	0.0045
211	2.6678	0.0045
212	2.6723	0.0045
213	2.6768	0.0045
214	2.6813	0.0045
215	2.6857	0.0044
216	2.6901	0.0044
217	2.6946	0.0044
218	2.6990	0.0044
219	2.7034	0.0044
220	2.7078	0.0044
221	2.7121	0.0044
222	2.7165	0.0044
223	2.7208	0.0043
224	2.7252	0.0043
225	2.7295	0.0043
226	2.7338	0.0043
227	2.7381	0.0043
228	2.7424	0.0043
229	2.7467	0.0043
230	2.7509	0.0043
231	2.7552	0.0042
232	2.7594	0.0042
233	2.7636	0.0042
234	2.7678	0.0042
235	2.7720	0.0042
236	2.7762	0.0042
237	2.7804	0.0042
238	2.7846	0.0042
239	2.7887	0.0042
240	2.7929	0.0041
241	2.7970	0.0041

242	2.8011	0.0041	
243	2.8052	0.0041	
244	2.8093	0.0041	
245	2.8134	0.0041	
246	2.8175	0.0041	
247	2.8216	0.0041	
248	2.8256	0.0041	
249	2.8297	0.0040	
250	2.8337	0.0040	
251	2.8378	0.0040	
252	2.8418	0.0040	
253	2.8458	0.0040	
254	2.8498	0.0040	
255	2.8538	0.0040	
256	2.8577	0.0040	
257	2.8617	0.0040	
258	2.8657	0.0040	
259	2.8696	0.0039	
260	2.8735	0.0039	
261	2.8775	0.0039	
262	2.8814	0.0039	
263	2.8853	0.0039	
264	2.8892	0.0039	
265	2.8931	0.0039	
266	2.8969	0.0039	
267	2.9008	0.0039	
268	2.9047	0.0039	
269	2.9085	0.0039	
270	2.9124	0.0038	
271	2.9162	0.0038	
272	2.9200	0.0038	
273	2.9238	0.0038	
274	2.9276	0.0038	
275	2.9314	0.0038	
276	2.9352	0.0038	
277	2.9390	0.0038	
278	2.9428	0.0038	
279	2.9465	0.0038	
280	2.9503	0.0038	
281	2.9540	0.0037	
282	2.9578	0.0037	
283	2.9615	0.0037	
284	2.9652	0.0037	
285	2.9689	0.0037	
286	2.9726	0.0037	
287	2.9763	0.0037	
288	2.9800	0.0037	

Unit Period	Unit Rainfall	Unit Soil-Loss	Effective Rainfall

(number)	(In)	(In)	(In)
1	0.0037	0.0004	0.0032
2	0.0037	0.0004	0.0032
3	0.0037	0.0005	0.0033
4	0.0037	0.0005	0.0033
5	0.0037	0.0005	0.0033
6	0.0037	0.0005	0.0033
7	0.0038	0.0005	0.0033
8	0.0038	0.0005	0.0033
9	0.0038	0.0005	0.0033
10	0.0038	0.0005	0.0033
11	0.0038	0.0005	0.0034
12	0.0038	0.0005	0.0034
13	0.0038	0.0005	0.0034
14	0.0039	0.0005	0.0034
15	0.0039	0.0005	0.0034
16	0.0039	0.0005	0.0034
17	0.0039	0.0005	0.0034
18	0.0039	0.0005	0.0034
19	0.0039	0.0005	0.0034
20	0.0039	0.0005	0.0035
21	0.0040	0.0005	0.0035
22	0.0040	0.0005	0.0035
23	0.0040	0.0005	0.0035
24	0.0040	0.0005	0.0035
25	0.0040	0.0005	0.0035
26	0.0040	0.0005	0.0035
27	0.0040	0.0005	0.0036
28	0.0041	0.0005	0.0036
29	0.0041	0.0005	0.0036
30	0.0041	0.0005	0.0036
31	0.0041	0.0005	0.0036
32	0.0041	0.0005	0.0036
33	0.0041	0.0005	0.0036
34	0.0042	0.0005	0.0037
35	0.0042	0.0005	0.0037
36	0.0042	0.0005	0.0037
37	0.0042	0.0005	0.0037
38	0.0042	0.0005	0.0037
39	0.0042	0.0005	0.0037
40	0.0043	0.0005	0.0037
41	0.0043	0.0005	0.0038
42	0.0043	0.0005	0.0038
43	0.0043	0.0005	0.0038
44	0.0043	0.0005	0.0038
45	0.0044	0.0005	0.0038
46	0.0044	0.0005	0.0038
47	0.0044	0.0005	0.0039
48	0.0044	0.0005	0.0039

49	0.0044	0.0005	0.0039
50	0.0044	0.0005	0.0039
51	0.0045	0.0005	0.0039
52	0.0045	0.0005	0.0039
53	0.0045	0.0005	0.0040
54	0.0045	0.0006	0.0040
55	0.0046	0.0006	0.0040
56	0.0046	0.0006	0.0040
57	0.0046	0.0006	0.0040
58	0.0046	0.0006	0.0041
59	0.0046	0.0006	0.0041
60	0.0047	0.0006	0.0041
61	0.0047	0.0006	0.0041
62	0.0047	0.0006	0.0041
63	0.0047	0.0006	0.0042
64	0.0048	0.0006	0.0042
65	0.0048	0.0006	0.0042
66	0.0048	0.0006	0.0042
67	0.0048	0.0006	0.0042
68	0.0049	0.0006	0.0043
69	0.0049	0.0006	0.0043
70	0.0049	0.0006	0.0043
71	0.0049	0.0006	0.0043
72	0.0050	0.0006	0.0044
73	0.0050	0.0006	0.0044
74	0.0050	0.0006	0.0044
75	0.0050	0.0006	0.0044
76	0.0051	0.0006	0.0044
77	0.0051	0.0006	0.0045
78	0.0051	0.0006	0.0045
79	0.0052	0.0006	0.0045
80	0.0052	0.0006	0.0045
81	0.0052	0.0006	0.0046
82	0.0052	0.0006	0.0046
83	0.0053	0.0006	0.0046
84	0.0053	0.0006	0.0047
85	0.0053	0.0006	0.0047
86	0.0054	0.0007	0.0047
87	0.0054	0.0007	0.0048
88	0.0054	0.0007	0.0048
89	0.0055	0.0007	0.0048
90	0.0055	0.0007	0.0048
91	0.0055	0.0007	0.0049
92	0.0056	0.0007	0.0049
93	0.0056	0.0007	0.0049
94	0.0056	0.0007	0.0050
95	0.0057	0.0007	0.0050
96	0.0057	0.0007	0.0050
97	0.0058	0.0007	0.0051
98	0.0058	0.0007	0.0051

99	0.0058	0.0007	0.0051
100	0.0059	0.0007	0.0052
101	0.0059	0.0007	0.0052
102	0.0060	0.0007	0.0052
103	0.0060	0.0007	0.0053
104	0.0060	0.0007	0.0053
105	0.0061	0.0007	0.0054
106	0.0061	0.0007	0.0054
107	0.0062	0.0008	0.0054
108	0.0062	0.0008	0.0055
109	0.0063	0.0008	0.0055
110	0.0063	0.0008	0.0055
111	0.0064	0.0008	0.0056
112	0.0064	0.0008	0.0056
113	0.0065	0.0008	0.0057
114	0.0065	0.0008	0.0057
115	0.0066	0.0008	0.0058
116	0.0066	0.0008	0.0058
117	0.0067	0.0008	0.0059
118	0.0067	0.0008	0.0059
119	0.0068	0.0008	0.0060
120	0.0069	0.0008	0.0060
121	0.0069	0.0008	0.0061
122	0.0070	0.0008	0.0061
123	0.0071	0.0009	0.0062
124	0.0071	0.0009	0.0063
125	0.0072	0.0009	0.0063
126	0.0073	0.0009	0.0064
127	0.0073	0.0009	0.0065
128	0.0074	0.0009	0.0065
129	0.0075	0.0009	0.0066
130	0.0075	0.0009	0.0066
131	0.0077	0.0009	0.0067
132	0.0077	0.0009	0.0068
133	0.0078	0.0010	0.0069
134	0.0079	0.0010	0.0069
135	0.0080	0.0010	0.0070
136	0.0080	0.0010	0.0071
137	0.0082	0.0010	0.0072
138	0.0082	0.0010	0.0072
139	0.0084	0.0010	0.0073
140	0.0084	0.0010	0.0074
141	0.0086	0.0010	0.0075
142	0.0086	0.0011	0.0076
143	0.0088	0.0011	0.0077
144	0.0089	0.0011	0.0078
145	0.0123	0.0015	0.0108
146	0.0123	0.0015	0.0108
147	0.0125	0.0015	0.0110
148	0.0126	0.0015	0.0111

149	0.0128	0.0016	0.0113
150	0.0129	0.0016	0.0114
151	0.0131	0.0016	0.0115
152	0.0132	0.0016	0.0116
153	0.0135	0.0016	0.0118
154	0.0136	0.0017	0.0119
155	0.0138	0.0017	0.0122
156	0.0140	0.0017	0.0123
157	0.0142	0.0017	0.0125
158	0.0144	0.0017	0.0126
159	0.0147	0.0018	0.0129
160	0.0148	0.0018	0.0130
161	0.0151	0.0018	0.0133
162	0.0153	0.0019	0.0134
163	0.0157	0.0019	0.0138
164	0.0158	0.0019	0.0139
165	0.0162	0.0020	0.0143
166	0.0164	0.0020	0.0144
167	0.0169	0.0021	0.0148
168	0.0171	0.0021	0.0150
169	0.0176	0.0021	0.0155
170	0.0179	0.0022	0.0157
171	0.0184	0.0022	0.0162
172	0.0187	0.0023	0.0164
173	0.0194	0.0024	0.0170
174	0.0197	0.0024	0.0173
175	0.0205	0.0025	0.0180
176	0.0209	0.0025	0.0183
177	0.0218	0.0026	0.0191
178	0.0223	0.0027	0.0196
179	0.0234	0.0027	0.0207
180	0.0240	0.0027	0.0213
181	0.0254	0.0027	0.0227
182	0.0262	0.0027	0.0235
183	0.0280	0.0027	0.0253
184	0.0290	0.0027	0.0263
185	0.0262	0.0027	0.0235
186	0.0277	0.0027	0.0250
187	0.0314	0.0027	0.0287
188	0.0339	0.0027	0.0312
189	0.0408	0.0027	0.0381
190	0.0461	0.0027	0.0434
191	0.0659	0.0027	0.0632
192	0.0906	0.0027	0.0879
193	0.2835	0.0027	0.2808
194	0.0537	0.0027	0.0510
195	0.0369	0.0027	0.0342
196	0.0294	0.0027	0.0267
197	0.0302	0.0027	0.0275
198	0.0270	0.0027	0.0243

199	0.0247	0.0027	0.0220
200	0.0228	0.0027	0.0201
201	0.0213	0.0026	0.0187
202	0.0201	0.0024	0.0176
203	0.0190	0.0023	0.0167
204	0.0181	0.0022	0.0159
205	0.0173	0.0021	0.0152
206	0.0167	0.0020	0.0146
207	0.0160	0.0019	0.0141
208	0.0155	0.0019	0.0136
209	0.0150	0.0018	0.0132
210	0.0145	0.0018	0.0128
211	0.0141	0.0017	0.0124
212	0.0137	0.0017	0.0120
213	0.0134	0.0016	0.0117
214	0.0130	0.0016	0.0114
215	0.0127	0.0015	0.0112
216	0.0124	0.0015	0.0109
217	0.0090	0.0011	0.0079
218	0.0087	0.0011	0.0077
219	0.0085	0.0010	0.0075
220	0.0083	0.0010	0.0073
221	0.0081	0.0010	0.0071
222	0.0079	0.0010	0.0070
223	0.0078	0.0009	0.0068
224	0.0076	0.0009	0.0067
225	0.0074	0.0009	0.0065
226	0.0073	0.0009	0.0064
227	0.0072	0.0009	0.0063
228	0.0070	0.0009	0.0062
229	0.0069	0.0008	0.0061
230	0.0068	0.0008	0.0060
231	0.0067	0.0008	0.0059
232	0.0066	0.0008	0.0058
233	0.0065	0.0008	0.0057
234	0.0064	0.0008	0.0056
235	0.0063	0.0008	0.0055
236	0.0062	0.0007	0.0054
237	0.0061	0.0007	0.0053
238	0.0060	0.0007	0.0053
239	0.0059	0.0007	0.0052
240	0.0058	0.0007	0.0051
241	0.0057	0.0007	0.0050
242	0.0057	0.0007	0.0050
243	0.0056	0.0007	0.0049
244	0.0055	0.0007	0.0048
245	0.0055	0.0007	0.0048
246	0.0054	0.0007	0.0047
247	0.0053	0.0006	0.0047
248	0.0053	0.0006	0.0046

249	0.0052	0.0006	0.0046
250	0.0051	0.0006	0.0045
251	0.0051	0.0006	0.0045
252	0.0050	0.0006	0.0044
253	0.0050	0.0006	0.0044
254	0.0049	0.0006	0.0043
255	0.0049	0.0006	0.0043
256	0.0048	0.0006	0.0042
257	0.0048	0.0006	0.0042
258	0.0047	0.0006	0.0041
259	0.0047	0.0006	0.0041
260	0.0046	0.0006	0.0041
261	0.0046	0.0006	0.0040
262	0.0045	0.0006	0.0040
263	0.0045	0.0005	0.0040
264	0.0045	0.0005	0.0039
265	0.0044	0.0005	0.0039
266	0.0044	0.0005	0.0039
267	0.0043	0.0005	0.0038
268	0.0043	0.0005	0.0038
269	0.0043	0.0005	0.0038
270	0.0042	0.0005	0.0037
271	0.0042	0.0005	0.0037
272	0.0042	0.0005	0.0037
273	0.0041	0.0005	0.0036
274	0.0041	0.0005	0.0036
275	0.0041	0.0005	0.0036
276	0.0040	0.0005	0.0035
277	0.0040	0.0005	0.0035
278	0.0040	0.0005	0.0035
279	0.0039	0.0005	0.0035
280	0.0039	0.0005	0.0034
281	0.0039	0.0005	0.0034
282	0.0039	0.0005	0.0034
283	0.0038	0.0005	0.0034
284	0.0038	0.0005	0.0033
285	0.0038	0.0005	0.0033
286	0.0038	0.0005	0.0033
287	0.0037	0.0005	0.0033
288	0.0037	0.0005	0.0033

Total soil rain loss = 0.30(In)
Total effective rainfall = 2.68(In)
Peak flow rate in flood hydrograph = 2.08(CFS)

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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

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                    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       0.0002      0.02  Q         |         |         |         |
   0+15       0.0004      0.04  Q         |         |         |         |
   0+20       0.0007      0.04  Q         |         |         |         |
   0+25       0.0010      0.04  Q         |         |         |         |
   0+30       0.0012      0.04  Q         |         |         |         |
   0+35       0.0015      0.04  Q         |         |         |         |
   0+40       0.0018      0.04  Q         |         |         |         |
   0+45       0.0021      0.04  Q         |         |         |         |
   0+50       0.0023      0.04  Q         |         |         |         |
   0+55       0.0026      0.04  Q         |         |         |         |
   1+ 0       0.0029      0.04  Q         |         |         |         |
   1+ 5       0.0032      0.04  Q         |         |         |         |
   1+10       0.0035      0.04  Q         |         |         |         |
   1+15       0.0038      0.04  Q         |         |         |         |
   1+20       0.0040      0.04  Q         |         |         |         |
   1+25       0.0043      0.04  Q         |         |         |         |
   1+30       0.0046      0.04  Q         |         |         |         |
   1+35       0.0049      0.04  Q         |         |         |         |
   1+40       0.0052      0.04  Q         |         |         |         |
   1+45       0.0055      0.04  Q         |         |         |         |
   1+50       0.0058      0.04  QV        |         |         |         |
   1+55       0.0061      0.04  QV        |         |         |         |
   2+ 0       0.0064      0.04  QV        |         |         |         |
   2+ 5       0.0067      0.04  QV        |         |         |         |
   2+10       0.0070      0.04  QV        |         |         |         |
   2+15       0.0073      0.04  QV        |         |         |         |
   2+20       0.0076      0.04  QV        |         |         |         |
   2+25       0.0079      0.04  QV        |         |         |         |
   2+30       0.0082      0.04  QV        |         |         |         |
   2+35       0.0085      0.04  QV        |         |         |         |
   2+40       0.0088      0.04  QV        |         |         |         |
   2+45       0.0091      0.04  QV        |         |         |         |
   2+50       0.0094      0.04  QV        |         |         |         |
   2+55       0.0097      0.04  QV        |         |         |         |
   3+ 0       0.0100      0.04  QV        |         |         |         |
   3+ 5       0.0103      0.04  QV        |         |         |         |
   3+10       0.0106      0.05  QV        |         |         |         |
   3+15       0.0109      0.05  QV        |         |         |         |
   3+20       0.0112      0.05  QV        |         |         |         |
   3+25       0.0115      0.05  Q V       |         |         |         |
   3+30       0.0119      0.05  Q V       |         |         |         |
   3+35       0.0122      0.05  Q V       |         |         |         |
   3+40       0.0125      0.05  Q V       |         |         |         |
   3+45       0.0128      0.05  Q V       |         |         |         |
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 3+50        0.0131       0.05  Q V        |          |          |          |
 3+55        0.0135       0.05  Q V        |          |          |          |
 4+ 0        0.0138       0.05  Q V        |          |          |          |
 4+ 5        0.0141       0.05  Q V        |          |          |          |
 4+10        0.0144       0.05  Q V        |          |          |          |
 4+15        0.0148       0.05  Q V        |          |          |          |
 4+20        0.0151       0.05  Q V        |          |          |          |
 4+25        0.0154       0.05  Q V        |          |          |          |
 4+30        0.0158       0.05  Q V        |          |          |          |
 4+35        0.0161       0.05  Q V        |          |          |          |
 4+40        0.0164       0.05  Q V        |          |          |          |
 4+45        0.0168       0.05  Q V        |          |          |          |
 4+50        0.0171       0.05  Q  V       |          |          |          |
 4+55        0.0174       0.05  Q  V       |          |          |          |
 5+ 0        0.0178       0.05  Q  V       |          |          |          |
 5+ 5        0.0181       0.05  Q  V       |          |          |          |
 5+10        0.0185       0.05  Q  V       |          |          |          |
 5+15        0.0188       0.05  Q  V       |          |          |          |
 5+20        0.0192       0.05  Q  V       |          |          |          |
 5+25        0.0195       0.05  Q  V       |          |          |          |
 5+30        0.0199       0.05  Q  V       |          |          |          |
 5+35        0.0202       0.05  Q  V       |          |          |          |
 5+40        0.0206       0.05  Q  V       |          |          |          |
 5+45        0.0209       0.05  Q  V       |          |          |          |
 5+50        0.0213       0.05  Q  V       |          |          |          |
 5+55        0.0217       0.05  Q  V       |          |          |          |
 6+ 0        0.0220       0.05  Q  V       |          |          |          |
 6+ 5        0.0224       0.05  Q  V       |          |          |          |
 6+10        0.0228       0.05  Q   V      |          |          |          |
 6+15        0.0231       0.05  Q   V      |          |          |          |
 6+20        0.0235       0.05  Q   V      |          |          |          |
 6+25        0.0239       0.05  Q   V      |          |          |          |
 6+30        0.0243       0.05  Q   V      |          |          |          |
 6+35        0.0246       0.05  Q   V      |          |          |          |
 6+40        0.0250       0.06  Q   V      |          |          |          |
 6+45        0.0254       0.06  Q   V      |          |          |          |
 6+50        0.0258       0.06  Q   V      |          |          |          |
 6+55        0.0262       0.06  Q   V      |          |          |          |
 7+ 0        0.0265       0.06  Q   V      |          |          |          |
 7+ 5        0.0269       0.06  Q   V      |          |          |          |
 7+10        0.0273       0.06  Q   V      |          |          |          |
 7+15        0.0277       0.06  Q   V      |          |          |          |
 7+20        0.0281       0.06  Q   V      |          |          |          |
 7+25        0.0285       0.06  Q    V     |          |          |          |
 7+30        0.0289       0.06  Q    V     |          |          |          |
 7+35        0.0293       0.06  Q    V     |          |          |          |
 7+40        0.0297       0.06  Q    V     |          |          |          |
 7+45        0.0302       0.06  Q    V     |          |          |          |
 7+50        0.0306       0.06  Q    V     |          |          |          |
 7+55        0.0310       0.06  Q    V     |          |          |          |
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 8+ 0       0.0314      0.06  Q    V    |         |         |         |
 8+ 5       0.0318      0.06  Q    V    |         |         |         |
 8+10       0.0322      0.06  Q    V    |         |         |         |
 8+15       0.0327      0.06  Q    V    |         |         |         |
 8+20       0.0331      0.06  Q    V    |         |         |         |
 8+25       0.0335      0.06  Q    V    |         |         |         |
 8+30       0.0340      0.06  Q     V   |         |         |         |
 8+35       0.0344      0.06  Q     V   |         |         |         |
 8+40       0.0349      0.06  Q     V   |         |         |         |
 8+45       0.0353      0.06  Q     V   |         |         |         |
 8+50       0.0357      0.07  Q     V   |         |         |         |
 8+55       0.0362      0.07  Q     V   |         |         |         |
 9+ 0       0.0367      0.07  Q     V   |         |         |         |
 9+ 5       0.0371      0.07  Q     V   |         |         |         |
 9+10       0.0376      0.07  Q     V   |         |         |         |
 9+15       0.0380      0.07  Q     V   |         |         |         |
 9+20       0.0385      0.07  Q     V   |         |         |         |
 9+25       0.0390      0.07  Q     V   |         |         |         |
 9+30       0.0395      0.07  Q     V   |         |         |         |
 9+35       0.0399      0.07  Q      V  |         |         |         |
 9+40       0.0404      0.07  Q      V  |         |         |         |
 9+45       0.0409      0.07  Q      V  |         |         |         |
 9+50       0.0414      0.07  Q      V  |         |         |         |
 9+55       0.0419      0.07  Q      V  |         |         |         |
10+ 0       0.0424      0.07  Q      V  |         |         |         |
10+ 5       0.0429      0.07  Q      V  |         |         |         |
10+10       0.0434      0.07  Q      V  |         |         |         |
10+15       0.0439      0.07  Q      V  |         |         |         |
10+20       0.0445      0.08  Q      V  |         |         |         |
10+25       0.0450      0.08  Q      V  |         |         |         |
10+30       0.0455      0.08  Q       V |         |         |         |
10+35       0.0460      0.08  Q       V |         |         |         |
10+40       0.0466      0.08  Q       V |         |         |         |
10+45       0.0471      0.08  Q       V |         |         |         |
10+50       0.0477      0.08  Q       V |         |         |         |
10+55       0.0482      0.08  Q       V |         |         |         |
11+ 0       0.0488      0.08  Q       V |         |         |         |
11+ 5       0.0494      0.08  Q       V |         |         |         |
11+10       0.0499      0.08  Q       V |         |         |         |
11+15       0.0505      0.08  Q       V |         |         |         |
11+20       0.0511      0.09  Q        V|         |         |         |
11+25       0.0517      0.09  Q        V|         |         |         |
11+30       0.0523      0.09  Q        V|         |         |         |
11+35       0.0529      0.09  Q        V|         |         |         |
11+40       0.0535      0.09  Q        V|         |         |         |
11+45       0.0541      0.09  Q        V|         |         |         |
11+50       0.0548      0.09  Q        V|         |         |         |
11+55       0.0554      0.09  Q        V|         |         |         |
12+ 0       0.0560      0.09  Q        V|         |         |         |
12+ 5       0.0567      0.10  Q         V         |         |         |
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12+10       0.0575      0.12  Q         V         |         |         |
12+15       0.0584      0.13  Q         V         |         |         |
12+20       0.0593      0.13  Q         V         |         |         |
12+25       0.0602      0.13  Q         V         |         |         |
12+30       0.0612      0.14  Q         V         |         |         |
12+35       0.0621      0.14  Q         |V        |         |         |
12+40       0.0631      0.14  Q         |V        |         |         |
12+45       0.0641      0.14  Q         |V        |         |         |
12+50       0.0651      0.14  Q         |V        |         |         |
12+55       0.0661      0.15  Q         |V        |         |         |
13+ 0       0.0671      0.15  Q         |V        |         |         |
13+ 5       0.0681      0.15  Q         | V       |         |         |
13+10       0.0691      0.15  Q         | V       |         |         |
13+15       0.0702      0.15  Q         | V       |         |         |
13+20       0.0713      0.16  Q         | V       |         |         |
13+25       0.0724      0.16  Q         | V       |         |         |
13+30       0.0735      0.16  Q         |  V      |         |         |
13+35       0.0746      0.16  Q         |  V      |         |         |
13+40       0.0757      0.17  Q         |  V      |         |         |
13+45       0.0769      0.17  Q         |  V      |         |         |
13+50       0.0781      0.17  Q         |  V      |         |         |
13+55       0.0793      0.18  Q         |   V     |         |         |
14+ 0       0.0805      0.18  Q         |   V     |         |         |
14+ 5       0.0818      0.18  Q         |   V     |         |         |
14+10       0.0831      0.19  Q         |   V     |         |         |
14+15       0.0844      0.19  Q         |   V     |         |         |
14+20       0.0857      0.19  Q         |    V    |         |         |
14+25       0.0871      0.20  Q         |    V    |         |         |
14+30       0.0885      0.20  Q         |    V    |         |         |
14+35       0.0900      0.21  Q         |    V    |         |         |
14+40       0.0914      0.22  Q         |     V   |         |         |
14+45       0.0930      0.22  Q         |     V   |         |         |
14+50       0.0946      0.23  Q         |     V   |         |         |
14+55       0.0962      0.24  Q         |      V  |         |         |
15+ 0       0.0979      0.25  Q         |      V  |         |         |
15+ 5       0.0996      0.26  |Q        |      V  |         |         |
15+10       0.1015      0.27  |Q        |      V  |         |         |
15+15       0.1034      0.28  |Q        |       V |         |         |
15+20       0.1055      0.30  |Q        |       V |         |         |
15+25       0.1076      0.31  |Q        |        V|         |         |
15+30       0.1097      0.30  |Q        |        V|         |         |
15+35       0.1118      0.30  |Q        |        V|         |         |
15+40       0.1141      0.33  |Q        |         V         |         |
15+45       0.1167      0.37  |Q        |         V         |         |
15+50       0.1196      0.43  |Q        |         |V        |         |
15+55       0.1232      0.51  | Q       |         |V        |         |
16+ 0       0.1278      0.68  | Q       |         | V       |         |
16+ 5       0.1356      1.13  |   Q     |         |   V     |         |
16+10       0.1499      2.08  |       Q |         |     V   |         |
16+15       0.1611      1.63  |     Q   |         |       V |         |
```

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16+20       0.1662      0.74  | Q       |         |        V|         |
16+25       0.1693      0.44  |Q        |         |        V|         |
16+30       0.1716      0.34  |Q        |         |         V         |
16+35       0.1738      0.31  |Q        |         |         V         |
16+40       0.1757      0.28  |Q        |         |         |V        |
16+45       0.1775      0.26  |Q        |         |         |V        |
16+50       0.1791      0.24  Q         |         |         |V        |
16+55       0.1807      0.22  Q         |         |         | V       |
17+ 0       0.1821      0.21  Q         |         |         | V       |
17+ 5       0.1835      0.20  Q         |         |         | V       |
17+10       0.1848      0.19  Q         |         |         | V       |
17+15       0.1860      0.18  Q         |         |         | V       |
17+20       0.1873      0.18  Q         |         |         |  V      |
17+25       0.1884      0.17  Q         |         |         |  V      |
17+30       0.1895      0.16  Q         |         |         |  V      |
17+35       0.1906      0.16  Q         |         |         |  V      |
17+40       0.1917      0.15  Q         |         |         |  V      |
17+45       0.1927      0.15  Q         |         |         |   V     |
17+50       0.1937      0.15  Q         |         |         |   V     |
17+55       0.1947      0.14  Q         |         |         |   V     |
18+ 0       0.1956      0.14  Q         |         |         |   V     |
18+ 5       0.1966      0.13  Q         |         |         |   V     |
18+10       0.1973      0.11  Q         |         |         |   V     |
18+15       0.1980      0.10  Q         |         |         |    V    |
18+20       0.1987      0.09  Q         |         |         |    V    |
18+25       0.1993      0.09  Q         |         |         |    V    |
18+30       0.1999      0.09  Q         |         |         |    V    |
18+35       0.2005      0.09  Q         |         |         |    V    |
18+40       0.2011      0.08  Q         |         |         |    V    |
18+45       0.2016      0.08  Q         |         |         |    V    |
18+50       0.2022      0.08  Q         |         |         |    V    |
18+55       0.2027      0.08  Q         |         |         |    V    |
19+ 0       0.2033      0.08  Q         |         |         |     V   |
19+ 5       0.2038      0.08  Q         |         |         |     V   |
19+10       0.2043      0.07  Q         |         |         |     V   |
19+15       0.2048      0.07  Q         |         |         |     V   |
19+20       0.2053      0.07  Q         |         |         |     V   |
19+25       0.2058      0.07  Q         |         |         |     V   |
19+30       0.2063      0.07  Q         |         |         |     V   |
19+35       0.2067      0.07  Q         |         |         |     V   |
19+40       0.2072      0.07  Q         |         |         |     V   |
19+45       0.2077      0.07  Q         |         |         |     V   |
19+50       0.2081      0.07  Q         |         |         |     V   |
19+55       0.2086      0.06  Q         |         |         |     V   |
20+ 0       0.2090      0.06  Q         |         |         |      V  |
20+ 5       0.2094      0.06  Q         |         |         |      V  |
20+10       0.2099      0.06  Q         |         |         |      V  |
20+15       0.2103      0.06  Q         |         |         |      V  |
20+20       0.2107      0.06  Q         |         |         |      V  |
20+25       0.2111      0.06  Q         |         |         |      V  |
```

```
   20+30       0.2115      0.06  Q         |         |         |      V  |
   20+35       0.2119      0.06  Q         |         |         |      V  |
   20+40       0.2123      0.06  Q         |         |         |      V  |
   20+45       0.2127      0.06  Q         |         |         |      V  |
   20+50       0.2131      0.06  Q         |         |         |      V  |
   20+55       0.2135      0.06  Q         |         |         |      V  |
   21+ 0       0.2138      0.05  Q         |         |         |      V  |
   21+ 5       0.2142      0.05  Q         |         |         |      V  |
   21+10       0.2146      0.05  Q         |         |         |       V |
   21+15       0.2150      0.05  Q         |         |         |       V |
   21+20       0.2153      0.05  Q         |         |         |       V |
   21+25       0.2157      0.05  Q         |         |         |       V |
   21+30       0.2160      0.05  Q         |         |         |       V |
   21+35       0.2164      0.05  Q         |         |         |       V |
   21+40       0.2167      0.05  Q         |         |         |       V |
   21+45       0.2171      0.05  Q         |         |         |       V |
   21+50       0.2174      0.05  Q         |         |         |       V |
   21+55       0.2177      0.05  Q         |         |         |       V |
   22+ 0       0.2181      0.05  Q         |         |         |       V |
   22+ 5       0.2184      0.05  Q         |         |         |       V |
   22+10       0.2187      0.05  Q         |         |         |       V |
   22+15       0.2191      0.05  Q         |         |         |       V |
   22+20       0.2194      0.05  Q         |         |         |       V |
   22+25       0.2197      0.05  Q         |         |         |       V |
   22+30       0.2200      0.05  Q         |         |         |       V |
   22+35       0.2203      0.05  Q         |         |         |        V|
   22+40       0.2207      0.05  Q         |         |         |        V|
   22+45       0.2210      0.04  Q         |         |         |        V|
   22+50       0.2213      0.04  Q         |         |         |        V|
   22+55       0.2216      0.04  Q         |         |         |        V|
   23+ 0       0.2219      0.04  Q         |         |         |        V|
   23+ 5       0.2222      0.04  Q         |         |         |        V|
   23+10       0.2225      0.04  Q         |         |         |        V|
   23+15       0.2228      0.04  Q         |         |         |        V|
   23+20       0.2231      0.04  Q         |         |         |        V|
   23+25       0.2233      0.04  Q         |         |         |        V|
   23+30       0.2236      0.04  Q         |         |         |        V|
   23+35       0.2239      0.04  Q         |         |         |        V|
   23+40       0.2242      0.04  Q         |         |         |        V|
   23+45       0.2245      0.04  Q         |         |         |        V|
   23+50       0.2248      0.04  Q         |         |         |        V|
   23+55       0.2250      0.04  Q         |         |         |        V|
   24+ 0       0.2253      0.04  Q         |         |         |        V|
   24+ 5       0.2256      0.04  Q         |         |         |        V|
   24+10       0.2257      0.02  Q         |         |         |        V|
   24+15       0.2257      0.00  Q         |         |         |        V|
   24+20       0.2257      0.00  Q         |         |         |         V
-----------------------------------------------------------------------
```

PROPOSED 2YR STORM DA-S-2

```
        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  02/23/24

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


Program License Serial Number 6458

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

        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 2
             0.81            1           0.77
---------------------------------------------------------------------
Rainfall data for year 2
             0.81            6           1.82
---------------------------------------------------------------------
Rainfall data for year 2
             0.81           24           2.98
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

******** 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)
 90.0      78.0          0.81      1.000     0.404    0.110    0.044

Area-averaged adjusted loss rate Fm (In/Hr) =  0.044

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

Area       Area          SCS CN    SCS CN      S     Pervious
 (Ac.)      Fract         (AMC2)    (AMC1)           Yield Fr
     0.09   0.110         90.0      78.0       2.82     0.374
     0.72   0.890         98.0      98.0       0.20     0.922

Area-averaged catchment yield fraction, Y =  0.862
Area-averaged low loss fraction, Yb =  0.138
Direct entry of lag time by user
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =       0.81(Ac.)
Catchment Lag time =   0.100 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 83.3333
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.044(In/Hr)
Average low loss rate fraction (Yb) = 0.138 (decimal)
VALLEY DEVELOPED S-Graph Selected
Computed peak 5-minute rainfall =  0.284(In)
Computed peak 30-minute rainfall =  0.581(In)
Specified peak 1-hour rainfall =  0.766(In)
Computed peak 3-hour rainfall =  1.302(In)
Specified peak 6-hour rainfall =  1.820(In)
Specified peak 24-hour rainfall =  2.980(In)


Rainfall depth area reduction factors:
Using a total area of       0.81(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000     Adjusted rainfall =  0.283(In)
30-minute factor = 1.000    Adjusted rainfall =  0.580(In)
1-hour factor = 1.000       Adjusted rainfall =  0.766(In)
3-hour factor = 1.000       Adjusted rainfall =  1.302(In)
6-hour factor = 1.000       Adjusted rainfall =  1.820(In)
24-hour factor = 1.000      Adjusted rainfall =  2.980(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 =        9.80 (CFS))
```

1	12.207	1.196
2	66.918	5.359
3	94.948	2.746
4	99.050	0.402
5	100.000	0.093

Peak Unit Number	Adjusted mass rainfall (In)	Unit rainfall (In)
1	0.2835	0.2835
2	0.3741	0.0906
3	0.4399	0.0659
4	0.4936	0.0537
5	0.5397	0.0461
6	0.5805	0.0408
7	0.6174	0.0369
8	0.6513	0.0339
9	0.6827	0.0314
10	0.7121	0.0294
11	0.7398	0.0277
12	0.7660	0.0262
13	0.7962	0.0302
14	0.8252	0.0290
15	0.8531	0.0280
16	0.8802	0.0270
17	0.9063	0.0262
18	0.9317	0.0254
19	0.9563	0.0247
20	0.9803	0.0240
21	1.0037	0.0234
22	1.0265	0.0228
23	1.0488	0.0223
24	1.0706	0.0218
25	1.0919	0.0213
26	1.1128	0.0209
27	1.1332	0.0205
28	1.1533	0.0201
29	1.1730	0.0197
30	1.1924	0.0194
31	1.2115	0.0190
32	1.2302	0.0187
33	1.2486	0.0184
34	1.2667	0.0181
35	1.2846	0.0179
36	1.3022	0.0176
37	1.3195	0.0173
38	1.3366	0.0171
39	1.3535	0.0169
40	1.3702	0.0167
41	1.3866	0.0164

42	1.4028	0.0162
43	1.4189	0.0160
44	1.4347	0.0158
45	1.4504	0.0157
46	1.4659	0.0155
47	1.4812	0.0153
48	1.4963	0.0151
49	1.5113	0.0150
50	1.5261	0.0148
51	1.5408	0.0147
52	1.5553	0.0145
53	1.5697	0.0144
54	1.5839	0.0142
55	1.5980	0.0141
56	1.6120	0.0140
57	1.6258	0.0138
58	1.6395	0.0137
59	1.6531	0.0136
60	1.6666	0.0135
61	1.6799	0.0134
62	1.6932	0.0132
63	1.7063	0.0131
64	1.7193	0.0130
65	1.7323	0.0129
66	1.7451	0.0128
67	1.7578	0.0127
68	1.7704	0.0126
69	1.7830	0.0125
70	1.7954	0.0124
71	1.8077	0.0123
72	1.8200	0.0123
73	1.8289	0.0090
74	1.8378	0.0089
75	1.8466	0.0088
76	1.8553	0.0087
77	1.8640	0.0086
78	1.8726	0.0086
79	1.8811	0.0085
80	1.8895	0.0084
81	1.8979	0.0084
82	1.9062	0.0083
83	1.9144	0.0082
84	1.9226	0.0082
85	1.9307	0.0081
86	1.9387	0.0080
87	1.9467	0.0080
88	1.9546	0.0079
89	1.9625	0.0079
90	1.9703	0.0078
91	1.9781	0.0078

92	1.9858	0.0077
93	1.9934	0.0077
94	2.0010	0.0076
95	2.0086	0.0075
96	2.0161	0.0075
97	2.0235	0.0074
98	2.0309	0.0074
99	2.0383	0.0073
100	2.0456	0.0073
101	2.0528	0.0073
102	2.0600	0.0072
103	2.0672	0.0072
104	2.0743	0.0071
105	2.0814	0.0071
106	2.0884	0.0070
107	2.0954	0.0070
108	2.1023	0.0069
109	2.1092	0.0069
110	2.1161	0.0069
111	2.1229	0.0068
112	2.1297	0.0068
113	2.1365	0.0067
114	2.1432	0.0067
115	2.1498	0.0067
116	2.1565	0.0066
117	2.1631	0.0066
118	2.1696	0.0066
119	2.1761	0.0065
120	2.1826	0.0065
121	2.1891	0.0065
122	2.1955	0.0064
123	2.2019	0.0064
124	2.2082	0.0064
125	2.2145	0.0063
126	2.2208	0.0063
127	2.2271	0.0063
128	2.2333	0.0062
129	2.2395	0.0062
130	2.2457	0.0062
131	2.2518	0.0061
132	2.2579	0.0061
133	2.2640	0.0061
134	2.2700	0.0060
135	2.2760	0.0060
136	2.2820	0.0060
137	2.2879	0.0060
138	2.2939	0.0059
139	2.2998	0.0059
140	2.3056	0.0059
141	2.3115	0.0058

142	2.3173	0.0058
143	2.3231	0.0058
144	2.3289	0.0058
145	2.3346	0.0057
146	2.3403	0.0057
147	2.3460	0.0057
148	2.3517	0.0057
149	2.3573	0.0056
150	2.3629	0.0056
151	2.3685	0.0056
152	2.3741	0.0056
153	2.3796	0.0055
154	2.3851	0.0055
155	2.3906	0.0055
156	2.3961	0.0055
157	2.4016	0.0055
158	2.4070	0.0054
159	2.4124	0.0054
160	2.4178	0.0054
161	2.4232	0.0054
162	2.4285	0.0053
163	2.4338	0.0053
164	2.4391	0.0053
165	2.4444	0.0053
166	2.4497	0.0053
167	2.4549	0.0052
168	2.4601	0.0052
169	2.4653	0.0052
170	2.4705	0.0052
171	2.4757	0.0052
172	2.4808	0.0051
173	2.4859	0.0051
174	2.4910	0.0051
175	2.4961	0.0051
176	2.5012	0.0051
177	2.5062	0.0050
178	2.5112	0.0050
179	2.5162	0.0050
180	2.5212	0.0050
181	2.5262	0.0050
182	2.5312	0.0050
183	2.5361	0.0049
184	2.5410	0.0049
185	2.5459	0.0049
186	2.5508	0.0049
187	2.5557	0.0049
188	2.5605	0.0049
189	2.5654	0.0048
190	2.5702	0.0048
191	2.5750	0.0048

192	2.5798	0.0048
193	2.5845	0.0048
194	2.5893	0.0048
195	2.5940	0.0047
196	2.5988	0.0047
197	2.6035	0.0047
198	2.6082	0.0047
199	2.6128	0.0047
200	2.6175	0.0047
201	2.6222	0.0046
202	2.6268	0.0046
203	2.6314	0.0046
204	2.6360	0.0046
205	2.6406	0.0046
206	2.6452	0.0046
207	2.6497	0.0046
208	2.6543	0.0045
209	2.6588	0.0045
210	2.6633	0.0045
211	2.6678	0.0045
212	2.6723	0.0045
213	2.6768	0.0045
214	2.6813	0.0045
215	2.6857	0.0044
216	2.6902	0.0044
217	2.6946	0.0044
218	2.6990	0.0044
219	2.7034	0.0044
220	2.7078	0.0044
221	2.7121	0.0044
222	2.7165	0.0044
223	2.7208	0.0043
224	2.7252	0.0043
225	2.7295	0.0043
226	2.7338	0.0043
227	2.7381	0.0043
228	2.7424	0.0043
229	2.7467	0.0043
230	2.7509	0.0043
231	2.7552	0.0042
232	2.7594	0.0042
233	2.7636	0.0042
234	2.7678	0.0042
235	2.7720	0.0042
236	2.7762	0.0042
237	2.7804	0.0042
238	2.7846	0.0042
239	2.7887	0.0042
240	2.7929	0.0041
241	2.7970	0.0041

242	2.8011	0.0041
243	2.8052	0.0041
244	2.8093	0.0041
245	2.8134	0.0041
246	2.8175	0.0041
247	2.8216	0.0041
248	2.8256	0.0041
249	2.8297	0.0040
250	2.8337	0.0040
251	2.8378	0.0040
252	2.8418	0.0040
253	2.8458	0.0040
254	2.8498	0.0040
255	2.8538	0.0040
256	2.8577	0.0040
257	2.8617	0.0040
258	2.8657	0.0040
259	2.8696	0.0039
260	2.8735	0.0039
261	2.8775	0.0039
262	2.8814	0.0039
263	2.8853	0.0039
264	2.8892	0.0039
265	2.8931	0.0039
266	2.8969	0.0039
267	2.9008	0.0039
268	2.9047	0.0039
269	2.9085	0.0039
270	2.9124	0.0038
271	2.9162	0.0038
272	2.9200	0.0038
273	2.9238	0.0038
274	2.9276	0.0038
275	2.9314	0.0038
276	2.9352	0.0038
277	2.9390	0.0038
278	2.9428	0.0038
279	2.9465	0.0038
280	2.9503	0.0038
281	2.9540	0.0037
282	2.9578	0.0037
283	2.9615	0.0037
284	2.9652	0.0037
285	2.9689	0.0037
286	2.9726	0.0037
287	2.9763	0.0037
288	2.9800	0.0037

Unit Period	Unit Rainfall	Unit Soil-Loss	Effective Rainfall

(number)	(In)	(In)	(In)
1	0.0037	0.0005	0.0032
2	0.0037	0.0005	0.0032
3	0.0037	0.0005	0.0032
4	0.0037	0.0005	0.0032
5	0.0037	0.0005	0.0032
6	0.0037	0.0005	0.0032
7	0.0038	0.0005	0.0032
8	0.0038	0.0005	0.0032
9	0.0038	0.0005	0.0033
10	0.0038	0.0005	0.0033
11	0.0038	0.0005	0.0033
12	0.0038	0.0005	0.0033
13	0.0038	0.0005	0.0033
14	0.0039	0.0005	0.0033
15	0.0039	0.0005	0.0033
16	0.0039	0.0005	0.0033
17	0.0039	0.0005	0.0034
18	0.0039	0.0005	0.0034
19	0.0039	0.0005	0.0034
20	0.0039	0.0005	0.0034
21	0.0040	0.0005	0.0034
22	0.0040	0.0005	0.0034
23	0.0040	0.0006	0.0034
24	0.0040	0.0006	0.0034
25	0.0040	0.0006	0.0035
26	0.0040	0.0006	0.0035
27	0.0040	0.0006	0.0035
28	0.0041	0.0006	0.0035
29	0.0041	0.0006	0.0035
30	0.0041	0.0006	0.0035
31	0.0041	0.0006	0.0035
32	0.0041	0.0006	0.0036
33	0.0041	0.0006	0.0036
34	0.0042	0.0006	0.0036
35	0.0042	0.0006	0.0036
36	0.0042	0.0006	0.0036
37	0.0042	0.0006	0.0036
38	0.0042	0.0006	0.0036
39	0.0042	0.0006	0.0037
40	0.0043	0.0006	0.0037
41	0.0043	0.0006	0.0037
42	0.0043	0.0006	0.0037
43	0.0043	0.0006	0.0037
44	0.0043	0.0006	0.0037
45	0.0044	0.0006	0.0038
46	0.0044	0.0006	0.0038
47	0.0044	0.0006	0.0038
48	0.0044	0.0006	0.0038

49	0.0044	0.0006	0.0038
50	0.0044	0.0006	0.0038
51	0.0045	0.0006	0.0039
52	0.0045	0.0006	0.0039
53	0.0045	0.0006	0.0039
54	0.0045	0.0006	0.0039
55	0.0046	0.0006	0.0039
56	0.0046	0.0006	0.0039
57	0.0046	0.0006	0.0040
58	0.0046	0.0006	0.0040
59	0.0046	0.0006	0.0040
60	0.0047	0.0006	0.0040
61	0.0047	0.0006	0.0040
62	0.0047	0.0006	0.0041
63	0.0047	0.0007	0.0041
64	0.0048	0.0007	0.0041
65	0.0048	0.0007	0.0041
66	0.0048	0.0007	0.0041
67	0.0048	0.0007	0.0042
68	0.0049	0.0007	0.0042
69	0.0049	0.0007	0.0042
70	0.0049	0.0007	0.0042
71	0.0049	0.0007	0.0043
72	0.0050	0.0007	0.0043
73	0.0050	0.0007	0.0043
74	0.0050	0.0007	0.0043
75	0.0050	0.0007	0.0043
76	0.0051	0.0007	0.0044
77	0.0051	0.0007	0.0044
78	0.0051	0.0007	0.0044
79	0.0052	0.0007	0.0044
80	0.0052	0.0007	0.0045
81	0.0052	0.0007	0.0045
82	0.0052	0.0007	0.0045
83	0.0053	0.0007	0.0046
84	0.0053	0.0007	0.0046
85	0.0053	0.0007	0.0046
86	0.0054	0.0007	0.0046
87	0.0054	0.0007	0.0047
88	0.0054	0.0007	0.0047
89	0.0055	0.0008	0.0047
90	0.0055	0.0008	0.0047
91	0.0055	0.0008	0.0048
92	0.0056	0.0008	0.0048
93	0.0056	0.0008	0.0048
94	0.0056	0.0008	0.0049
95	0.0057	0.0008	0.0049
96	0.0057	0.0008	0.0049
97	0.0058	0.0008	0.0050
98	0.0058	0.0008	0.0050

99	0.0058	0.0008	0.0050
100	0.0059	0.0008	0.0051
101	0.0059	0.0008	0.0051
102	0.0060	0.0008	0.0051
103	0.0060	0.0008	0.0052
104	0.0060	0.0008	0.0052
105	0.0061	0.0008	0.0053
106	0.0061	0.0008	0.0053
107	0.0062	0.0009	0.0053
108	0.0062	0.0009	0.0054
109	0.0063	0.0009	0.0054
110	0.0063	0.0009	0.0054
111	0.0064	0.0009	0.0055
112	0.0064	0.0009	0.0055
113	0.0065	0.0009	0.0056
114	0.0065	0.0009	0.0056
115	0.0066	0.0009	0.0057
116	0.0066	0.0009	0.0057
117	0.0067	0.0009	0.0058
118	0.0067	0.0009	0.0058
119	0.0068	0.0009	0.0059
120	0.0069	0.0009	0.0059
121	0.0069	0.0010	0.0060
122	0.0070	0.0010	0.0060
123	0.0071	0.0010	0.0061
124	0.0071	0.0010	0.0061
125	0.0072	0.0010	0.0062
126	0.0073	0.0010	0.0063
127	0.0073	0.0010	0.0063
128	0.0074	0.0010	0.0064
129	0.0075	0.0010	0.0065
130	0.0075	0.0010	0.0065
131	0.0077	0.0011	0.0066
132	0.0077	0.0011	0.0066
133	0.0078	0.0011	0.0067
134	0.0079	0.0011	0.0068
135	0.0080	0.0011	0.0069
136	0.0080	0.0011	0.0069
137	0.0082	0.0011	0.0070
138	0.0082	0.0011	0.0071
139	0.0084	0.0012	0.0072
140	0.0084	0.0012	0.0073
141	0.0086	0.0012	0.0074
142	0.0086	0.0012	0.0075
143	0.0088	0.0012	0.0076
144	0.0089	0.0012	0.0076
145	0.0123	0.0017	0.0106
146	0.0123	0.0017	0.0106
147	0.0125	0.0017	0.0108
148	0.0126	0.0017	0.0109

149	0.0128	0.0018	0.0111
150	0.0129	0.0018	0.0111
151	0.0131	0.0018	0.0113
152	0.0132	0.0018	0.0114
153	0.0135	0.0019	0.0116
154	0.0136	0.0019	0.0117
155	0.0138	0.0019	0.0119
156	0.0140	0.0019	0.0120
157	0.0142	0.0020	0.0123
158	0.0144	0.0020	0.0124
159	0.0147	0.0020	0.0126
160	0.0148	0.0020	0.0128
161	0.0151	0.0021	0.0130
162	0.0153	0.0021	0.0132
163	0.0157	0.0022	0.0135
164	0.0158	0.0022	0.0137
165	0.0162	0.0022	0.0140
166	0.0164	0.0023	0.0142
167	0.0169	0.0023	0.0145
168	0.0171	0.0024	0.0147
169	0.0176	0.0024	0.0152
170	0.0179	0.0025	0.0154
171	0.0184	0.0025	0.0159
172	0.0187	0.0026	0.0161
173	0.0194	0.0027	0.0167
174	0.0197	0.0027	0.0170
175	0.0205	0.0028	0.0176
176	0.0209	0.0029	0.0180
177	0.0218	0.0030	0.0188
178	0.0223	0.0031	0.0192
179	0.0234	0.0032	0.0202
180	0.0240	0.0033	0.0207
181	0.0254	0.0035	0.0219
182	0.0262	0.0036	0.0225
183	0.0280	0.0037	0.0243
184	0.0290	0.0037	0.0253
185	0.0262	0.0036	0.0226
186	0.0277	0.0037	0.0240
187	0.0314	0.0037	0.0277
188	0.0339	0.0037	0.0302
189	0.0408	0.0037	0.0371
190	0.0461	0.0037	0.0424
191	0.0659	0.0037	0.0622
192	0.0906	0.0037	0.0869
193	0.2835	0.0037	0.2798
194	0.0537	0.0037	0.0500
195	0.0369	0.0037	0.0332
196	0.0294	0.0037	0.0257
197	0.0302	0.0037	0.0265
198	0.0270	0.0037	0.0233

199	0.0247	0.0034	0.0212
200	0.0228	0.0031	0.0197
201	0.0213	0.0029	0.0184
202	0.0201	0.0028	0.0173
203	0.0190	0.0026	0.0164
204	0.0181	0.0025	0.0156
205	0.0173	0.0024	0.0150
206	0.0167	0.0023	0.0144
207	0.0160	0.0022	0.0138
208	0.0155	0.0021	0.0133
209	0.0150	0.0021	0.0129
210	0.0145	0.0020	0.0125
211	0.0141	0.0019	0.0122
212	0.0137	0.0019	0.0118
213	0.0134	0.0018	0.0115
214	0.0130	0.0018	0.0112
215	0.0127	0.0018	0.0110
216	0.0124	0.0017	0.0107
217	0.0090	0.0012	0.0077
218	0.0087	0.0012	0.0075
219	0.0085	0.0012	0.0073
220	0.0083	0.0011	0.0072
221	0.0081	0.0011	0.0070
222	0.0079	0.0011	0.0068
223	0.0078	0.0011	0.0067
224	0.0076	0.0010	0.0065
225	0.0074	0.0010	0.0064
226	0.0073	0.0010	0.0063
227	0.0072	0.0010	0.0062
228	0.0070	0.0010	0.0061
229	0.0069	0.0010	0.0060
230	0.0068	0.0009	0.0058
231	0.0067	0.0009	0.0057
232	0.0066	0.0009	0.0057
233	0.0065	0.0009	0.0056
234	0.0064	0.0009	0.0055
235	0.0063	0.0009	0.0054
236	0.0062	0.0009	0.0053
237	0.0061	0.0008	0.0052
238	0.0060	0.0008	0.0052
239	0.0059	0.0008	0.0051
240	0.0058	0.0008	0.0050
241	0.0057	0.0008	0.0049
242	0.0057	0.0008	0.0049
243	0.0056	0.0008	0.0048
244	0.0055	0.0008	0.0048
245	0.0055	0.0008	0.0047
246	0.0054	0.0007	0.0046
247	0.0053	0.0007	0.0046
248	0.0053	0.0007	0.0045

249	0.0052	0.0007	0.0045
250	0.0051	0.0007	0.0044
251	0.0051	0.0007	0.0044
252	0.0050	0.0007	0.0043
253	0.0050	0.0007	0.0043
254	0.0049	0.0007	0.0042
255	0.0049	0.0007	0.0042
256	0.0048	0.0007	0.0042
257	0.0048	0.0007	0.0041
258	0.0047	0.0007	0.0041
259	0.0047	0.0006	0.0040
260	0.0046	0.0006	0.0040
261	0.0046	0.0006	0.0040
262	0.0045	0.0006	0.0039
263	0.0045	0.0006	0.0039
264	0.0045	0.0006	0.0038
265	0.0044	0.0006	0.0038
266	0.0044	0.0006	0.0038
267	0.0043	0.0006	0.0037
268	0.0043	0.0006	0.0037
269	0.0043	0.0006	0.0037
270	0.0042	0.0006	0.0037
271	0.0042	0.0006	0.0036
272	0.0042	0.0006	0.0036
273	0.0041	0.0006	0.0036
274	0.0041	0.0006	0.0035
275	0.0041	0.0006	0.0035
276	0.0040	0.0006	0.0035
277	0.0040	0.0006	0.0035
278	0.0040	0.0005	0.0034
279	0.0039	0.0005	0.0034
280	0.0039	0.0005	0.0034
281	0.0039	0.0005	0.0034
282	0.0039	0.0005	0.0033
283	0.0038	0.0005	0.0033
284	0.0038	0.0005	0.0033
285	0.0038	0.0005	0.0033
286	0.0038	0.0005	0.0032
287	0.0037	0.0005	0.0032
288	0.0037	0.0005	0.0032

Total soil rain loss = 0.35(In)
Total effective rainfall = 2.63(In)
Peak flow rate in flood hydrograph = 1.83(CFS)

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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       0.0002      0.02  Q         |         |         |         |
  0+15       0.0004      0.03  Q         |         |         |         |
  0+20       0.0006      0.03  Q         |         |         |         |
  0+25       0.0008      0.03  Q         |         |         |         |
  0+30       0.0010      0.03  Q         |         |         |         |
  0+35       0.0012      0.03  Q         |         |         |         |
  0+40       0.0015      0.03  Q         |         |         |         |
  0+45       0.0017      0.03  Q         |         |         |         |
  0+50       0.0019      0.03  Q         |         |         |         |
  0+55       0.0021      0.03  Q         |         |         |         |
  1+ 0       0.0023      0.03  Q         |         |         |         |
  1+ 5       0.0026      0.03  Q         |         |         |         |
  1+10       0.0028      0.03  Q         |         |         |         |
  1+15       0.0030      0.03  Q         |         |         |         |
  1+20       0.0032      0.03  Q         |         |         |         |
  1+25       0.0035      0.03  Q         |         |         |         |
  1+30       0.0037      0.03  Q         |         |         |         |
  1+35       0.0039      0.03  Q         |         |         |         |
  1+40       0.0041      0.03  Q         |         |         |         |
  1+45       0.0044      0.03  Q         |         |         |         |
  1+50       0.0046      0.03  QV        |         |         |         |
  1+55       0.0048      0.03  QV        |         |         |         |
  2+ 0       0.0051      0.03  QV        |         |         |         |
  2+ 5       0.0053      0.03  QV        |         |         |         |
  2+10       0.0055      0.03  QV        |         |         |         |
  2+15       0.0058      0.03  QV        |         |         |         |
  2+20       0.0060      0.03  QV        |         |         |         |
  2+25       0.0062      0.03  QV        |         |         |         |
  2+30       0.0065      0.03  QV        |         |         |         |
  2+35       0.0067      0.03  QV        |         |         |         |
  2+40       0.0069      0.03  QV        |         |         |         |
  2+45       0.0072      0.03  QV        |         |         |         |
  2+50       0.0074      0.03  QV        |         |         |         |
  2+55       0.0077      0.04  QV        |         |         |         |
  3+ 0       0.0079      0.04  QV        |         |         |         |
  3+ 5       0.0081      0.04  QV        |         |         |         |
  3+10       0.0084      0.04  QV        |         |         |         |
  3+15       0.0086      0.04  QV        |         |         |         |
  3+20       0.0089      0.04  Q V       |         |         |         |
  3+25       0.0091      0.04  Q V       |         |         |         |
  3+30       0.0094      0.04  Q V       |         |         |         |
  3+35       0.0096      0.04  Q V       |         |         |         |
  3+40       0.0099      0.04  Q V       |         |         |         |
  3+45       0.0101      0.04  Q V       |         |         |         |
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3+50	0.0104	0.04	Q V				
3+55	0.0106	0.04	Q V				
4+ 0	0.0109	0.04	Q V				
4+ 5	0.0112	0.04	Q V				
4+10	0.0114	0.04	Q V				
4+15	0.0117	0.04	Q V				
4+20	0.0119	0.04	Q V				
4+25	0.0122	0.04	Q V				
4+30	0.0125	0.04	Q V				
4+35	0.0127	0.04	Q V				
4+40	0.0130	0.04	Q V				
4+45	0.0132	0.04	Q V				
4+50	0.0135	0.04	Q V				
4+55	0.0138	0.04	Q V				
5+ 0	0.0141	0.04	Q V				
5+ 5	0.0143	0.04	Q V				
5+10	0.0146	0.04	Q V				
5+15	0.0149	0.04	Q V				
5+20	0.0151	0.04	Q V				
5+25	0.0154	0.04	Q V				
5+30	0.0157	0.04	Q V				
5+35	0.0160	0.04	Q V				
5+40	0.0163	0.04	Q V				
5+45	0.0165	0.04	Q V				
5+50	0.0168	0.04	Q V				
5+55	0.0171	0.04	Q V				
6+ 0	0.0174	0.04	Q V				
6+ 5	0.0177	0.04	Q V				
6+10	0.0180	0.04	Q V				
6+15	0.0183	0.04	Q V				
6+20	0.0186	0.04	Q V				
6+25	0.0189	0.04	Q V				
6+30	0.0191	0.04	Q V				
6+35	0.0194	0.04	Q V				
6+40	0.0197	0.04	Q V				
6+45	0.0200	0.04	Q V				
6+50	0.0203	0.04	Q V				
6+55	0.0207	0.04	Q V				
7+ 0	0.0210	0.04	Q V				
7+ 5	0.0213	0.04	Q V				
7+10	0.0216	0.05	Q V				
7+15	0.0219	0.05	Q V				
7+20	0.0222	0.05	Q V				
7+25	0.0225	0.05	Q V				
7+30	0.0228	0.05	Q V				
7+35	0.0232	0.05	Q V				
7+40	0.0235	0.05	Q V				
7+45	0.0238	0.05	Q V				
7+50	0.0241	0.05	Q V				
7+55	0.0245	0.05	Q V				

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 8+ 0       0.0248      0.05  Q    V    |         |         |         |
 8+ 5       0.0251      0.05  Q    V    |         |         |         |
 8+10       0.0254      0.05  Q    V    |         |         |         |
 8+15       0.0258      0.05  Q    V    |         |         |         |
 8+20       0.0261      0.05  Q    V    |         |         |         |
 8+25       0.0265      0.05  Q    V    |         |         |         |
 8+30       0.0268      0.05  Q     V   |         |         |         |
 8+35       0.0272      0.05  Q     V   |         |         |         |
 8+40       0.0275      0.05  Q     V   |         |         |         |
 8+45       0.0279      0.05  Q     V   |         |         |         |
 8+50       0.0282      0.05  Q     V   |         |         |         |
 8+55       0.0286      0.05  Q     V   |         |         |         |
 9+ 0       0.0289      0.05  Q     V   |         |         |         |
 9+ 5       0.0293      0.05  Q     V   |         |         |         |
 9+10       0.0296      0.05  Q     V   |         |         |         |
 9+15       0.0300      0.05  Q     V   |         |         |         |
 9+20       0.0304      0.05  Q     V   |         |         |         |
 9+25       0.0308      0.05  Q     V   |         |         |         |
 9+30       0.0311      0.05  Q      V  |         |         |         |
 9+35       0.0315      0.06  Q      V  |         |         |         |
 9+40       0.0319      0.06  Q      V  |         |         |         |
 9+45       0.0323      0.06  Q      V  |         |         |         |
 9+50       0.0327      0.06  Q      V  |         |         |         |
 9+55       0.0331      0.06  Q      V  |         |         |         |
10+ 0       0.0335      0.06  Q      V  |         |         |         |
10+ 5       0.0339      0.06  Q      V  |         |         |         |
10+10       0.0343      0.06  Q      V  |         |         |         |
10+15       0.0347      0.06  Q      V  |         |         |         |
10+20       0.0351      0.06  Q      V  |         |         |         |
10+25       0.0355      0.06  Q      V  |         |         |         |
10+30       0.0359      0.06  Q       V |         |         |         |
10+35       0.0363      0.06  Q       V |         |         |         |
10+40       0.0368      0.06  Q       V |         |         |         |
10+45       0.0372      0.06  Q       V |         |         |         |
10+50       0.0376      0.06  Q       V |         |         |         |
10+55       0.0381      0.06  Q       V |         |         |         |
11+ 0       0.0385      0.06  Q       V |         |         |         |
11+ 5       0.0389      0.06  Q       V |         |         |         |
11+10       0.0394      0.07  Q       V |         |         |         |
11+15       0.0399      0.07  Q       V |         |         |         |
11+20       0.0403      0.07  Q        V|         |         |         |
11+25       0.0408      0.07  Q        V|         |         |         |
11+30       0.0413      0.07  Q        V|         |         |         |
11+35       0.0417      0.07  Q        V|         |         |         |
11+40       0.0422      0.07  Q        V|         |         |         |
11+45       0.0427      0.07  Q        V|         |         |         |
11+50       0.0432      0.07  Q        V|         |         |         |
11+55       0.0437      0.07  Q        V|         |         |         |
12+ 0       0.0442      0.07  Q        V|         |         |         |
12+ 5       0.0448      0.08  Q         V         |         |         |
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12+10       0.0454      0.09  Q         V         |         |         |
12+15       0.0461      0.10  Q         V         |         |         |
12+20       0.0468      0.11  Q         V         |         |         |
12+25       0.0476      0.11  Q         V         |         |         |
12+30       0.0483      0.11  Q         V         |         |         |
12+35       0.0491      0.11  Q         |V        |         |         |
12+40       0.0498      0.11  Q         |V        |         |         |
12+45       0.0506      0.11  Q         |V        |         |         |
12+50       0.0514      0.11  Q         |V        |         |         |
12+55       0.0522      0.11  Q         |V        |         |         |
13+ 0       0.0530      0.12  Q         |V        |         |         |
13+ 5       0.0538      0.12  Q         | V       |         |         |
13+10       0.0546      0.12  Q         | V       |         |         |
13+15       0.0554      0.12  Q         | V       |         |         |
13+20       0.0563      0.12  Q         | V       |         |         |
13+25       0.0571      0.12  Q         | V       |         |         |
13+30       0.0580      0.13  Q         |  V      |         |         |
13+35       0.0589      0.13  Q         |  V      |         |         |
13+40       0.0598      0.13  Q         |  V      |         |         |
13+45       0.0607      0.13  Q         |  V      |         |         |
13+50       0.0617      0.14  Q         |  V      |         |         |
13+55       0.0626      0.14  Q         |   V     |         |         |
14+ 0       0.0636      0.14  Q         |   V     |         |         |
14+ 5       0.0646      0.14  Q         |   V     |         |         |
14+10       0.0656      0.15  Q         |   V     |         |         |
14+15       0.0666      0.15  Q         |    V    |         |         |
14+20       0.0677      0.15  Q         |    V    |         |         |
14+25       0.0688      0.16  Q         |    V    |         |         |
14+30       0.0699      0.16  Q         |    V    |         |         |
14+35       0.0710      0.17  Q         |     V   |         |         |
14+40       0.0722      0.17  Q         |     V   |         |         |
14+45       0.0734      0.18  Q         |     V   |         |         |
14+50       0.0747      0.18  Q         |     V   |         |         |
14+55       0.0760      0.19  Q         |      V  |         |         |
15+ 0       0.0773      0.19  Q         |      V  |         |         |
15+ 5       0.0787      0.20  Q         |      V  |         |         |
15+10       0.0801      0.21  Q         |       V |         |         |
15+15       0.0817      0.22  Q         |       V |         |         |
15+20       0.0833      0.23  Q         |       V |         |         |
15+25       0.0849      0.24  Q         |        V|         |         |
15+30       0.0865      0.23  Q         |        V|         |         |
15+35       0.0881      0.24  Q         |        V|         |         |
15+40       0.0899      0.26  |Q        |         V         |         |
15+45       0.0920      0.29  |Q        |         V         |         |
15+50       0.0943      0.35  |Q        |         |V        |         |
15+55       0.0972      0.42  |Q        |         |V        |         |
16+ 0       0.1012      0.57  | Q       |         | V       |         |
16+ 5       0.1080      0.99  |  Q      |         |   V     |         |
16+10       0.1206      1.83  |      Q  |         |      V  |         |
16+15       0.1283      1.12  |   Q     |         |       V |         |
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16+20       0.1315      0.47  |Q        |         |        V|         |
16+25       0.1336      0.31  |Q        |         |         V         |
16+30       0.1354      0.26  |Q        |         |         V         |
16+35       0.1370      0.24  Q         |         |         V         |
16+40       0.1385      0.21  Q         |         |         |V        |
16+45       0.1398      0.20  Q         |         |         |V        |
16+50       0.1411      0.18  Q         |         |         |V        |
16+55       0.1423      0.17  Q         |         |         | V       |
17+ 0       0.1434      0.16  Q         |         |         | V       |
17+ 5       0.1445      0.16  Q         |         |         | V       |
17+10       0.1455      0.15  Q         |         |         | V       |
17+15       0.1465      0.14  Q         |         |         |  V      |
17+20       0.1474      0.14  Q         |         |         |  V      |
17+25       0.1483      0.13  Q         |         |         |  V      |
17+30       0.1492      0.13  Q         |         |         |  V      |
17+35       0.1501      0.12  Q         |         |         |  V      |
17+40       0.1509      0.12  Q         |         |         |   V     |
17+45       0.1517      0.12  Q         |         |         |   V     |
17+50       0.1525      0.11  Q         |         |         |   V     |
17+55       0.1532      0.11  Q         |         |         |   V     |
18+ 0       0.1540      0.11  Q         |         |         |   V     |
18+ 5       0.1547      0.10  Q         |         |         |   V     |
18+10       0.1553      0.09  Q         |         |         |   V     |
18+15       0.1558      0.08  Q         |         |         |    V    |
18+20       0.1563      0.07  Q         |         |         |    V    |
18+25       0.1568      0.07  Q         |         |         |    V    |
18+30       0.1573      0.07  Q         |         |         |    V    |
18+35       0.1577      0.07  Q         |         |         |    V    |
18+40       0.1582      0.07  Q         |         |         |    V    |
18+45       0.1586      0.06  Q         |         |         |    V    |
18+50       0.1591      0.06  Q         |         |         |    V    |
18+55       0.1595      0.06  Q         |         |         |    V    |
19+ 0       0.1599      0.06  Q         |         |         |     V   |
19+ 5       0.1603      0.06  Q         |         |         |     V   |
19+10       0.1607      0.06  Q         |         |         |     V   |
19+15       0.1611      0.06  Q         |         |         |     V   |
19+20       0.1615      0.06  Q         |         |         |     V   |
19+25       0.1619      0.06  Q         |         |         |     V   |
19+30       0.1623      0.05  Q         |         |         |     V   |
19+35       0.1626      0.05  Q         |         |         |     V   |
19+40       0.1630      0.05  Q         |         |         |     V   |
19+45       0.1634      0.05  Q         |         |         |     V   |
19+50       0.1637      0.05  Q         |         |         |     V   |
19+55       0.1641      0.05  Q         |         |         |     V   |
20+ 0       0.1644      0.05  Q         |         |         |      V  |
20+ 5       0.1647      0.05  Q         |         |         |      V  |
20+10       0.1651      0.05  Q         |         |         |      V  |
20+15       0.1654      0.05  Q         |         |         |      V  |
20+20       0.1657      0.05  Q         |         |         |      V  |
20+25       0.1661      0.05  Q         |         |         |      V  |
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   20+30       0.1664      0.05  Q         |         |         |      V  |
   20+35       0.1667      0.05  Q         |         |         |      V  |
   20+40       0.1670      0.05  Q         |         |         |      V  |
   20+45       0.1673      0.04  Q         |         |         |      V  |
   20+50       0.1676      0.04  Q         |         |         |      V  |
   20+55       0.1679      0.04  Q         |         |         |      V  |
   21+ 0       0.1682      0.04  Q         |         |         |      V  |
   21+ 5       0.1685      0.04  Q         |         |         |      V  |
   21+10       0.1688      0.04  Q         |         |         |       V |
   21+15       0.1691      0.04  Q         |         |         |       V |
   21+20       0.1694      0.04  Q         |         |         |       V |
   21+25       0.1696      0.04  Q         |         |         |       V |
   21+30       0.1699      0.04  Q         |         |         |       V |
   21+35       0.1702      0.04  Q         |         |         |       V |
   21+40       0.1705      0.04  Q         |         |         |       V |
   21+45       0.1707      0.04  Q         |         |         |       V |
   21+50       0.1710      0.04  Q         |         |         |       V |
   21+55       0.1713      0.04  Q         |         |         |       V |
   22+ 0       0.1715      0.04  Q         |         |         |       V |
   22+ 5       0.1718      0.04  Q         |         |         |       V |
   22+10       0.1721      0.04  Q         |         |         |       V |
   22+15       0.1723      0.04  Q         |         |         |       V |
   22+20       0.1726      0.04  Q         |         |         |       V |
   22+25       0.1728      0.04  Q         |         |         |       V |
   22+30       0.1731      0.04  Q         |         |         |        V|
   22+35       0.1733      0.04  Q         |         |         |        V|
   22+40       0.1736      0.04  Q         |         |         |        V|
   22+45       0.1738      0.04  Q         |         |         |        V|
   22+50       0.1740      0.03  Q         |         |         |        V|
   22+55       0.1743      0.03  Q         |         |         |        V|
   23+ 0       0.1745      0.03  Q         |         |         |        V|
   23+ 5       0.1748      0.03  Q         |         |         |        V|
   23+10       0.1750      0.03  Q         |         |         |        V|
   23+15       0.1752      0.03  Q         |         |         |        V|
   23+20       0.1754      0.03  Q         |         |         |        V|
   23+25       0.1757      0.03  Q         |         |         |        V|
   23+30       0.1759      0.03  Q         |         |         |        V|
   23+35       0.1761      0.03  Q         |         |         |        V|
   23+40       0.1764      0.03  Q         |         |         |        V|
   23+45       0.1766      0.03  Q         |         |         |        V|
   23+50       0.1768      0.03  Q         |         |         |        V|
   23+55       0.1770      0.03  Q         |         |         |        V|
   24+ 0       0.1772      0.03  Q         |         |         |        V|
   24+ 5       0.1774      0.03  Q         |         |         |        V|
   24+10       0.1775      0.01  Q         |         |         |        V|
   24+15       0.1775      0.00  Q         |         |         |        V|
   24+20       0.1775      0.00  Q         |         |         |        V|
-----------------------------------------------------------------------
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SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
0	0.	0.	0.	0.	0.	0.	0.
5	0.02	0.02	0.02	0.02	0.	0.	0.
10	0.04	0.06	0.07	0.08	0.	0.	0.
15	0.04	0.08	0.14	0.15	0.01	0.	0.01
20	0.04	0.08	0.2	0.22	0.01	0.	0.01
25	0.04	0.08	0.26	0.28	0.01	0.	0.01
30	0.04	0.08	0.31	0.34	0.01	0.	0.01
35	0.04	0.08	0.36	0.39	0.02	0.	0.02
40	0.04	0.08	0.41	0.44	0.02	0.	0.02
45	0.04	0.08	0.45	0.49	0.02	0.	0.02
50	0.04	0.08	0.49	0.53	0.02	0.	0.02
55	0.04	0.08	0.53	0.57	0.02	0.	0.02
60	0.04	0.08	0.56	0.61	0.02	0.	0.02
65	0.04	0.08	0.59	0.64	0.02	0.	0.02
70	0.04	0.08	0.62	0.67	0.03	0.	0.03
75	0.04	0.08	0.64	0.7	0.03	0.	0.03
80	0.04	0.08	0.67	0.72	0.03	0.	0.03
85	0.04	0.08	0.69	0.75	0.03	0.	0.03
90	0.04	0.08	0.71	0.77	0.03	0.	0.03
95	0.04	0.08	0.73	0.79	0.03	0.	0.03
100	0.04	0.08	0.74	0.81	0.03	0.	0.03
105	0.04	0.08	0.76	0.82	0.03	0.	0.03
110	0.04	0.08	0.77	0.84	0.03	0.	0.03
115	0.04	0.08	0.79	0.85	0.03	0.	0.03
120	0.04	0.08	0.8	0.87	0.03	0.	0.03
125	0.04	0.08	0.81	0.88	0.03	0.	0.03
130	0.04	0.08	0.82	0.89	0.03	0.	0.03
135	0.04	0.08	0.83	0.9	0.04	0.	0.04
140	0.04	0.08	0.84	0.91	0.04	0.	0.04
145	0.04	0.08	0.85	0.92	0.04	0.	0.04
150	0.04	0.08	0.86	0.93	0.04	0.	0.04
155	0.04	0.08	0.86	0.94	0.04	0.	0.04
160	0.04	0.08	0.87	0.94	0.04	0.	0.04
165	0.04	0.08	0.88	0.95	0.04	0.	0.04
170	0.04	0.08	0.88	0.96	0.04	0.	0.04
175	0.04	0.08	0.89	0.96	0.04	0.	0.04
180	0.04	0.08	0.89	0.97	0.04	0.	0.04
185	0.05	0.09	0.9	0.98	0.04	0.	0.04
190	0.05	0.1	0.93	1.	0.04	0.	0.04
195	0.05	0.1	0.95	1.03	0.04	0.	0.04
200	0.05	0.1	0.97	1.05	0.04	0.	0.04
205	0.05	0.1	0.98	1.07	0.04	0.	0.04
210	0.05	0.1	1.	1.08	0.04	0.	0.04
215	0.05	0.1	1.01	1.1	0.04	0.	0.04
220	0.05	0.1	1.03	1.11	0.04	0.	0.04

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
225	0.05	0.1	1.04	1.13	0.04	0.	0.04
230	0.05	0.1	1.05	1.14	0.04	0.	0.04
235	0.05	0.1	1.06	1.15	0.04	0.	0.04
240	0.05	0.1	1.07	1.16	0.05	0.	0.05
245	0.05	0.1	1.08	1.17	0.05	0.	0.05
250	0.05	0.1	1.09	1.18	0.05	0.	0.05
255	0.05	0.1	1.09	1.19	0.05	0.	0.05
260	0.05	0.1	1.1	1.19	0.05	0.	0.05
265	0.05	0.1	1.11	1.2	0.05	0.	0.05
270	0.05	0.1	1.11	1.21	0.05	0.	0.05
275	0.05	0.1	1.12	1.21	0.05	0.	0.05
280	0.05	0.1	1.12	1.22	0.05	0.	0.05
285	0.05	0.1	1.13	1.22	0.05	0.	0.05
290	0.05	0.1	1.13	1.23	0.05	0.	0.05
295	0.05	0.1	1.14	1.23	0.05	0.	0.05
300	0.05	0.1	1.14	1.24	0.05	0.	0.05
305	0.05	0.1	1.14	1.24	0.05	0.	0.05
310	0.05	0.1	1.15	1.24	0.05	0.	0.05
315	0.05	0.1	1.15	1.25	0.05	0.	0.05
320	0.05	0.1	1.15	1.25	0.05	0.	0.05
325	0.05	0.1	1.15	1.25	0.05	0.	0.05
330	0.05	0.1	1.16	1.25	0.05	0.	0.05
335	0.05	0.1	1.16	1.26	0.05	0.	0.05
340	0.05	0.1	1.16	1.26	0.05	0.	0.05
345	0.05	0.1	1.16	1.26	0.05	0.	0.05
350	0.05	0.1	1.16	1.26	0.05	0.	0.05
355	0.05	0.1	1.17	1.26	0.05	0.	0.05
360	0.05	0.1	1.17	1.27	0.05	0.	0.05
365	0.05	0.1	1.17	1.27	0.05	0.	0.05
370	0.05	0.1	1.17	1.27	0.05	0.	0.05
375	0.05	0.1	1.17	1.27	0.05	0.	0.05
380	0.05	0.1	1.17	1.27	0.05	0.	0.05
385	0.05	0.1	1.17	1.27	0.05	0.	0.05
390	0.05	0.1	1.17	1.27	0.05	0.	0.05
395	0.06	0.11	1.18	1.28	0.05	0.	0.05
400	0.06	0.12	1.2	1.3	0.05	0.	0.05
405	0.06	0.12	1.22	1.32	0.05	0.	0.05
410	0.06	0.12	1.23	1.34	0.05	0.	0.05
415	0.06	0.12	1.25	1.35	0.05	0.	0.05
420	0.06	0.12	1.26	1.37	0.05	0.	0.05
425	0.06	0.12	1.27	1.38	0.05	0.	0.05
430	0.06	0.12	1.29	1.39	0.05	0.	0.05
435	0.06	0.12	1.3	1.41	0.05	0.	0.05
440	0.06	0.12	1.31	1.42	0.06	0.	0.06
445	0.06	0.12	1.32	1.43	0.06	0.	0.06

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
450	0.06	0.12	1.32	1.44	0.06	0.	0.06
455	0.06	0.12	1.33	1.44	0.06	0.	0.06
460	0.06	0.12	1.34	1.45	0.06	0.	0.06
465	0.06	0.12	1.34	1.46	0.06	0.	0.06
470	0.06	0.12	1.35	1.46	0.06	0.	0.06
475	0.06	0.12	1.36	1.47	0.06	0.	0.06
480	0.06	0.12	1.36	1.48	0.06	0.	0.06
485	0.06	0.12	1.37	1.48	0.06	0.	0.06
490	0.06	0.12	1.37	1.49	0.06	0.	0.06
495	0.06	0.12	1.37	1.49	0.06	0.	0.06
500	0.06	0.12	1.38	1.49	0.06	0.	0.06
505	0.06	0.12	1.38	1.5	0.06	0.	0.06
510	0.06	0.12	1.38	1.5	0.06	0.	0.06
515	0.06	0.12	1.39	1.5	0.06	0.	0.06
520	0.06	0.12	1.39	1.51	0.06	0.	0.06
525	0.07	0.13	1.4	1.52	0.06	0.	0.06
530	0.07	0.14	1.42	1.54	0.06	0.	0.06
535	0.07	0.14	1.44	1.56	0.06	0.	0.06
540	0.07	0.14	1.46	1.58	0.06	0.	0.06
545	0.07	0.14	1.47	1.6	0.06	0.	0.06
550	0.07	0.14	1.49	1.61	0.06	0.	0.06
555	0.07	0.14	1.5	1.63	0.06	0.	0.06
560	0.07	0.14	1.51	1.64	0.06	0.	0.06
565	0.07	0.14	1.52	1.65	0.06	0.	0.06
570	0.07	0.14	1.53	1.66	0.06	0.	0.06
575	0.07	0.14	1.54	1.67	0.07	0.	0.07
580	0.07	0.14	1.55	1.68	0.07	0.	0.07
585	0.07	0.14	1.56	1.69	0.07	0.	0.07
590	0.07	0.14	1.57	1.7	0.07	0.	0.07
595	0.07	0.14	1.57	1.71	0.07	0.	0.07
600	0.07	0.14	1.58	1.71	0.07	0.	0.07
605	0.07	0.14	1.59	1.72	0.07	0.	0.07
610	0.07	0.14	1.59	1.73	0.07	0.	0.07
615	0.08	0.15	1.61	1.74	0.07	0.	0.07
620	0.08	0.16	1.63	1.77	0.07	0.	0.07
625	0.08	0.16	1.65	1.79	0.07	0.	0.07
630	0.08	0.16	1.67	1.81	0.07	0.	0.07
635	0.08	0.16	1.69	1.83	0.07	0.	0.07
640	0.08	0.16	1.7	1.85	0.07	0.	0.07
645	0.08	0.16	1.72	1.86	0.07	0.	0.07
650	0.08	0.16	1.73	1.88	0.07	0.	0.07
655	0.08	0.16	1.74	1.89	0.07	0.	0.07
660	0.08	0.16	1.76	1.9	0.07	0.	0.07
665	0.08	0.16	1.77	1.92	0.07	0.	0.07
670	0.08	0.16	1.78	1.93	0.08	0.	0.08

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
675	0.09	0.17	1.79	1.95	0.08	0.	0.08
680	0.09	0.18	1.82	1.97	0.08	0.	0.08
685	0.09	0.18	1.84	2.	0.08	0.	0.08
690	0.09	0.18	1.87	2.02	0.08	0.	0.08
695	0.09	0.18	1.89	2.05	0.08	0.	0.08
700	0.09	0.18	1.91	2.07	0.08	0.	0.08
705	0.09	0.18	1.92	2.09	0.08	0.	0.08
710	0.09	0.18	1.94	2.1	0.08	0.	0.08
715	0.09	0.18	1.95	2.12	0.08	0.	0.08
720	0.1	0.19	1.98	2.14	0.08	0.	0.08
725	0.12	0.22	2.03	2.2	0.09	0.	0.09
730	0.13	0.25	2.1	2.28	0.09	0.	0.09
735	0.13	0.26	2.18	2.36	0.09	0.	0.09
740	0.13	0.26	2.25	2.44	0.09	0.	0.09
745	0.14	0.27	2.32	2.52	0.1	0.	0.1
750	0.14	0.28	2.4	2.6	0.1	0.	0.1
755	0.14	0.28	2.47	2.68	0.1	0.	0.1
760	0.14	0.28	2.53	2.75	0.11	0.	0.11
765	0.14	0.28	2.6	2.81	0.11	0.	0.11
770	0.15	0.29	2.66	2.89	0.11	0.	0.11
775	0.15	0.3	2.73	2.96	0.12	0.	0.12
780	0.15	0.3	2.79	3.03	0.12	0.	0.12
785	0.15	0.3	2.85	3.09	0.12	0.	0.12
790	0.15	0.3	2.91	3.15	0.12	0.	0.12
795	0.16	0.31	2.97	3.22	0.13	0.	0.13
800	0.16	0.32	3.03	3.29	0.13	0.	0.13
805	0.16	0.32	3.09	3.35	0.13	0.	0.13
810	0.16	0.32	3.14	3.41	0.13	0.	0.13
815	0.17	0.33	3.2	3.47	0.14	0.	0.14
820	0.17	0.34	3.27	3.54	0.14	0.	0.14
825	0.17	0.34	3.33	3.61	0.14	0.	0.14
830	0.18	0.35	3.39	3.68	0.14	0.	0.14
835	0.18	0.36	3.46	3.75	0.15	0.	0.15
840	0.18	0.36	3.52	3.82	0.15	0.	0.15
845	0.19	0.37	3.59	3.89	0.15	0.	0.15
850	0.19	0.38	3.66	3.97	0.15	0.	0.15
855	0.19	0.38	3.72	4.04	0.16	0.	0.16
860	0.2	0.39	3.79	4.11	0.16	0.	0.16
865	0.2	0.4	3.87	4.19	0.16	0.	0.16
870	0.21	0.41	3.94	4.28	0.17	0.	0.17
875	0.22	0.43	4.03	4.37	0.17	0.	0.17
880	0.22	0.44	4.12	4.47	0.17	0.	0.17
885	0.23	0.45	4.22	4.57	0.18	0.	0.18
890	0.24	0.47	4.32	4.69	0.18	0.	0.18
895	0.25	0.49	4.44	4.81	0.19	0.	0.19

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
900	0.26	0.51	4.56	4.95	0.19	0.	0.19
905	0.27	0.53	4.7	5.09	0.2	0.	0.2
910	0.28	0.55	4.84	5.25	0.2	0.	0.2
915	0.3	0.58	4.99	5.42	0.21	0.	0.21
920	0.31	0.61	5.17	5.6	0.22	0.	0.22
925	0.3	0.61	5.33	5.78	0.23	0.	0.23
930	0.3	0.6	5.47	5.93	0.23	0.	0.23
935	0.33	0.63	5.62	6.1	0.24	0.	0.24
940	0.37	0.7	5.84	6.32	0.24	0.	0.24
945	0.43	0.8	6.17	6.64	0.24	0.	0.24
950	0.51	0.94	6.63	7.11	0.24	0.	0.24
955	0.68	1.19	7.34	7.82	0.24	0.	0.24
960	1.13	1.81	8.68	9.15	0.24	0.	0.24
965	2.08	3.21	11.41	11.89	0.24	0.	0.24
970	1.63	3.71	14.64	15.12	0.24	0.	0.24
975	0.74	2.37	16.54	17.01	0.24	0.	0.24
980	0.44	1.18	17.24	17.72	0.24	0.	0.24
985	0.34	0.78	17.54	18.02	0.24	0.	0.24
990	0.31	0.65	17.72	18.19	0.24	0.	0.24
995	0.28	0.59	17.83	18.31	0.24	0.	0.24
1000	0.26	0.54	17.89	18.37	0.24	0.	0.24
1005	0.24	0.5	17.91	18.39	0.24	0.	0.24
1010	0.22	0.46	17.9	18.37	0.24	0.	0.24
1015	0.21	0.43	17.85	18.33	0.24	0.	0.24
1020	0.2	0.41	17.78	18.26	0.24	0.	0.24
1025	0.19	0.39	17.7	18.17	0.24	0.	0.24
1030	0.18	0.37	17.59	18.07	0.24	0.	0.24
1035	0.18	0.36	17.47	17.95	0.24	0.	0.24
1040	0.17	0.35	17.35	17.82	0.24	0.	0.24
1045	0.16	0.33	17.2	17.68	0.24	0.	0.24
1050	0.16	0.32	17.04	17.52	0.24	0.	0.24
1055	0.15	0.31	16.88	17.35	0.24	0.	0.24
1060	0.15	0.3	16.7	17.18	0.24	0.	0.24
1065	0.15	0.3	16.52	17.	0.24	0.	0.24
1070	0.14	0.29	16.34	16.81	0.24	0.	0.24
1075	0.14	0.28	16.14	16.62	0.24	0.	0.24
1080	0.13	0.27	15.93	16.41	0.24	0.	0.24
1085	0.11	0.24	15.69	16.17	0.24	0.	0.24
1090	0.1	0.21	15.43	15.9	0.24	0.	0.24
1095	0.09	0.19	15.14	15.62	0.24	0.	0.24
1100	0.09	0.18	14.84	15.32	0.24	0.	0.24
1105	0.09	0.18	14.55	15.02	0.24	0.	0.24
1110	0.09	0.18	14.25	14.73	0.24	0.	0.24
1115	0.08	0.17	13.94	14.42	0.24	0.	0.24
1120	0.08	0.16	13.63	14.1	0.24	0.	0.24

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1125	0.08	0.16	13.31	13.79	0.24	0.	0.24
1130	0.08	0.16	12.99	13.47	0.24	0.	0.24
1135	0.08	0.16	12.68	13.15	0.24	0.	0.24
1140	0.08	0.16	12.36	12.84	0.24	0.	0.24
1145	0.07	0.15	12.03	12.51	0.24	0.	0.24
1150	0.07	0.14	11.69	12.17	0.24	0.	0.24
1155	0.07	0.14	11.36	11.83	0.24	0.	0.24
1160	0.07	0.14	11.02	11.5	0.24	0.	0.24
1165	0.07	0.14	10.68	11.16	0.24	0.	0.24
1170	0.07	0.14	10.35	10.82	0.24	0.	0.24
1175	0.07	0.14	10.01	10.49	0.24	0.	0.24
1180	0.07	0.14	9.67	10.15	0.24	0.	0.24
1185	0.07	0.14	9.34	9.81	0.24	0.	0.24
1190	0.06	0.13	8.99	9.47	0.24	0.	0.24
1195	0.06	0.12	8.63	9.11	0.24	0.	0.24
1200	0.06	0.12	8.28	8.75	0.24	0.	0.24
1205	0.06	0.12	7.92	8.4	0.24	0.	0.24
1210	0.06	0.12	7.56	8.04	0.24	0.	0.24
1215	0.06	0.12	7.21	7.68	0.24	0.	0.24
1220	0.06	0.12	6.85	7.33	0.24	0.	0.24
1225	0.06	0.12	6.49	6.97	0.24	0.	0.24
1230	0.06	0.12	6.13	6.61	0.24	0.	0.24
1235	0.06	0.12	5.78	6.25	0.24	0.	0.24
1240	0.06	0.12	5.44	5.9	0.23	0.	0.23
1245	0.06	0.12	5.13	5.56	0.22	0.	0.22
1250	0.06	0.12	4.84	5.25	0.2	0.	0.2
1255	0.05	0.11	4.56	4.95	0.19	0.	0.19
1260	0.05	0.1	4.3	4.66	0.18	0.	0.18
1265	0.05	0.1	4.06	4.4	0.17	0.	0.17
1270	0.05	0.1	3.83	4.16	0.16	0.	0.16
1275	0.05	0.1	3.63	3.93	0.15	0.	0.15
1280	0.05	0.1	3.44	3.73	0.15	0.	0.15
1285	0.05	0.1	3.26	3.54	0.14	0.	0.14
1290	0.05	0.1	3.1	3.36	0.13	0.	0.13
1295	0.05	0.1	2.95	3.2	0.12	0.	0.12
1300	0.05	0.1	2.81	3.05	0.12	0.	0.12
1305	0.05	0.1	2.68	2.91	0.11	0.	0.11
1310	0.05	0.1	2.57	2.78	0.11	0.	0.11
1315	0.05	0.1	2.46	2.67	0.1	0.	0.1
1320	0.05	0.1	2.36	2.56	0.1	0.	0.1
1325	0.05	0.1	2.27	2.46	0.1	0.	0.1
1330	0.05	0.1	2.18	2.37	0.09	0.	0.09
1335	0.05	0.1	2.11	2.28	0.09	0.	0.09
1340	0.05	0.1	2.03	2.21	0.09	0.	0.09
1345	0.05	0.1	1.97	2.13	0.08	0.	0.08

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1350	0.05	0.1	1.91	2.07	0.08	0.	0.08
1355	0.05	0.1	1.85	2.01	0.08	0.	0.08
1360	0.04	0.09	1.79	1.94	0.08	0.	0.08
1365	0.04	0.08	1.72	1.87	0.07	0.	0.07
1370	0.04	0.08	1.66	1.8	0.07	0.	0.07
1375	0.04	0.08	1.61	1.74	0.07	0.	0.07
1380	0.04	0.08	1.56	1.69	0.07	0.	0.07
1385	0.04	0.08	1.51	1.64	0.06	0.	0.06
1390	0.04	0.08	1.46	1.59	0.06	0.	0.06
1395	0.04	0.08	1.42	1.54	0.06	0.	0.06
1400	0.04	0.08	1.39	1.5	0.06	0.	0.06
1405	0.04	0.08	1.35	1.47	0.06	0.	0.06
1410	0.04	0.08	1.32	1.43	0.06	0.	0.06
1415	0.04	0.08	1.29	1.4	0.05	0.	0.05
1420	0.04	0.08	1.27	1.37	0.05	0.	0.05
1425	0.04	0.08	1.24	1.35	0.05	0.	0.05
1430	0.04	0.08	1.22	1.32	0.05	0.	0.05
1435	0.04	0.08	1.2	1.3	0.05	0.	0.05
1440	0.04	0.08	1.18	1.28	0.05	0.	0.05
1445	0.	0.04	1.12	1.22	0.05	0.	0.05
1450	0.	0.	1.03	1.12	0.04	0.	0.04
1455	0.	0.	0.95	1.03	0.04	0.	0.04
1460	0.	0.	0.88	0.95	0.04	0.	0.04
1465	0.	0.	0.81	0.88	0.03	0.	0.03
1470	0.	0.	0.75	0.81	0.03	0.	0.03
1475	0.	0.	0.69	0.75	0.03	0.	0.03
1480	0.	0.	0.64	0.69	0.03	0.	0.03
1485	0.	0.	0.59	0.64	0.02	0.	0.02
1490	0.	0.	0.54	0.59	0.02	0.	0.02
1495	0.	0.	0.5	0.54	0.02	0.	0.02
1500	0.	0.	0.46	0.5	0.02	0.	0.02
1505	0.	0.	0.42	0.46	0.02	0.	0.02
1510	0.	0.	0.39	0.42	0.02	0.	0.02
1515	0.	0.	0.36	0.39	0.02	0.	0.02
1520	0.	0.	0.33	0.36	0.01	0.	0.01
1525	0.	0.	0.31	0.33	0.01	0.	0.01
1530	0.	0.	0.28	0.31	0.01	0.	0.01
1535	0.	0.	0.26	0.28	0.01	0.	0.01
1540	0.	0.	0.24	0.26	0.01	0.	0.01
1545	0.	0.	0.22	0.24	0.01	0.	0.01
1550	0.	0.	0.2	0.22	0.01	0.	0.01
1555	0.	0.	0.19	0.2	0.01	0.	0.01
1560	0.	0.	0.17	0.19	0.01	0.	0.01
1565	0.	0.	0.16	0.17	0.01	0.	0.01
1570	0.	0.	0.15	0.16	0.01	0.	0.01

SW 2yr 24hr Pipe/Basin stage-storage routing

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1575	0.	0.	0.14	0.15	0.01	0.	0.01
1580	0.	0.	0.13	0.14	0.01	0.	0.01
1585	0.	0.	0.12	0.13	0.	0.	0.
1590	0.	0.	0.11	0.12	0.	0.	0.
1595	0.	0.	0.1	0.11	0.	0.	0.
1600	0.	0.	0.09	0.1	0.	0.	0.
1605	0.	0.	0.08	0.09	0.	0.	0.
1610	0.	0.	0.08	0.08	0.	0.	0.
1615	0.	0.	0.07	0.08	0.	0.	0.
1620	0.	0.	0.07	0.07	0.	0.	0.
1625	0.	0.	0.06	0.07	0.	0.	0.
1630	0.	0.	0.06	0.06	0.	0.	0.
1635	0.	0.	0.05	0.06	0.	0.	0.
1640	0.	0.	0.05	0.05	0.	0.	0.
1645	0.	0.	0.04	0.05	0.	0.	0.
1650	0.	0.	0.04	0.04	0.	0.	0.
1655	0.	0.	0.04	0.04	0.	0.	0.
1660	0.	0.	0.03	0.04	0.	0.	0.
1665	0.	0.	0.03	0.03	0.	0.	0.
1670	0.	0.	0.03	0.03	0.	0.	0.
1675	0.	0.	0.03	0.03	0.	0.	0.
1680	0.	0.	0.02	0.03	0.	0.	0.
1685	0.	0.	0.02	0.02	0.	0.	0.
1690	0.	0.	0.02	0.02	0.	0.	0.
1695	0.	0.	0.02	0.02	0.	0.	0.
1700	0.	0.	0.02	0.02	0.	0.	0.
1705	0.	0.	0.02	0.02	0.	0.	0.
1710	0.	0.	0.02	0.02	0.	0.	0.
1715	0.	0.	0.01	0.02	0.	0.	0.
1720	0.	0.	0.01	0.01	0.	0.	0.
1725	0.	0.	0.01	0.01	0.	0.	0.
1730	0.	0.	0.01	0.01	0.	0.	0.
1735	0.	0.	0.01	0.01	0.	0.	0.
1740	0.	0.	0.01	0.01	0.	0.	0.
1745	0.	0.	0.01	0.01	0.	0.	0.
1750	0.	0.	0.01	0.01	0.	0.	0.
1755	0.	0.	0.01	0.01	0.	0.	0.
1760	0.	0.	0.01	0.01	0.	0.	0.
1765	0.	0.	0.01	0.01	0.	0.	0.
1770	0.	0.	0.01	0.01	0.	0.	0.
1775	0.	0.	0.01	0.01	0.	0.	0.
1780	0.	0.	0.	0.01	0.	0.	0.
1785	0.	0.	0.	0.	0.	0.	0.

PULS Summary Table SW		
Max Inflow (2yr, 24hr)	2.0800	cfs
Max Infiltration	0.2384	cfs
Max Outflow (design)	0.2384	cfs
Elev (10yr, 24hr)	1490.39	ft
Overflow Discharge	0.0000	cfs
Vbmp	7,264	cf
Elev VBMP	1490.50	ft

MC-4500 Chamber - Storage Table									
2	3	6	7	8	9	10	11	12	13
Water surface elevation			Storage					Outflow	
base	Chamber	Inc.	Cumulative Storage						
elev	sf	cf/ft	cf/ft	cf	Underdrain	orifice	Infiltration	cfs	2S/dt+0
1484	1756.00	0	-	-			0.000	0.000	0.00
1485	1756.00	882.36	882.36	882.4			0.238	0.238	6.12
1486	1756.00	1,398.17	1,140.27	2,280.5			0.238	0.238	15.44
1487	1756.00	1,339.07	1,206.53	3,619.6			0.238	0.238	24.37
1488	1756.00	1,243.41	1,215.75	4,863.0			0.238	0.238	32.66
1488.67	1756.00	1,122.99	1,202.50	5,611.7			0.238	0.238	37.65
1488.75	1756.00	1,048.68	1,199.80	5,699.1			0.238	0.238	38.23
1489.25	1756.00	964.82	1,177.42	6,181.5			0.238	0.238	41.45
1489.75	1756.00	761.18	1,141.23	6,562.1			0.239	0.239	43.99
1490.25	1756.00	702.40	1,106.12	6,913.3			0.239	0.239	46.33
1490.75	1756.00	702.40	1,076.22	7,264.5		0.87	0.239	1.112	49.54
1490.92	1756.00	3.18	1,227.20	7,265.0		1.24	0.239	1.474	49.91
1491.08	1756.00	6.25	1,430.31	7,266.0		1.51	0.239	1.752	50.19

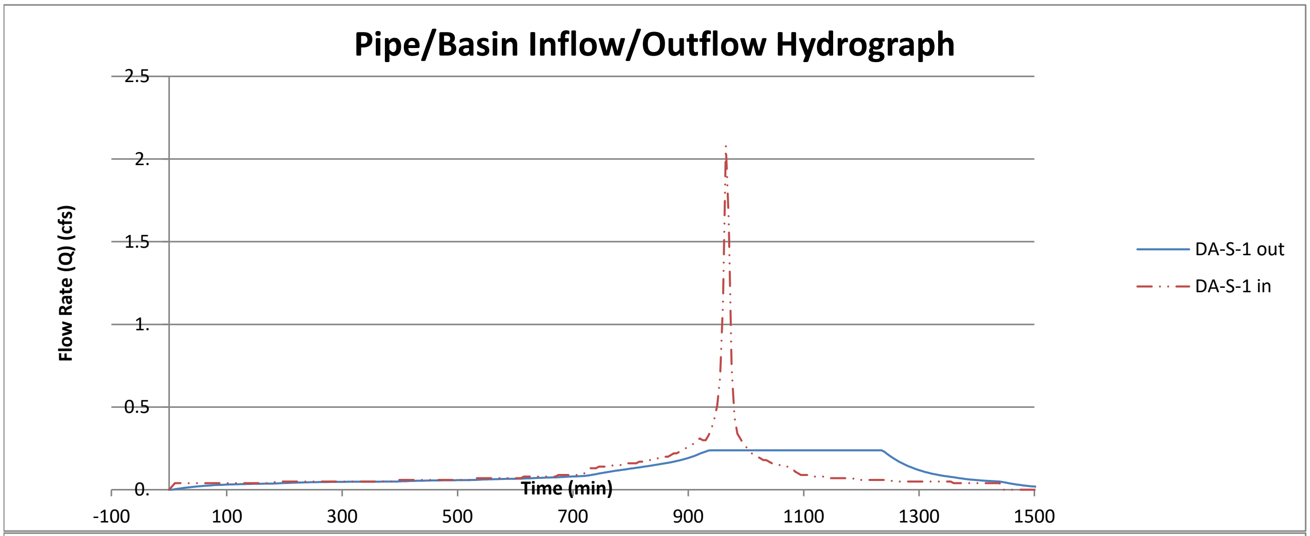
Overflow Pipe Orifice Calculations			
head			Q
elev	(in)	(ft)	cfs
1,497.25	0.00	0.00	0
1,497.42	2.00	0.17	0.873647102
1,497.58	2.00	0.33	1.235523581
1,497.92	2.00	0.50	1.513201169

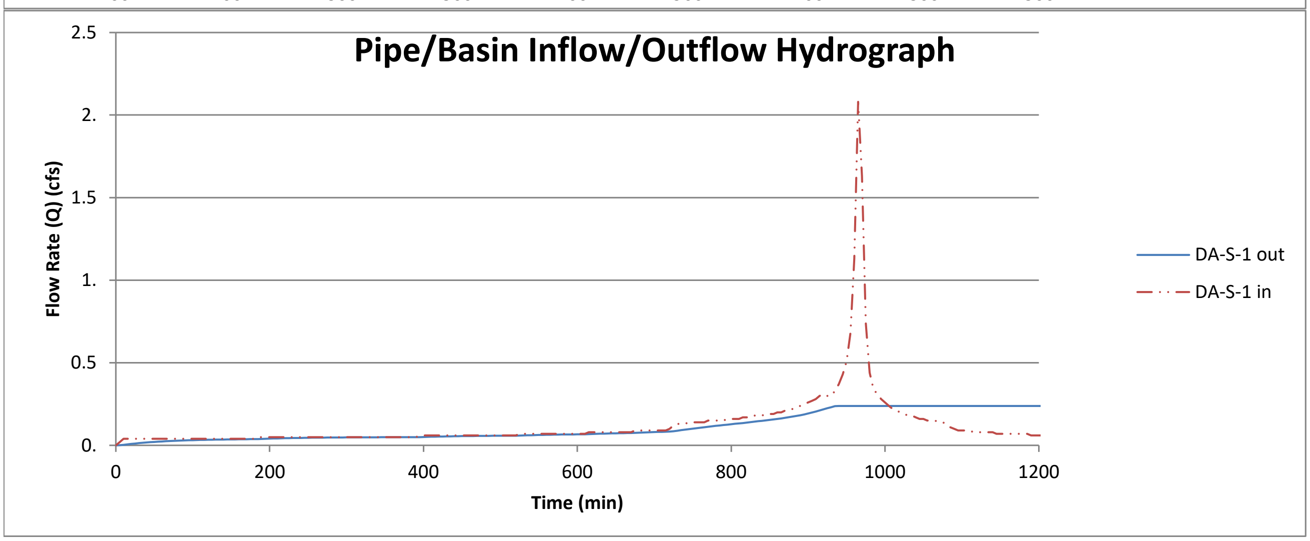
number	1	
INVERT	1497.25	
diameter/height	0.6666667	=H
	0.6666667	=L
perimeter	2.6666667	ft
area	0.4444444	sf

Orifice Flow Calculations

Orifice Flow Equation: $Q = 0.6A\sqrt{2gh}$

- **Q** = Capacity in CFS
- **A** = Free open area of grate in sq. ft.
- **g** = 32.2 (feet per sec/sec)
- **h** = Head in feet


Pipe/Basin Inflow/Outflow Hydrograph
Flow Rate (Q) (cfs)
Time (min)
DA-S-1 out
DA-S-1 in
2.5
2.
1.5
1.
0.5
0.
-100
100
300
500
700
900
1100
1300
1500


Pipe/Basin Inflow/Outflow Hydrograph
Flow Rate (Q) (cfs)
Time (min)
DA-S-1 out
DA-S-1 in
2.5
2.
1.5
1.
0.5
0.
0
200
400
600
800
1000
1200

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
0	0.01	0.	0.	0.	0.	0.	0.
5	0.03	0.04	0.04	0.04	0.	0.	0.
10	0.05	0.08	0.11	0.12	0.	0.	0.
15	0.05	0.1	0.19	0.21	0.01	0.	0.01
20	0.05	0.1	0.27	0.29	0.01	0.	0.01
25	0.05	0.1	0.34	0.37	0.01	0.	0.01
30	0.05	0.1	0.41	0.44	0.02	0.	0.02
35	0.05	0.1	0.47	0.51	0.02	0.	0.02
40	0.05	0.1	0.52	0.57	0.02	0.	0.02
45	0.05	0.1	0.57	0.62	0.02	0.	0.02
50	0.05	0.1	0.62	0.67	0.03	0.	0.03
55	0.05	0.1	0.67	0.72	0.03	0.	0.03
60	0.05	0.1	0.71	0.77	0.03	0.	0.03
65	0.05	0.1	0.74	0.81	0.03	0.	0.03
70	0.05	0.1	0.78	0.84	0.03	0.	0.03
75	0.05	0.1	0.81	0.88	0.03	0.	0.03
80	0.05	0.1	0.84	0.91	0.04	0.	0.04
85	0.05	0.1	0.87	0.94	0.04	0.	0.04
90	0.05	0.1	0.89	0.97	0.04	0.	0.04
95	0.05	0.1	0.91	0.99	0.04	0.	0.04
100	0.05	0.1	0.93	1.01	0.04	0.	0.04
105	0.06	0.11	0.96	1.04	0.04	0.	0.04
110	0.06	0.12	1.	1.08	0.04	0.	0.04
115	0.06	0.12	1.03	1.12	0.04	0.	0.04
120	0.06	0.12	1.06	1.15	0.04	0.	0.04
125	0.06	0.12	1.09	1.18	0.05	0.	0.05
130	0.06	0.12	1.12	1.21	0.05	0.	0.05
135	0.06	0.12	1.14	1.24	0.05	0.	0.05
140	0.06	0.12	1.16	1.26	0.05	0.	0.05
145	0.06	0.12	1.18	1.28	0.05	0.	0.05
150	0.06	0.12	1.2	1.3	0.05	0.	0.05
155	0.06	0.12	1.22	1.32	0.05	0.	0.05
160	0.06	0.12	1.23	1.34	0.05	0.	0.05
165	0.06	0.12	1.25	1.35	0.05	0.	0.05
170	0.06	0.12	1.26	1.37	0.05	0.	0.05
175	0.06	0.12	1.28	1.38	0.05	0.	0.05
180	0.06	0.12	1.29	1.4	0.05	0.	0.05
185	0.06	0.12	1.3	1.41	0.05	0.	0.05
190	0.06	0.12	1.31	1.42	0.06	0.	0.06
195	0.06	0.12	1.32	1.43	0.06	0.	0.06
200	0.06	0.12	1.32	1.44	0.06	0.	0.06
205	0.06	0.12	1.33	1.44	0.06	0.	0.06
210	0.06	0.12	1.34	1.45	0.06	0.	0.06
215	0.06	0.12	1.35	1.46	0.06	0.	0.06
220	0.06	0.12	1.35	1.47	0.06	0.	0.06

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
225	0.06	0.12	1.36	1.47	0.06	0.	0.06
230	0.06	0.12	1.36	1.48	0.06	0.	0.06
235	0.06	0.12	1.37	1.48	0.06	0.	0.06
240	0.06	0.12	1.37	1.49	0.06	0.	0.06
245	0.06	0.12	1.38	1.49	0.06	0.	0.06
250	0.06	0.12	1.38	1.5	0.06	0.	0.06
255	0.06	0.12	1.38	1.5	0.06	0.	0.06
260	0.06	0.12	1.39	1.5	0.06	0.	0.06
265	0.06	0.12	1.39	1.51	0.06	0.	0.06
270	0.06	0.12	1.39	1.51	0.06	0.	0.06
275	0.06	0.12	1.39	1.51	0.06	0.	0.06
280	0.06	0.12	1.4	1.51	0.06	0.	0.06
285	0.06	0.12	1.4	1.52	0.06	0.	0.06
290	0.06	0.12	1.4	1.52	0.06	0.	0.06
295	0.06	0.12	1.4	1.52	0.06	0.	0.06
300	0.06	0.12	1.4	1.52	0.06	0.	0.06
305	0.07	0.13	1.41	1.53	0.06	0.	0.06
310	0.07	0.14	1.43	1.55	0.06	0.	0.06
315	0.07	0.14	1.45	1.57	0.06	0.	0.06
320	0.07	0.14	1.47	1.59	0.06	0.	0.06
325	0.07	0.14	1.48	1.61	0.06	0.	0.06
330	0.07	0.14	1.5	1.62	0.06	0.	0.06
335	0.07	0.14	1.51	1.64	0.06	0.	0.06
340	0.07	0.14	1.52	1.65	0.06	0.	0.06
345	0.07	0.14	1.53	1.66	0.06	0.	0.06
350	0.07	0.14	1.54	1.67	0.06	0.	0.06
355	0.07	0.14	1.55	1.68	0.07	0.	0.07
360	0.07	0.14	1.56	1.69	0.07	0.	0.07
365	0.07	0.14	1.57	1.7	0.07	0.	0.07
370	0.07	0.14	1.57	1.71	0.07	0.	0.07
375	0.07	0.14	1.58	1.71	0.07	0.	0.07
380	0.07	0.14	1.59	1.72	0.07	0.	0.07
385	0.07	0.14	1.59	1.73	0.07	0.	0.07
390	0.07	0.14	1.6	1.73	0.07	0.	0.07
395	0.07	0.14	1.6	1.74	0.07	0.	0.07
400	0.07	0.14	1.61	1.74	0.07	0.	0.07
405	0.07	0.14	1.61	1.75	0.07	0.	0.07
410	0.07	0.14	1.62	1.75	0.07	0.	0.07
415	0.07	0.14	1.62	1.76	0.07	0.	0.07
420	0.07	0.14	1.62	1.76	0.07	0.	0.07
425	0.07	0.14	1.63	1.76	0.07	0.	0.07
430	0.07	0.14	1.63	1.77	0.07	0.	0.07
435	0.08	0.15	1.64	1.78	0.07	0.	0.07
440	0.08	0.16	1.66	1.8	0.07	0.	0.07
445	0.08	0.16	1.68	1.82	0.07	0.	0.07

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
450	0.08	0.16	1.7	1.84	0.07	0.	0.07
455	0.08	0.16	1.71	1.86	0.07	0.	0.07
460	0.08	0.16	1.73	1.87	0.07	0.	0.07
465	0.08	0.16	1.74	1.89	0.07	0.	0.07
470	0.08	0.16	1.75	1.9	0.07	0.	0.07
475	0.08	0.16	1.76	1.91	0.07	0.	0.07
480	0.08	0.16	1.77	1.92	0.07	0.	0.07
485	0.08	0.16	1.78	1.93	0.08	0.	0.08
490	0.08	0.16	1.79	1.94	0.08	0.	0.08
495	0.08	0.16	1.8	1.95	0.08	0.	0.08
500	0.08	0.16	1.81	1.96	0.08	0.	0.08
505	0.08	0.16	1.81	1.97	0.08	0.	0.08
510	0.08	0.16	1.82	1.97	0.08	0.	0.08
515	0.08	0.16	1.83	1.98	0.08	0.	0.08
520	0.08	0.16	1.83	1.99	0.08	0.	0.08
525	0.08	0.16	1.84	1.99	0.08	0.	0.08
530	0.09	0.17	1.85	2.01	0.08	0.	0.08
535	0.09	0.18	1.87	2.03	0.08	0.	0.08
540	0.09	0.18	1.89	2.05	0.08	0.	0.08
545	0.09	0.18	1.91	2.07	0.08	0.	0.08
550	0.09	0.18	1.93	2.09	0.08	0.	0.08
555	0.09	0.18	1.95	2.11	0.08	0.	0.08
560	0.09	0.18	1.96	2.13	0.08	0.	0.08
565	0.09	0.18	1.97	2.14	0.08	0.	0.08
570	0.09	0.18	1.99	2.15	0.08	0.	0.08
575	0.09	0.18	2.	2.17	0.08	0.	0.08
580	0.09	0.18	2.01	2.18	0.08	0.	0.08
585	0.09	0.18	2.02	2.19	0.09	0.	0.09
590	0.09	0.18	2.03	2.2	0.09	0.	0.09
595	0.09	0.18	2.04	2.21	0.09	0.	0.09
600	0.1	0.19	2.05	2.23	0.09	0.	0.09
605	0.1	0.2	2.08	2.25	0.09	0.	0.09
610	0.1	0.2	2.1	2.28	0.09	0.	0.09
615	0.1	0.2	2.12	2.3	0.09	0.	0.09
620	0.1	0.2	2.14	2.32	0.09	0.	0.09
625	0.1	0.2	2.16	2.34	0.09	0.	0.09
630	0.1	0.2	2.18	2.36	0.09	0.	0.09
635	0.1	0.2	2.19	2.38	0.09	0.	0.09
640	0.1	0.2	2.21	2.39	0.09	0.	0.09
645	0.1	0.2	2.22	2.41	0.09	0.	0.09
650	0.1	0.2	2.23	2.42	0.09	0.	0.09
655	0.11	0.21	2.25	2.44	0.09	0.	0.09
660	0.11	0.22	2.28	2.47	0.1	0.	0.1
665	0.11	0.22	2.3	2.5	0.1	0.	0.1
670	0.11	0.22	2.33	2.52	0.1	0.	0.1

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
675	0.11	0.22	2.35	2.55	0.1	0.	0.1
680	0.11	0.22	2.37	2.57	0.1	0.	0.1
685	0.11	0.22	2.39	2.59	0.1	0.	0.1
690	0.11	0.22	2.41	2.61	0.1	0.	0.1
695	0.12	0.23	2.43	2.64	0.1	0.	0.1
700	0.12	0.24	2.46	2.67	0.1	0.	0.1
705	0.12	0.24	2.49	2.7	0.11	0.	0.11
710	0.12	0.24	2.52	2.73	0.11	0.	0.11
715	0.12	0.24	2.55	2.76	0.11	0.	0.11
720	0.13	0.25	2.58	2.8	0.11	0.	0.11
725	0.14	0.27	2.63	2.85	0.11	0.	0.11
730	0.15	0.29	2.69	2.92	0.11	0.	0.11
735	0.15	0.3	2.76	2.99	0.12	0.	0.12
740	0.16	0.31	2.83	3.07	0.12	0.	0.12
745	0.16	0.32	2.9	3.15	0.12	0.	0.12
750	0.16	0.32	2.97	3.22	0.13	0.	0.13
755	0.16	0.32	3.04	3.29	0.13	0.	0.13
760	0.16	0.32	3.1	3.36	0.13	0.	0.13
765	0.17	0.33	3.16	3.43	0.13	0.	0.13
770	0.17	0.34	3.23	3.5	0.14	0.	0.14
775	0.17	0.34	3.29	3.57	0.14	0.	0.14
780	0.17	0.34	3.35	3.63	0.14	0.	0.14
785	0.18	0.35	3.41	3.7	0.14	0.	0.14
790	0.18	0.36	3.48	3.77	0.15	0.	0.15
795	0.18	0.36	3.54	3.84	0.15	0.	0.15
800	0.19	0.37	3.6	3.91	0.15	0.	0.15
805	0.19	0.38	3.68	3.98	0.15	0.	0.15
810	0.19	0.38	3.74	4.06	0.16	0.	0.16
815	0.2	0.39	3.81	4.13	0.16	0.	0.16
820	0.2	0.4	3.88	4.21	0.16	0.	0.16
825	0.2	0.4	3.95	4.28	0.17	0.	0.17
830	0.21	0.41	4.02	4.36	0.17	0.	0.17
835	0.21	0.42	4.09	4.44	0.17	0.	0.17
840	0.22	0.43	4.17	4.52	0.18	0.	0.18
845	0.22	0.44	4.25	4.61	0.18	0.	0.18
850	0.23	0.45	4.34	4.7	0.18	0.	0.18
855	0.24	0.47	4.43	4.81	0.19	0.	0.19
860	0.24	0.48	4.54	4.91	0.19	0.	0.19
865	0.25	0.49	4.65	5.03	0.19	0.	0.19
870	0.26	0.51	4.78	5.16	0.19	0.	0.19
875	0.27	0.53	4.93	5.31	0.19	0.	0.19
880	0.27	0.54	5.1	5.47	0.19	0.	0.19
885	0.29	0.56	5.28	5.66	0.19	0.	0.19
890	0.3	0.59	5.49	5.87	0.19	0.	0.19
895	0.31	0.61	5.72	6.1	0.19	0.	0.19

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
900	0.32	0.63	5.98	6.35	0.19	0.	0.19
905	0.34	0.66	6.26	6.64	0.19	0.	0.19
910	0.36	0.7	6.58	6.96	0.19	0.	0.19
915	0.38	0.74	6.95	7.32	0.19	0.	0.19
920	0.4	0.78	7.35	7.73	0.19	0.	0.19
925	0.41	0.81	7.78	8.16	0.19	0.	0.19
930	0.43	0.84	8.24	8.62	0.19	0.	0.19
935	0.48	0.91	8.78	9.15	0.19	0.	0.19
940	0.53	1.01	9.41	9.79	0.19	0.	0.19
945	0.62	1.15	10.18	10.56	0.19	0.	0.19
950	0.74	1.36	11.16	11.54	0.19	0.	0.19
955	0.99	1.73	12.52	12.89	0.19	0.	0.19
960	1.69	2.68	14.82	15.2	0.19	0.	0.19
965	3.07	4.76	19.2	19.58	0.19	0.	0.19
970	1.89	4.96	23.78	24.16	0.19	0.	0.19
975	0.82	2.71	26.12	26.49	0.19	0.	0.19
980	0.55	1.37	27.11	27.49	0.19	0.	0.19
985	0.44	0.99	27.72	28.1	0.19	0.	0.19
990	0.39	0.83	28.17	28.55	0.19	0.	0.19
995	0.35	0.74	28.54	28.91	0.19	0.	0.19
1000	0.31	0.66	28.82	29.2	0.19	0.	0.19
1005	0.29	0.6	29.04	29.42	0.19	0.	0.19
1010	0.27	0.56	29.22	29.6	0.19	0.	0.19
1015	0.25	0.52	29.37	29.74	0.19	0.	0.19
1020	0.24	0.49	29.48	29.86	0.19	0.	0.19
1025	0.23	0.47	29.57	29.95	0.19	0.	0.19
1030	0.21	0.44	29.63	30.01	0.19	0.	0.19
1035	0.21	0.42	29.68	30.05	0.19	0.	0.19
1040	0.2	0.41	29.71	30.09	0.19	0.	0.19
1045	0.19	0.39	29.72	30.1	0.19	0.	0.19
1050	0.18	0.37	29.71	30.09	0.19	0.	0.19
1055	0.18	0.36	29.7	30.07	0.19	0.	0.19
1060	0.17	0.35	29.67	30.05	0.19	0.	0.19
1065	0.17	0.34	29.63	30.01	0.19	0.	0.19
1070	0.16	0.33	29.58	29.96	0.19	0.	0.19
1075	0.16	0.32	29.53	29.9	0.19	0.	0.19
1080	0.15	0.31	29.46	29.84	0.19	0.	0.19
1085	0.13	0.28	29.36	29.74	0.19	0.	0.19
1090	0.12	0.25	29.23	29.61	0.19	0.	0.19
1095	0.12	0.24	29.1	29.47	0.19	0.	0.19
1100	0.12	0.24	28.96	29.34	0.19	0.	0.19
1105	0.11	0.23	28.81	29.19	0.19	0.	0.19
1110	0.11	0.22	28.65	29.03	0.19	0.	0.19
1115	0.11	0.22	28.5	28.87	0.19	0.	0.19
1120	0.11	0.22	28.34	28.72	0.19	0.	0.19

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1125	0.1	0.21	28.17	28.55	0.19	0.	0.19
1130	0.1	0.2	27.99	28.37	0.19	0.	0.19
1135	0.1	0.2	27.82	28.19	0.19	0.	0.19
1140	0.1	0.2	27.64	28.02	0.19	0.	0.19
1145	0.1	0.2	27.46	27.84	0.19	0.	0.19
1150	0.09	0.19	27.27	27.65	0.19	0.	0.19
1155	0.09	0.18	27.08	27.45	0.19	0.	0.19
1160	0.09	0.18	26.88	27.26	0.19	0.	0.19
1165	0.09	0.18	26.68	27.06	0.19	0.	0.19
1170	0.09	0.18	26.48	26.86	0.19	0.	0.19
1175	0.09	0.18	26.29	26.66	0.19	0.	0.19
1180	0.09	0.18	26.09	26.47	0.19	0.	0.19
1185	0.08	0.17	25.88	26.26	0.19	0.	0.19
1190	0.08	0.16	25.66	26.04	0.19	0.	0.19
1195	0.08	0.16	25.45	25.82	0.19	0.	0.19
1200	0.08	0.16	25.23	25.61	0.19	0.	0.19
1205	0.08	0.16	25.01	25.39	0.19	0.	0.19
1210	0.08	0.16	24.79	25.17	0.19	0.	0.19
1215	0.08	0.16	24.58	24.95	0.19	0.	0.19
1220	0.08	0.16	24.36	24.74	0.19	0.	0.19
1225	0.08	0.16	24.14	24.52	0.19	0.	0.19
1230	0.08	0.16	23.92	24.3	0.19	0.	0.19
1235	0.07	0.15	23.7	24.07	0.19	0.	0.19
1240	0.07	0.14	23.46	23.84	0.19	0.	0.19
1245	0.07	0.14	23.22	23.6	0.19	0.	0.19
1250	0.07	0.14	22.98	23.36	0.19	0.	0.19
1255	0.07	0.14	22.75	23.12	0.19	0.	0.19
1260	0.07	0.14	22.51	22.89	0.19	0.	0.19
1265	0.07	0.14	22.27	22.65	0.19	0.	0.19
1270	0.07	0.14	22.04	22.41	0.19	0.	0.19
1275	0.07	0.14	21.8	22.18	0.19	0.	0.19
1280	0.07	0.14	21.56	21.94	0.19	0.	0.19
1285	0.07	0.14	21.32	21.7	0.19	0.	0.19
1290	0.07	0.14	21.09	21.46	0.19	0.	0.19
1295	0.07	0.14	20.85	21.23	0.19	0.	0.19
1300	0.06	0.13	20.6	20.98	0.19	0.	0.19
1305	0.06	0.12	20.34	20.72	0.19	0.	0.19
1310	0.06	0.12	20.09	20.46	0.19	0.	0.19
1315	0.06	0.12	19.83	20.21	0.19	0.	0.19
1320	0.06	0.12	19.57	19.95	0.19	0.	0.19
1325	0.06	0.12	19.31	19.69	0.19	0.	0.19
1330	0.06	0.12	19.06	19.43	0.19	0.	0.19
1335	0.06	0.12	18.8	19.18	0.19	0.	0.19
1340	0.06	0.12	18.54	18.92	0.19	0.	0.19
1345	0.06	0.12	18.28	18.66	0.19	0.	0.19

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1350	0.06	0.12	18.03	18.4	0.19	0.	0.19
1355	0.06	0.12	17.77	18.15	0.19	0.	0.19
1360	0.06	0.12	17.51	17.89	0.19	0.	0.19
1365	0.06	0.12	17.25	17.63	0.19	0.	0.19
1370	0.06	0.12	17.	17.37	0.19	0.	0.19
1375	0.06	0.12	16.74	17.12	0.19	0.	0.19
1380	0.06	0.12	16.48	16.86	0.19	0.	0.19
1385	0.06	0.12	16.22	16.6	0.19	0.	0.19
1390	0.06	0.12	15.97	16.34	0.19	0.	0.19
1395	0.06	0.12	15.71	16.09	0.19	0.	0.19
1400	0.05	0.11	15.44	15.82	0.19	0.	0.19
1405	0.05	0.1	15.16	15.54	0.19	0.	0.19
1410	0.05	0.1	14.89	15.26	0.19	0.	0.19
1415	0.05	0.1	14.61	14.99	0.19	0.	0.19
1420	0.05	0.1	14.33	14.71	0.19	0.	0.19
1425	0.05	0.1	14.05	14.43	0.19	0.	0.19
1430	0.05	0.1	13.78	14.15	0.19	0.	0.19
1435	0.05	0.1	13.5	13.88	0.19	0.	0.19
1440	0.05	0.1	13.22	13.6	0.19	0.	0.19
1445	0.	0.05	12.89	13.27	0.19	0.	0.19
1450	0.	0.	12.52	12.89	0.19	0.	0.19
1455	0.	0.	12.14	12.52	0.19	0.	0.19
1460	0.	0.	11.76	12.14	0.19	0.	0.19
1465	0.	0.	11.38	11.76	0.19	0.	0.19
1470	0.	0.	11.01	11.38	0.19	0.	0.19
1475	0.	0.	10.63	11.01	0.19	0.	0.19
1480	0.	0.	10.25	10.63	0.19	0.	0.19
1485	0.	0.	9.88	10.25	0.19	0.	0.19
1490	0.	0.	9.5	9.88	0.19	0.	0.19
1495	0.	0.	9.12	9.5	0.19	0.	0.19
1500	0.	0.	8.74	9.12	0.19	0.	0.19
1505	0.	0.	8.37	8.74	0.19	0.	0.19
1510	0.	0.	7.99	8.37	0.19	0.	0.19
1515	0.	0.	7.61	7.99	0.19	0.	0.19
1520	0.	0.	7.23	7.61	0.19	0.	0.19
1525	0.	0.	6.86	7.23	0.19	0.	0.19
1530	0.	0.	6.48	6.86	0.19	0.	0.19
1535	0.	0.	6.1	6.48	0.19	0.	0.19
1540	0.	0.	5.72	6.1	0.19	0.	0.19
1545	0.	0.	5.35	5.72	0.19	0.	0.19
1550	0.	0.	4.97	5.35	0.19	0.	0.19
1555	0.	0.	4.59	4.97	0.19	0.	0.19
1560	0.	0.	4.23	4.59	0.18	0.	0.18
1565	0.	0.	3.91	4.23	0.16	0.	0.16
1570	0.	0.	3.6	3.91	0.15	0.	0.15

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1575	0.	0.	3.32	3.6	0.14	0.	0.14
1580	0.	0.	3.06	3.32	0.13	0.	0.13
1585	0.	0.	2.83	3.06	0.12	0.	0.12
1590	0.	0.	2.61	2.83	0.11	0.	0.11
1595	0.	0.	2.4	2.61	0.1	0.	0.1
1600	0.	0.	2.22	2.4	0.09	0.	0.09
1605	0.	0.	2.04	2.22	0.09	0.	0.09
1610	0.	0.	1.88	2.04	0.08	0.	0.08
1615	0.	0.	1.74	1.88	0.07	0.	0.07
1620	0.	0.	1.6	1.74	0.07	0.	0.07
1625	0.	0.	1.48	1.6	0.06	0.	0.06
1630	0.	0.	1.36	1.48	0.06	0.	0.06
1635	0.	0.	1.26	1.36	0.05	0.	0.05
1640	0.	0.	1.16	1.26	0.05	0.	0.05
1645	0.	0.	1.07	1.16	0.05	0.	0.05
1650	0.	0.	0.99	1.07	0.04	0.	0.04
1655	0.	0.	0.91	0.99	0.04	0.	0.04
1660	0.	0.	0.84	0.91	0.04	0.	0.04
1665	0.	0.	0.77	0.84	0.03	0.	0.03
1670	0.	0.	0.71	0.77	0.03	0.	0.03
1675	0.	0.	0.66	0.71	0.03	0.	0.03
1680	0.	0.	0.61	0.66	0.03	0.	0.03
1685	0.	0.	0.56	0.61	0.02	0.	0.02
1690	0.	0.	0.52	0.56	0.02	0.	0.02
1695	0.	0.	0.48	0.52	0.02	0.	0.02
1700	0.	0.	0.44	0.48	0.02	0.	0.02
1705	0.	0.	0.4	0.44	0.02	0.	0.02
1710	0.	0.	0.37	0.4	0.02	0.	0.02
1715	0.	0.	0.34	0.37	0.01	0.	0.01
1720	0.	0.	0.32	0.34	0.01	0.	0.01
1725	0.	0.	0.29	0.32	0.01	0.	0.01
1730	0.	0.	0.27	0.29	0.01	0.	0.01
1735	0.	0.	0.25	0.27	0.01	0.	0.01
1740	0.	0.	0.23	0.25	0.01	0.	0.01
1745	0.	0.	0.21	0.23	0.01	0.	0.01
1750	0.	0.	0.2	0.21	0.01	0.	0.01
1755	0.	0.	0.18	0.2	0.01	0.	0.01
1760	0.	0.	0.17	0.18	0.01	0.	0.01
1765	0.	0.	0.15	0.17	0.01	0.	0.01
1770	0.	0.	0.14	0.15	0.01	0.	0.01
1775	0.	0.	0.13	0.14	0.01	0.	0.01
1780	0.	0.	0.12	0.13	0.01	0.	0.01
1785	0.	0.	0.11	0.12	0.	0.	0.
1790	0.	0.	0.1	0.11	0.	0.	0.
1795	0.	0.	0.09	0.1	0.	0.	0.

SE 2yr 24hr Pipe/Basin stage-storage routing (10yr, 24hr)

time (min)	inflow (cfs)	Ij+Ij+1	(2Sj/dt)-Qj	(2Sj+1/dt)+Qj+1	outflow (cfs)	orifice (cfs)	total outflow (cfs)
1800	0.	0.	0.09	0.09	0.	0.	0.
1805	0.	0.	0.08	0.09	0.	0.	0.
1810	0.	0.	0.07	0.08	0.	0.	0.
1815	0.	0.	0.07	0.07	0.	0.	0.
1820	0.	0.	0.06	0.07	0.	0.	0.
1825	0.	0.	0.06	0.06	0.	0.	0.
1830	0.	0.	0.05	0.06	0.	0.	0.
1835	0.	0.	0.05	0.05	0.	0.	0.
1840	0.	0.	0.05	0.05	0.	0.	0.
1845	0.	0.	0.04	0.05	0.	0.	0.
1850	0.	0.	0.04	0.04	0.	0.	0.
1855	0.	0.	0.04	0.04	0.	0.	0.
1860	0.	0.	0.03	0.04	0.	0.	0.
1865	0.	0.	0.03	0.03	0.	0.	0.
1870	0.	0.	0.03	0.03	0.	0.	0.
1875	0.	0.	0.03	0.03	0.	0.	0.
1880	0.	0.	0.02	0.03	0.	0.	0.
1885	0.	0.	0.02	0.02	0.	0.	0.
1890	0.	0.	0.02	0.02	0.	0.	0.
1895	0.	0.	0.02	0.02	0.	0.	0.
1900	0.	0.	0.02	0.02	0.	0.	0.
1905	0.	0.	0.02	0.02	0.	0.	0.
1910	0.	0.	0.01	0.02	0.	0.	0.
1915	0.	0.	0.01	0.01	0.	0.	0.
1920	0.	0.	0.01	0.01	0.	0.	0.
1925	0.	0.	0.01	0.01	0.	0.	0.
1930	0.	0.	0.01	0.01	0.	0.	0.
1935	0.	0.	0.01	0.01	0.	0.	0.
1940	0.	0.	0.01	0.01	0.	0.	0.
1945	0.	0.	0.01	0.01	0.	0.	0.
1950	0.	0.	0.01	0.01	0.	0.	0.
1955	0.	0.	0.01	0.01	0.	0.	0.
1960	0.	0.	0.01	0.01	0.	0.	0.
1965	0.	0.	0.01	0.01	0.	0.	0.
1970	0.	0.	0.01	0.01	0.	0.	0.
1975	0.	0.	0.01	0.01	0.	0.	0.
1980	0.	0.	0.	0.01	0.	0.	0.
1985	0.	0.	0.	0.	0.	0.	0.

PULS Summary Table SE		
Max Inflow (2yr, 24hr)	3.0700	cfs
Max Infiltration	0.1887	cfs
Max Outflow (design)	0.1887	cfs
Elev (2yr, 24hr)	1490.36	ft
Overflow Discharge	0.0000	cfs
Vbmp	5,765	cf
Elev VBMP	1984.00	ft

MC-4500 Chamber - Storage Table									
2	3	6	7	8	9	10	11	12	13
Water surface elevation			Storage					Outflow	
base	Chamber	Inc.	Cumulative Storage						
elev	sf	cf/ft	cf/ft	cf	Underdrain	orifice	Infiltration	cfs	2S/dt+0
1484	1390.00	0	-	-			0.000	0.000	0.00
1485	1390.00	699.73	699.73	699.7			0.189	0.189	4.85
1486	1390.00	1,111.53	905.63	1,811.3			0.189	0.189	12.26
1487	1390.00	1,064.02	958.43	2,875.3			0.189	0.189	19.36
1488	1390.00	987.14	965.61	3,862.4			0.189	0.189	25.94
1488.67	1390.00	886.19	954.21	4,456.2			0.189	0.189	29.90
1488.75	1390.00	865.88	952.72	4,525.4			0.189	0.189	30.36
1489.25	1390.00	764.42	934.79	4,907.7			0.189	0.189	32.91
1489.75	1390.00	602.74	905.92	5,209.0			0.189	0.189	34.92
1490.25	1390.00	556.00	877.92	5,487.0			0.189	0.189	36.77
1490.75	1390.00	556.00	854.08	5,765.0		0.87	0.189	1.063	39.50
1490.92	1390.00	5.76	973.99	5,766.0		1.24	0.189	1.424	39.86
1491.08	1390.00	6.25	1,135.24	5,767.0		1.51	0.189	1.702	40.15

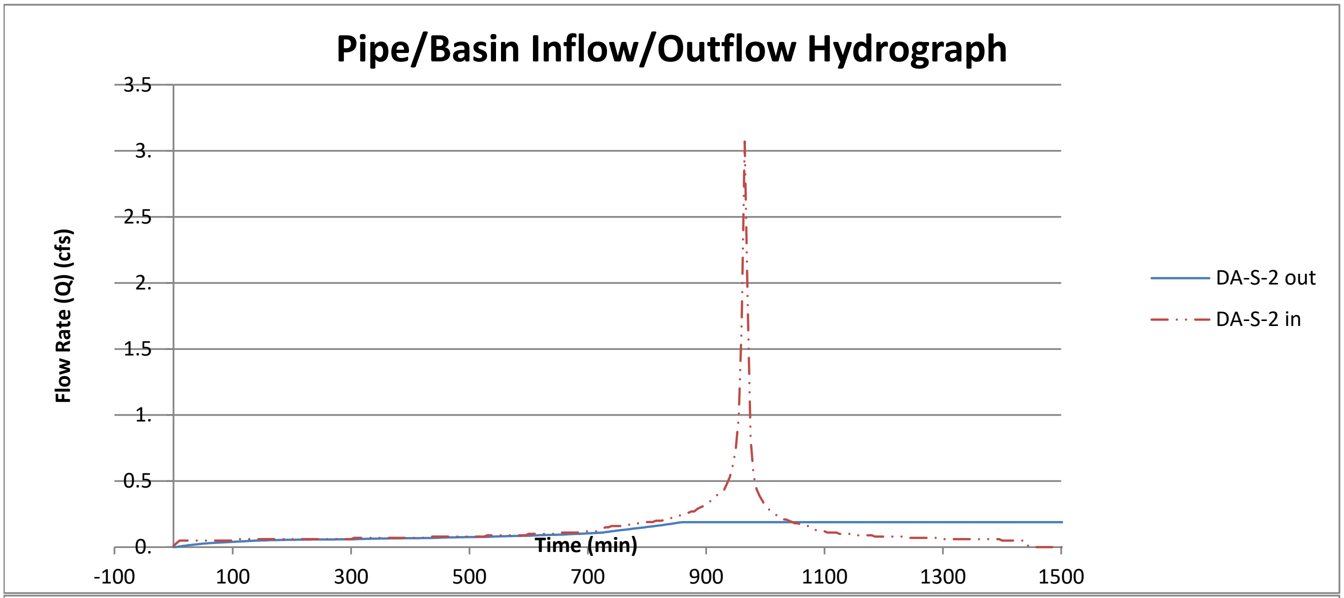
Overflow Pipe Orifice Calculations			
	head		Q
elev	(in)	(ft)	cfs
1,490.75	0.00	0.00	0
1,490.92	2.00	0.17	0.873647102
1,491.08	2.00	0.33	1.235523581
1,491.42	2.00	0.50	1.513201169

number	1	
INVERT	1497.25	
diameter/heig	0.66667	=H
	0.66667	=L
perimeter	2.66667	ft
area	0.44444	sf

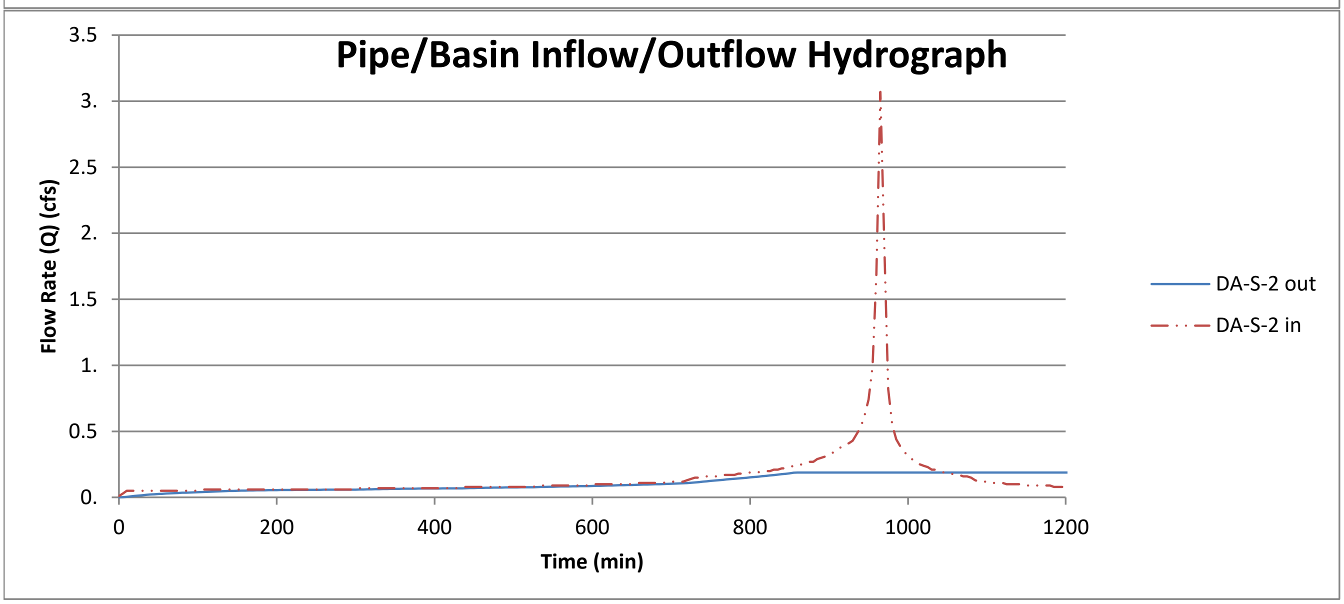
Orifice Flow Calculations

Orifice Flow Equation: $Q = 0.6A\sqrt{2gh}$

- **Q** = Capacity in CFS
- **A** = Free open area of grate in s
- **g** = 32.2 (feet per sec/sec)
- **h** = Head in feet



Pipe/Basin Inflow/Outflow Hydrograph
Flow Rate (Q) (cfs)
Time (min)
DA-S-2 out
DA-S-2 in



Pipe/Basin Inflow/Outflow Hydrograph
Flow Rate (Q) (cfs)
Time (min)
DA-S-2 out
DA-S-2 in

Isolator® Row
O&M Manual

The Isolator® Row

Introduction

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

The Isolator Row

The Isolator Row is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row and passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

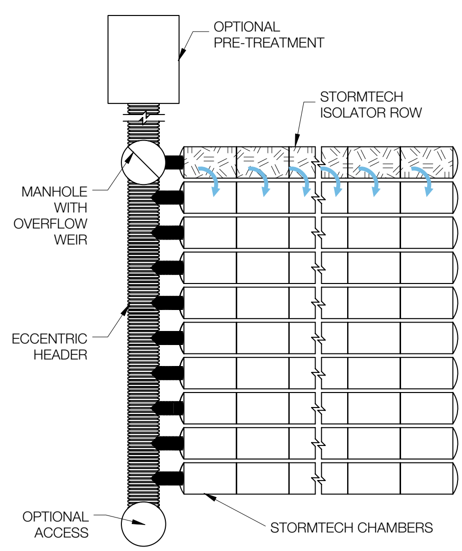
The Isolator Row is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row and includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row bypass through a manifold to the other chambers. This is achieved with an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row. After Stormwater flows through the Isolator Row and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row to minimize maintenance requirements and maintenance costs.

Note: *See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.*

Looking down the Isolator Row from the manhole opening, woven geotextile Fabric is shown between the chamber and stone base.

StormTech Isolator Row with Overflow Spillway (*not to scale*)



Isolator Row Inspection/Maintenance

Inspection

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the **actual frequency of inspection and maintenance practices.**

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

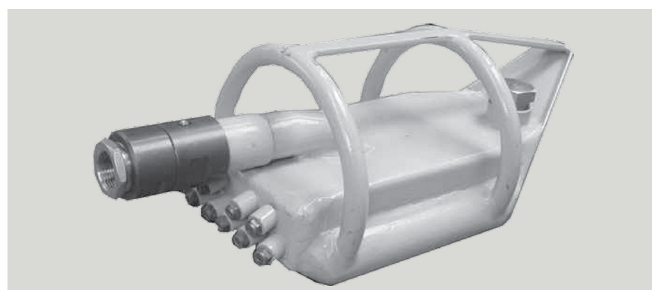
The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

Maintenance

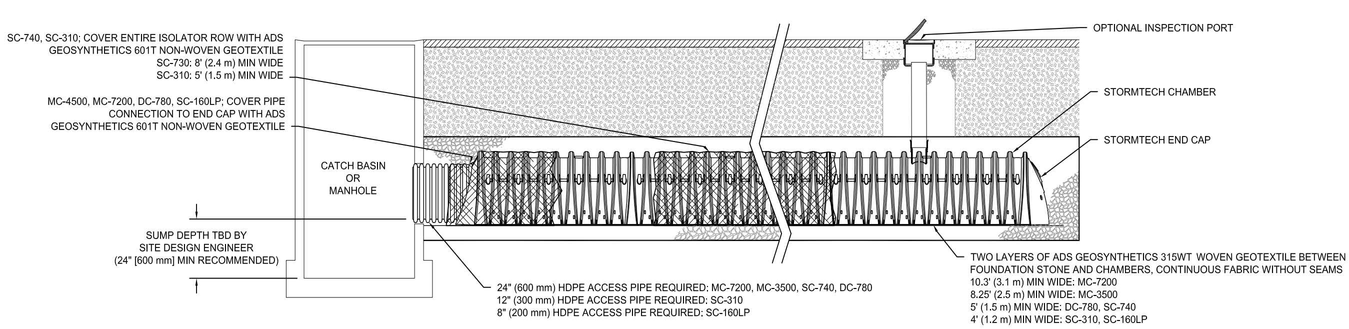
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row lengths up to 200" (61 m). **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**



StormTech Isolator Row (not to scale)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row.*



Isolator Row Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row
   i. Remove cover from manhole at upstream end of Isolator Row
   ii. Using a flashlight, inspect down Isolator Row through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

Step 2

Clean out Isolator Row using the JetVac process.

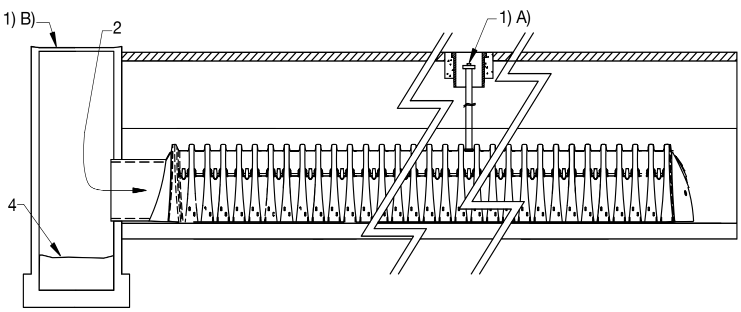
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

Replace all caps, lids and covers, record observations and actions.

Step 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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ADS StormTech® Installation Guide
SC-310/SC-740/DC-780

StormTech
Installation Video

Required Materials and Equipment List

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

Important Notes:

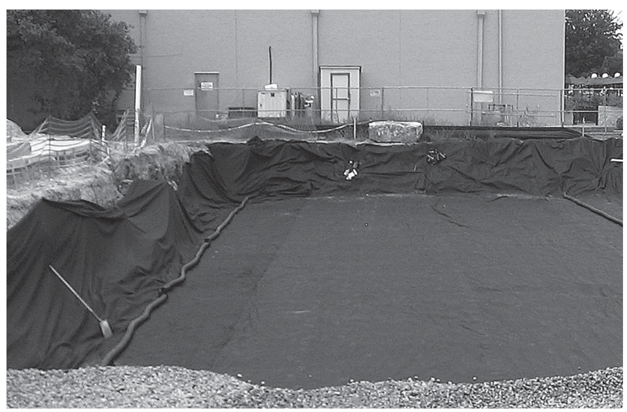
A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

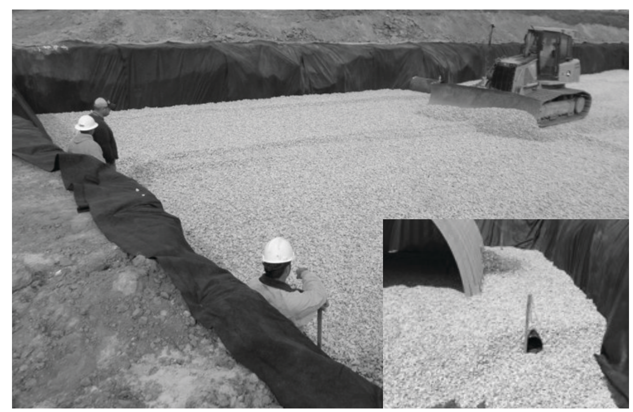
C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

Excavate bed and prepare subgrade per engineer's plans.



Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.



Place clean, crushed, angular stone foundation 6" (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out ADS Plus fabric at inlet rows (min. 12.5 ft (3.8 m)) at each inlet end cap. Place a continuous piece along entire length of Isolator® Plus Row(s).

Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between rows.

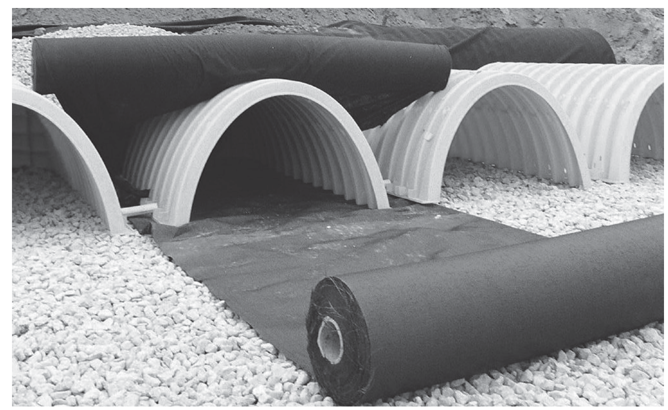
Attaching the End Caps

Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber’s end corrugation.

Prefabricated End Caps

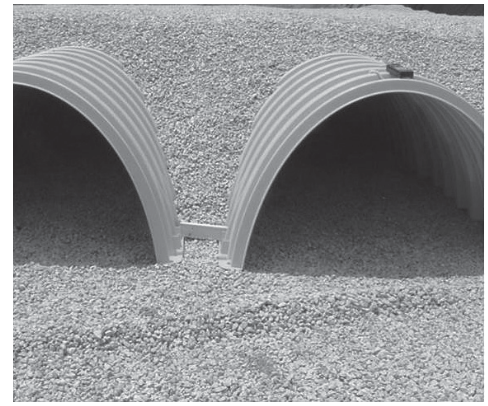
24” (600 mm) inlets are the maximum size that can fit into a SC-740/DC-780 end cap and must be prefabricated with a 24” (600 mm) pipe stub. SC-310 chambers with a 12” (300 mm) inlet pipe must use a prefabricated end cap with a 12” (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

Isolator Row Plus



Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. Drape a strip of ADS non-woven geotextile over the row of chambers (not required over DC-780). This is the same type of non-woven geotextile used as a separation layer around the angular stone of the StormTech system.

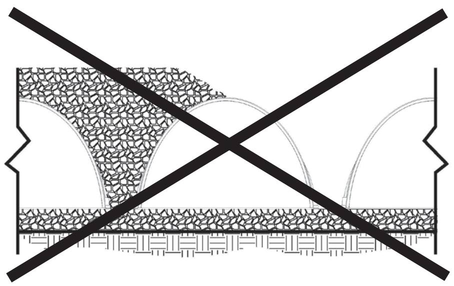
Initial Anchoring of Chambers – Embedment Stone



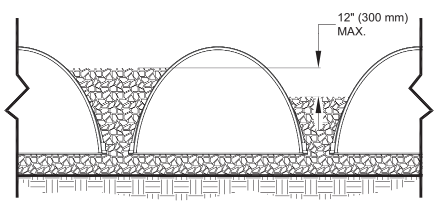
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

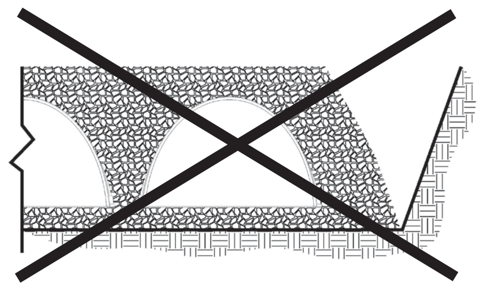
Backfill of Chambers – Embedment Stone



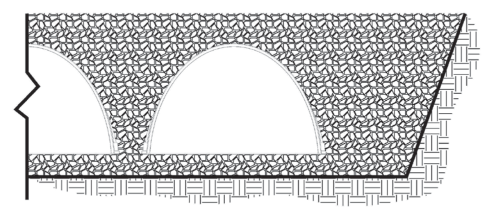
Uneven Backfill



Even Backfill



Perimeter Not Backfilled



Perimeter Fully Backfilled

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

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Backfill - Embedment Stone & Cover Stone

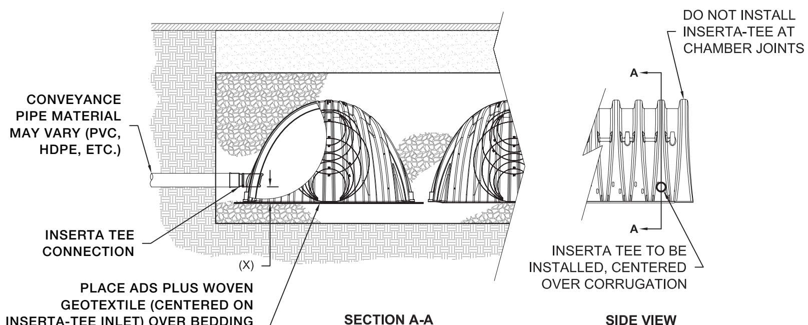
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6" (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) min. where edges meet. Compact each lift of backfill as specified in the site design engineer's drawings. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 36, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON.		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

StormTech Isolator Row Plus Detail

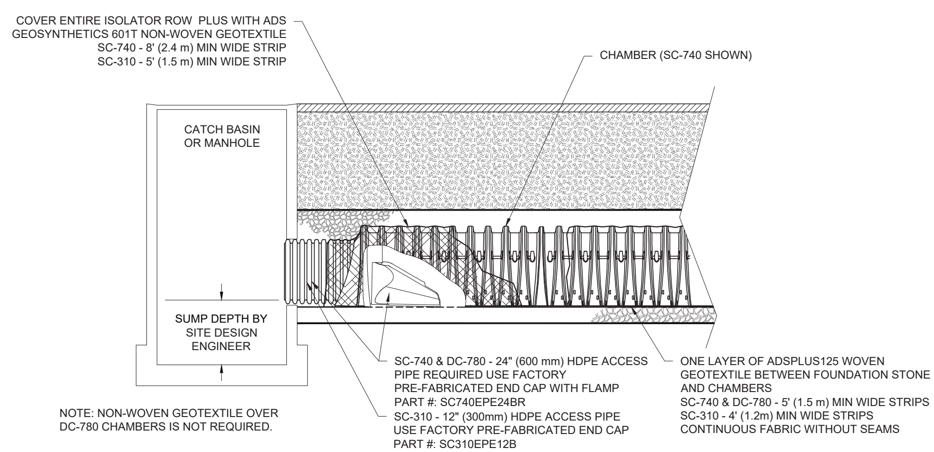


Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
Ⓓ **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
Ⓒ **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
Ⓑ **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
Ⓐ **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[2, 3]

Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 1- Inspection Port Detail

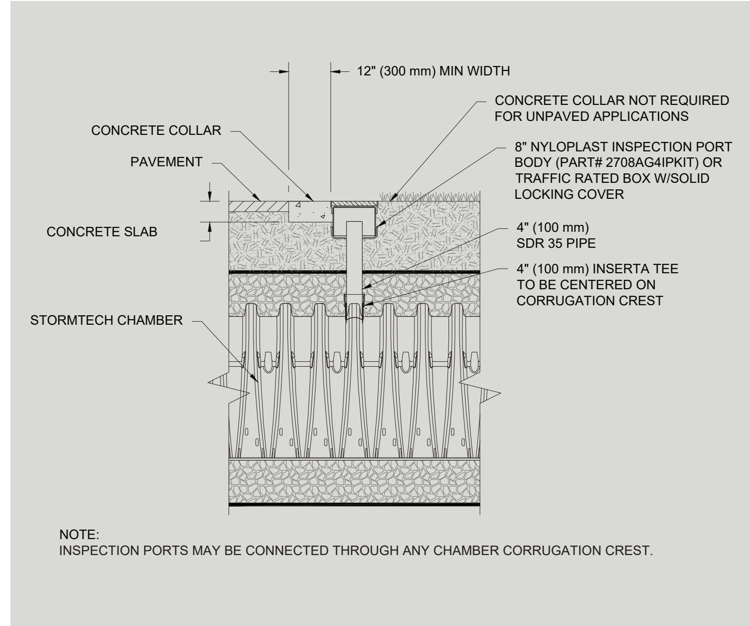
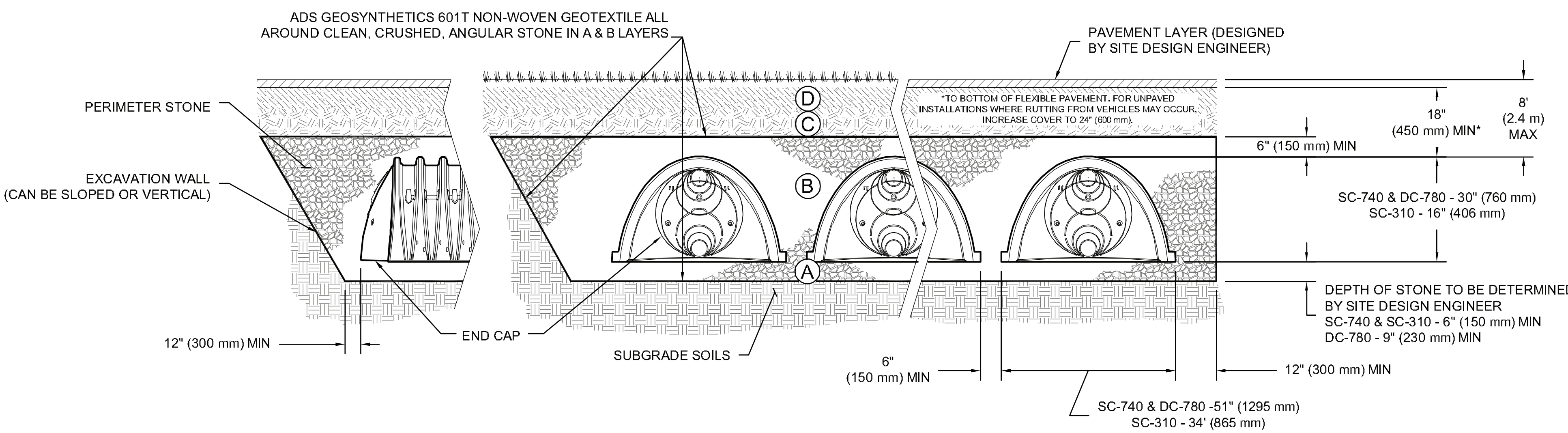


Figure 2 - Fill Material Locations



Notes:

1. 36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
2. During paving operations, dump truck axle loads on 18" (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
6. Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	3880 (186) 2640 (126) 2040 (97) 1690 (81) 1470 (70)	38,000 (169)
Ⓒ Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2690 (128) 1880 (90) 1490 (71) 1280 (61) 1150 (55)	20,000 (89)
	24" (600) Loose/ Dumped	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2390 (114) 1700 (81) 1370 (65) 1190 (57) 1080 (51)	20,000 (89) Roller gross vehicle weight not toexceed 12,000 lbs. (53 kN)
	18" (450)	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2110 (101) 1510 (72) 1250 (59) 1100 (52) 1020 (48)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
Ⓑ Embedment Stone	12" (300)	16,000 (71)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1540 (74) 1190 (57) 1010 (48) 910 (43) 840 (40)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
	6" (150)	8,000 (35)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1070 (51) 900 (43) 800 (38) 760 (36) 720 (34)	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36" (900mm) compacted cover is reached.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ Initial Fill Material	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18" (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6" (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12" (300 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6" (150 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

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Barracuda® Max & Barracuda Maintenance Guide

One of Barracuda's advantages is the ease of maintenance. Like any system that collects pollutants, the Barracuda must be maintained for continued effectiveness. Maintenance is a simple procedure performed using a vacuum truck or similar equipment. The systems were designed to minimize the volume of water removed during routine maintenance, reducing disposal costs.

Contractors can access the pollutants stored in the manhole through the manhole cover. This allows them to gain vacuum hose access to the bottom of the manhole to remove sediment and trash. There is no confined space entry necessary for inspection or maintenance.

The entire maintenance procedure typically takes 2 to 4 hours, depending on the system's size, the captured material, and the vacuum truck's capacity.

Local regulations may apply to the maintenance procedure. Safe and legal disposal of pollutants is the responsibility of the maintenance contractor. Maintenance should be performed only by a qualified contractor.

Inspection and Cleaning Cycle

Periodic inspection is needed to determine the need for and frequency of maintenance. You should begin inspecting as soon as construction is complete and then on an annual basis. Typically, the system needs to be cleaned every 1-3 years.

Excessive oils, fuels or sediments may reduce the maintenance cycle. Periodic inspection is important.

Determining When to Clean

To determine the sediment depth, the maintenance contractor should lower a stadia rod into the manhole until it contacts the top of the captured sediment and mark that spot on the rod. Then push the probe through to the bottom of the sump and mark that spot to determine sediment depth.

Maintenance should occur when the sediment has reached the levels indicated in the Storage Capacity Chart.

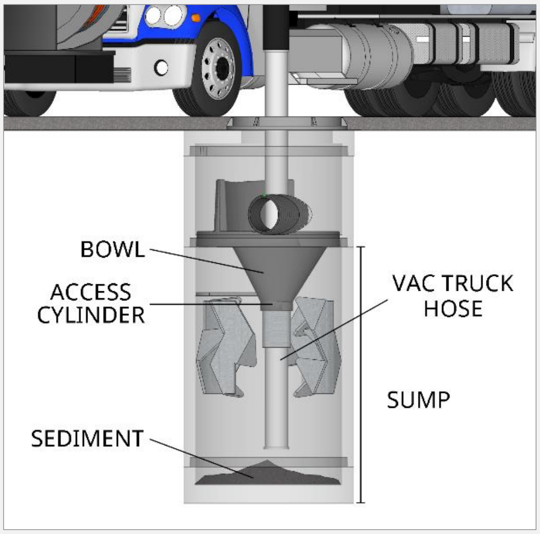
Barracuda Storage Capacities

Model	Manhole Diameter in. (mm)	Total System Volume Gallons (Liters)	Treatment Chamber Capacity Gallons (Liters)	Standard Sediment Capacity (20” depth) Yards^3 (meters^3)	NJDEP Sediment Capacity (50% of standard depth) Yards^3 (meters^3)
S3	36 (900)	264 (999)	212 (803)	0.44 (0.34)	0.22 (0.17)
S4	48 (1200)	665 (2517)	564 (2135)	0.78 (0.60)	0.39 (0.30)
S6	72 (1800)	1497 (5667)	1269 (4804)	1.75 (1.34)	0.88 (0.67)
S8	96 (2400)	4196 (15884)	3835 (14517)	3.10 (2.37)	1.55 (1.19)

Maintenance Instructions

1. Remove the manhole cover to provide access to the pollutant storage. Pollutants are stored in the sump, below the bowl assembly visible from the surface. Access this area through the 8” (200 mm), 10” (250 mm), 15” (375 mm) or 20” (500 mm) diameter access cylinder.
2. Use a vacuum truck or other similar equipment to remove all water, debris, oils and sediment. See figure 1.
3. Use a high pressure hose to clean the manhole of all the remaining sediment and debris. Then, use the vacuum truck to remove the water.
4. Fill the cleaned manhole with water until the level reaches the invert of the outlet pipe.
5. Replace the manhole cover.
6. Dispose of the polluted water, oils, sediment and trash at an approved facility.
   a. Local regulations prohibit the discharge of solid material into the sanitary system. Check with the local sewer authority for authority to discharge the liquid.
   b. Some localities treat the pollutants as leachate. Check with local regulators about disposal requirements.
   c. Additional local regulations may apply to the maintenance procedure.

Figure 1



Waste Handling & Disposal SC-34

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Improper storage and handling of solid wastes can allow toxic compounds, oils and greases, heavy metals, nutrients, suspended solids, and other pollutants to enter stormwater runoff. The discharge of pollutants to stormwater from waste handling and disposal can be prevented and reduced by tracking waste generation, storage, and disposal; reducing waste generation and disposal through source reduction, reuse, and recycling; and preventing run-on and runoff.

Approach

Pollution Prevention

- Accomplish reduction in the amount of waste generated using the following source controls:
  - Production planning and sequencing
  - Process or equipment modification
  - Raw material substitution or elimination
  - Loss prevention and housekeeping
  - Waste segregation and separation
  - Close loop recycling
- Establish a material tracking system to increase awareness about material usage. This may reduce spills and minimize contamination, thus reducing the amount of waste produced.
- Recycle materials whenever possible.

CASQA California Stormwater Quality Association

Suggested Protocols

General

- Cover storage containers with leak proof lids or some other means. If waste is not in containers, cover all waste piles (plastic tarps are acceptable coverage) and prevent stormwater run-on and runoff with a berm. The waste containers or piles must be covered except when in use.

- Use drip pans or absorbent materials whenever grease containers are emptied by vacuum trucks or other means. Grease cannot be left on the ground. Collected grease must be properly disposed of as garbage.

- Check storage containers weekly for leaks and to ensure that lids are on tightly. Replace any that are leaking, corroded, or otherwise deteriorating.

- Sweep and clean the storage area regularly. If it is paved, do not hose down the area to a storm drain.

- Dispose of rinse and wash water from cleaning waste containers into a sanitary sewer if allowed by the local sewer authority. Do not discharge wash water to the street or storm drain.

- Transfer waste from damaged containers into safe containers.

- Take special care when loading or unloading wastes to minimize losses. Loading systems can be used to minimize spills and fugitive emission losses such as dust or mist. Vacuum transfer systems can minimize waste loss.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.

- Provide a sufficient number of litter receptacles for the facility.

- Clean out and cover litter receptacles frequently to prevent spillage.

Waste Collection

- Keep waste collection areas clean.

- Inspect solid waste containers for structural damage regularly. Repair or replace damaged containers as necessary.

- Secure solid waste containers; containers must be closed tightly when not in use.

- Do not fill waste containers with washout water or any other liquid.

- Ensure that only appropriate solid wastes are added to the solid waste container. Certain wastes such as hazardous wastes, appliances, fluorescent lamps, pesticides, etc., may not be disposed of in solid waste containers (see chemical/ hazardous waste collection section below).

- Do not mix wastes; this can cause chemical reactions, make recycling impossible, and complicate disposal.

Good Housekeeping

- Use all of the product before disposing of the container.
- Keep the waste management area clean at all times by sweeping and cleaning up spills immediately.
- Use dry methods when possible (e.g., sweeping, use of absorbents) when cleaning around restaurant/food handling dumpster areas. If water must be used after sweeping/using absorbents, collect water and discharge through grease interceptor to the sewer.

Chemical/Hazardous Wastes

- Select designated hazardous waste collection areas on-site.
- Store hazardous materials and wastes in covered containers and protect them from vandalism.
- Place hazardous waste containers in secondary containment.
- Make sure that hazardous waste is collected, removed, and disposed of only at authorized disposal areas.
- Stencil or demarcate storm drains on the facility's property with prohibitive message regarding waste disposal.

Run-on/Runoff Prevention

- Prevent stormwater run-on from entering the waste management area by enclosing the area or building a berm around the area.
- Prevent waste materials from directly contacting rain.
- Cover waste piles with temporary covering material such as reinforced tarpaulin, polyethylene, polyurethane, polypropyleneor hypalon.
- Cover the area with a permanent roof if feasible.
- Cover dumpsters to prevent rain from washing waste out of holes or cracks in the bottom of the dumpster.
- Move the activity indoor after ensuring all safety concerns such as fire hazard and ventilation are addressed.

Inspection

- Inspect and replace faulty pumps or hoses regularly to minimize the potential of releases and spills.
- Check waste management areas for leaking containers or spills.

- Repair leaking equipment including valves, lines, seals, or pumps promptly.

Training

- Train staff in pollution prevention measures and proper disposal methods.
- Train employees and contractors in proper spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.
- Train employees and subcontractors in proper hazardous waste management.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Have an emergency plan, equipment and trained personnel ready at all times to deal immediately with major spills
- Collect all spilled liquids and properly dispose of them.
- Store and maintain appropriate spill cleanup materials in a location known to all near the designated wash area.
- Ensure that vehicles transporting waste have spill prevention equipment that can prevent spills during transport. Spill prevention equipment includes:
  - Vehicles equipped with baffles for liquid waste
  - Trucks with sealed gates and spill guards for solid waste

Other Considerations (Limitations and Regulations)

Hazardous waste cannot be reused or recycled; it must be disposed of by a licensed hazardous waste hauler.

Requirements

Costs

Capital and O&M costs for these programs will vary substantially depending on the size of the facility and the types of waste handled. Costs should be low if there is an inventory program in place.

Maintenance

- None except for maintaining equipment for material tracking program.

Supplemental Information

Further Detail of the BMP

Land Treatment System

Minimize runoff of polluted stormwater from land application by:

- Choosing a site where slopes are under 6%, the soil is permeable, there is a low water table, it is located away from wetlands or marshes, and there is a closed drainage system

- Avoiding application of waste to the site when it is raining or when the ground is saturated with water
- Growing vegetation on land disposal areas to stabilize soils and reduce the volume of surface water runoff from the site
- Maintaining adequate barriers between the land application site and the receiving waters (planted strips are particularly good)
- Using erosion control techniques such as mulching and matting, filter fences, straw bales, diversion terracing, and sediment basins
- Performing routine maintenance to ensure the erosion control or site stabilization measures are working

Examples

The port of Long Beach has a state-of-the-art database for identifying potential pollutant sources, documenting facility management practices, and tracking pollutants.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Solid Waste Container Best Management Practices – Fact Sheet On-Line Resources – Environmental Health and Safety. Harvard University. 2002.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Housekeeping Practices SC-60

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

Promote efficient and safe housekeeping practices (storage, use, and cleanup) when handling potentially harmful materials such as fertilizers, pesticides, cleaning solutions, paint products, automotive products, and swimming pool chemicals. Related information is provided in BMP fact sheets SC-11 Spill Prevention, Control & Cleanup and SC-34 Waste Handling & Disposal.

Approach

Pollution Prevention

- Purchase only the amount of material that will be needed for foreseeable use. In most cases this will result in cost savings in both purchasing and disposal. See SC-61 Safer Alternative Products for additional information.

- Be aware of new products that may do the same job with less environmental risk and for less or the equivalent cost. Total cost must be used here; this includes purchase price, transportation costs, storage costs, use related costs, clean up costs and disposal costs.

Suggested Protocols

General

- Keep work sites clean and orderly. Remove debris in a timely fashion. Sweep the area.

- Dispose of wash water, sweepings, and sediments, properly.

- Recycle or dispose of fluids properly.

- Establish a daily checklist of office, yard and plant areas to confirm cleanliness and adherence to proper storage and security. Specific employees should be assigned specific inspection responsibilities and given the authority to remedy any problems found.

- Post waste disposal charts in appropriate locations detailing for each waste its hazardous nature (poison, corrosive, flammable), prohibitions on its disposal (dumpster, drain, sewer) and the recommended disposal method (recycle, sewer, burn, storage, landfill).

- Summarize the chosen BMPs applicable to your operation and post them in appropriate conspicuous places.

- Require a signed checklist from every user of any hazardous material detailing amount taken, amount used, amount returned and disposal of spent material.
- Do a before audit of your site to establish baseline conditions and regular subsequent audits to note any changes and whether conditions are improving or deteriorating.
- Keep records of water, air and solid waste quantities and quality tests and their disposition.
- Maintain a mass balance of incoming, outgoing and on hand materials so you know when there are unknown losses that need to be tracked down and accounted for.
- Use and reward employee suggestions related to BMPs, hazards, pollution reduction, work place safety, cost reduction, alternative materials and procedures, recycling and disposal.
- Have, and review regularly, a contingency plan for spills, leaks, weather extremes etc. Make sure all employees know about it and what their role is so that it comes into force automatically.

Training
- Train all employees, management, office, yard, manufacturing, field and clerical in BMPs and pollution prevention and make them accountable.
- Train municipal employees who handle potentially harmful materials in good housekeeping practices.
- Train personnel who use pesticides in the proper use of the pesticides. The California Department of Pesticide Regulation license pesticide dealers, certify pesticide applicators and conduct onsite inspections.
- Train employees and contractors in proper techniques for spill containment and cleanup. The employee should have the tools and knowledge to immediately begin cleaning up a spill if one should occur.

Spill Response and Prevention
- Refer to SC-11, Spill Prevention, Control & Cleanup.
- Keep your Spill Prevention Control and Countermeasure (SPCC) plant up-to-date, and implement accordingly.
- Have spill cleanup materials readily available and in a known location.
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations
- There are no major limitations to this best management practice.
- There are no regulatory requirements to this BMP. Existing regulations already require municipalities to properly store, use, and dispose of hazardous materials

Requirements

Costs

- Minimal cost associated with this BMP. Implementation of good housekeeping practices may result in cost savings as these procedures may reduce the need for more costly BMPs.

Maintenance

- Ongoing maintenance required to keep a clean site. Level of effort is a function of site size and type of activities.

Supplemental Information

Further Detail of the BMP

- The California Integrated Waste Management Board's Recycling Hotline, 1-800-553-2962, provides information on household hazardous waste collection programs and facilities.

Examples

There are a number of communities with effective programs. The most pro-active include Santa Clara County and the City of Palo Alto, the City and County of San Francisco, and the Municipality of Metropolitan Seattle (Metro).

References and Resources

British Columbia Lake Stewardship Society. Best Management Practices to Protect Water Quality from Non-Point Source Pollution. March 2000. http://www.nalms.org/bclss/bmphome.html#bmp

King County Stormwater Pollution Control Manual - http://dnr.metrokc.gov/wlr/dss/spcm.htm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities, Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July, 1998, Revised by California Coastal Commission, February 2002.

Orange County Stormwater Program http://www.ocwatersheds.com/stormwater/swp_introduction.asp

San Mateo STOPPP - (http://stoppp.tripod.com/bmp.html)

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

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- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.

- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.

- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.

- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:

  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.

  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.

  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.

  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.

  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).

  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.

  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.

- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a know in location

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.

- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.

- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Photo Credit: Geoff Brosseau

Objectives

- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	☑
Bacteria	☑
Oil and Grease	☑
Organics	☑
Oxygen Demanding	☑

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff that may contain certain pollutants. Maintaining catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis will remove pollutants, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Approach

Suggested Protocols

Catch Basins/Inlet Structures

- Municipal staff should regularly inspect facilities to ensure the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC-75 Waste Handling and Disposal).
- Clean catch basins, storm drain inlets, and other conveyance structures in high pollutant load areas just before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.
- Keep accurate logs of the number of catch basins cleaned.
- Record the amount of waste collected.
- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.
- Dewater the wastes with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed of. Do not dewater near a storm drain or stream.
- Except for small communities with relatively few catch basins that may be cleaned manually, most municipalities will require mechanical cleaners such as eductors, vacuums, or bucket loaders.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.
- Collect flushed effluent and pump to the sanitary sewer for treatment.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.
- Do not allow discharge from cleaning a storm drain pump station or other facility to reach the storm drain system.
- Conduct quarterly routine maintenance at each pump station.
- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.
- Sample collected sediments to determine if landfill disposal is possible, or illegal discharges in the watershed are occurring.

Open Channel

- Consider modification of storm channel characteristics to improve channel hydraulics, to increase pollutant removals, and to enhance channel/creek aesthetic and habitat value.
- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies

(SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS

Illicit Connections and Discharges

- During routine maintenance of conveyance system and drainage structures field staff should look for evidence of illegal discharges or illicit connections:
  - Is there evidence of spills such as paints, discoloring, etc.
  - Are there any odors associated with the drainage system
  - Record locations of apparent illegal discharges/illicit connections
  - Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of up gradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.
  - Once the origin of flow is established, require illicit discharger to eliminate the discharge.
- Stencil storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as “Dump No Waste Drains to Stream” stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Illegal dumping hot spots
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)
  - Mode of dumping (abandoned containers, “midnight dumping” from moving vehicles, direct dumping of materials, accidents/spills)
  - Responsible parties
- Post “No Dumping” signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.
- Refer to fact sheet SC-10 Non-Stormwater Discharges.

- The State Department of Fish and Game has a hotline for reporting violations called Cal TIP (1-800-952-5400). The phone number may be used to report any violation of a Fish and Game code (illegal dumping, poaching, etc.).

- The California Department of Toxic Substances Control's Waste Alert Hotline, 1-800-69TOXIC, can be used to report hazardous waste violations.

Training

- Train crews in proper maintenance activities, including record keeping and disposal.

- Only properly trained individuals are allowed to handle hazardous materials/wastes.

- Train municipal employees from all departments (public works, utilities, street cleaning, parks and recreation, industrial waste inspection, hazardous waste inspection, sewer maintenance) to recognize and report illegal dumping.

- Train municipal employees and educate businesses, contractors, and the general public in proper and consistent methods for disposal.

- Train municipal staff regarding non-stormwater discharges (See SC-10 Non-Stormwater Discharges).

Spill Response and Prevention

- Refer to SC-11, Prevention, Control & Cleanup

- Have spill cleanup materials readily available and in a known location.

- Cleanup spills immediately and use dry methods if possible.

- Properly dispose of spill cleanup material.

Other Considerations

- Cleanup activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and disposal of flushed effluent to sanitary sewer may be prohibited in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Municipal codes should include sections prohibiting the discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

- Private property access rights may be needed to track illegal discharges up gradient.

- Requirements of municipal ordinance authority for suspected source verification testing for illicit connections necessary for guaranteed rights of entry.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget. A careful study of cleaning effectiveness should be undertaken before increased cleaning is implemented. Catch basin cleaning costs are less expensive if vacuum street sweepers are available; cleaning catch basins manually can cost approximately twice as much as cleaning the basins with a vacuum attached to a sweeper.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary. Encouraging reporting of illicit discharges by employees can offset costs by saving expense on inspectors and directing resources more efficiently. Some programs have used funds available from "environmental fees" or special assessment districts to fund their illicit connection elimination programs.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.

- Identifying illicit discharges requires teams of at least two people (volunteers can be used), plus administrative personnel, depending on the complexity of the storm sewer system.

- Arrangements must be made for proper disposal of collected wastes.

- Requires technical staff to detect and investigate illegal dumping violations, and to coordinate public education.

Supplemental Information

Further Detail of the BMP

Storm Drain flushing

Sanitary sewer flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in sanitary sewer systems. The same principles that make sanitary sewer flushing effective can be used to flush storm drains. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as to an open channel, to another point where flushing will be initiated, or over to the sanitary sewer and on to the treatment facilities, thus preventing re-suspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. The deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce the impacts of stormwater pollution, a second inflatable device, placed well downstream, may be used to re-collect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to re-collect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75 percent for organics and 55-65 percent for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm drain flushing.

Flow Management

Flow management has been one of the principal motivations for designing urban stream corridors in the past. Such needs may or may not be compatible with the stormwater quality goals in the stream corridor.

Downstream flood peaks can be suppressed by reducing through flow velocity. This can be accomplished by reducing gradient with grade control structures or increasing roughness with boulders, dense vegetation, or complex banks forms. Reducing velocity correspondingly increases flood height, so all such measures have a natural association with floodplain open space. Flood elevations laterally adjacent to the stream can be lowered by increasing through flow velocity.

However, increasing velocity increases flooding downstream and inherently conflicts with channel stability and human safety. Where topography permits, another way to lower flood elevation is to lower the level of the floodway with drop structures into a large but subtly excavated bowl where flood flows we allowed to spread out.

Stream Corridor Planning

Urban streams receive and convey stormwater flows from developed or developing watersheds. Planning of stream corridors thus interacts with urban stormwater management programs. If local programs are intended to control or protect downstream environments by managing flows delivered to the channels, then it is logical that such programs should be supplemented by management of the materials, forms, and uses of the downstream riparian corridor. Any proposal for steam alteration or management should be investigated for its potential flow and stability effects on upstream, downstream, and laterally adjacent areas. The timing and rate of flow from various tributaries can combine in complex ways to alter flood hazards. Each section of channel is unique, influenced by its own distribution of roughness elements, management activities, and stream responses.

Flexibility to adapt to stream features and behaviors as they evolve must be included in stream reclamation planning. The amenity and ecology of streams may be enhanced through the landscape design options of 1) corridor reservation, 2) bank treatment, 3) geomorphic restoration, and 4) grade control.

<u>Corridor reservation</u> - Reserving stream corridors and valleys to accommodate natural stream meandering, aggradation, degradation, and over bank flows allows streams to find their own form and generate less ongoing erosion. In California, open stream corridors in recent urban developments have produced recreational open space, irrigation of streamside plantings, and the aesthetic amenity of flowing water.

<u>Bank treatment</u> - The use of armoring, vegetative cover, and flow deflection may be used to influence a channel's form, stability, and biotic habitat. To prevent bank erosion, armoring can be done with rigid construction materials, such as concrete, masonry, wood planks and logs, riprap, and gabions. Concrete linings have been criticized because of their lack of provision of biotic habitat. In contrast, riprap and gabions make relatively porous and flexible linings. Boulders, placed in the bed reduce velocity and erosive power.

Riparian vegetation can stabilize the banks of streams that are at or near a condition of equilibrium. Binding networks of roots increase bank shear strength. During flood flows, resilient vegetation is forced into erosion-inhibiting mats. The roughness of vegetation leads to lower velocity, further reducing erosive effects. Structural flow deflection can protect banks from erosion or alter fish habitat. By concentrating flow, a deflector causes a pool to be scoured in the bed.

<u>Geomorphic restoration</u> – Restoration refers to alteration of disturbed streams so their form and behavior emulate those of undisturbed streams. Natural meanders are retained, with grading to gentle slopes on the inside of curves to allow point bars and riffle-pool sequences to develop. Trees are retained to provide scenic quality, biotic productivity, and roots for bank stabilization, supplemented by plantings where necessary.

A restorative approach can be successful where the stream is already approaching equilibrium. However, if upstream urbanization continues new flow regimes will be generated that could disrupt the equilibrium of the treated system.

<u>Grade Control</u> - A grade control structure is a level shelf of a permanent material, such as stone, masonry, or concrete, over which stream water flows. A grade control structure is called a sill, weir, or drop structure, depending on the relation of its invert elevation to upstream and downstream channels.

A sill is installed at the preexisting channel bed elevation to prevent upstream migration of nick points. It establishes a firm base level below which the upstream channel can not erode.

A weir or check dam is installed with invert above the preexisting bed elevation. A weir raises the local base level of the stream and causes aggradation upstream. The gradient, velocity, and erosive potential of the stream channel are reduced. A drop structure lowers the downstream invert below its preexisting elevation, reducing downstream gradient and velocity. Weirs and drop structure control erosion by dissipating energy and reducing slope velocity.

When carefully applied, grade control structures can be highly versatile in establishing human and environmental benefits in stabilized channels. To be successful, application of grade control structures should be guided by analysis of the stream system both upstream and downstream from the area to he reclaimed.

Examples

The California Department of Water Resources began the Urban Stream Restoration Program in 1985. The program provides grant funds to municipalities and community groups to implement stream restoration projects. The projects reduce damages from streambank aid watershed instability arid floods while restoring streams' aesthetic, recreational, and fish and wildlife values.

In Buena Vista Park, upper floodway slopes are gentle and grassed to achieve continuity of usable park land across the channel of small boulders at the base of the slopes.

The San Diego River is a large, vegetative lined channel, which was planted in a variety of species to support riparian wildlife while stabilizing the steep banks of the floodway.

References and Resources

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Orange County Stormwater Program
http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

San Diego Stormwater Co-permittees Jurisdictional Urban Runoff Management Program (URMP) Municipal Activities Model Program Guidance. 2001. Project Clean Water. November.

United States Environmental Protection Agency (USEPA). 1999. Stormwater Management Fact Sheet Non-stormwater Discharges to Storm Sewers. EPA 832-F-99-022. Office of Water, Washington, D.C. September.

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United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Illegal Dumping Control. On line: http://www.epa.gov/npdes/menuofbmps/poll_7.htm

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line: http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Design Objectives

☑ Maximize Infiltration

☑ Provide Retention

☑ Slow Runoff

☑ Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

Contain Pollutants

Collect and Convey

Description
Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach
Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications
Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations
Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach

Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Designing New Installations

The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.

- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:

  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff

  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect

  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible

  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth

- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Storm Drain Signage SD-13

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.

- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Design Objectives

Maximize Infiltration

Provide Retention

Slow Runoff

Minimize Impervious Land Coverage

Prohibit Dumping of Improper Materials

☑ Contain Pollutants

Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

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Picture of Existing Conditions