MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

Amethyst Self Storage

APN 3105-291-01

Prepared for:

Chad McKillop

West Gate Plaza LLC

1006 Straightway Court

Oceanside, CA 92057

619-395-0907

Prepared by:

JE Miller & Associates

17995 Outer Highway 18, Suite 1

Apple Valley, CA, 92307

760-242-6777

Submittal Date: 4/26/2023

Revision No. and Date: 12/12/2023

Revision No. and Date: 4/30/2024

Revision No. and Date: _____

Revision No. and Date: _____

Revision No. and Date: _____

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Amethyst Self Storage by JE Miller and Associates. The WQMP is intended to comply with the requirements of the City of Victorville/Mojave River Watershed Group and the Phase II Small MS4 General Permit for the Mojave River Watershed. 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 the Phase II Small MS4 Permit and the intent of San Bernardino County (unincorporated areas of Phelan, Oak Hills, Spring Valley Lake and Victorville) and the incorporated cities of Hesperia and Victorville and the Town of Apple Valley. Once the undersigned transfers its interest in the property, its successors in interest and the city/county/town shall be notified of the transfer. The new owner will be informed of its responsibility under this WQMP. A copy of the approved WQMP shall be available on the subject site in perpetuity.

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

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	APN 3105-291-01	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3105-291-01

Owner's Signature			
Owner Name: Chad McKillop			
Title	Owner		
Company	West Gate Plaza LLC		
Address	1006 Straightway Court, Oceanside, CA 92057		
Email	chad@hillsideequitygroup.com		
Telephone #	619-395-0907		
Signature		Date	2-23-24

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	APN 3105-291-01	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3105-291-01

"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 the California State Water Resources Control Board Order No. 2013-0001-DWQ.

Engineer:		PE Stamp Below
Title	Engineer	
Company	JE Miller and Associates	
Address	17995 Outer Highway 18, Suite 1	
Email	sjones@jemillersurvey.com	
Telephone #	760-242-6777	
Signature	Shelly Jones	
Date	5-14-2024	

Table of Contents

Forms

Section I – Introduction

This WQMP template has been prepared specifically for the Phase II Small MS4 General Permit in the Mojave River Watershed. This location is within the jurisdiction of the Lahontan Regional Water Quality Control Board (LRWQCB). This document should not be confused with the WQMP template for the Santa Ana Phase I area of San Bernardino County.

WQMP preparers must refer to the MS4 Permit for the Mojave Watershed WQMP template and Technical Guidance (TGD) document found at: http://cms.sbcounty.gov/dpw/Land/NPDES.aspx to find pertinent arid region and Mojave River Watershed specific references and requirements.

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	Amethyst Self Storage				
Project Owner Contact Name:	Chad McKillop				
Mailing Address:	1006 Straightway Court, Oceanside, CA 92057	E-mail Address:		Telephone:	619-395-0907
Permit/Application Number(s):		Tract/Parcel Map Number(s):	APN 3105-291-01		
Additional Information/ Comments:	This is the Preliminary WQMP				
Description of Project:	Amethyst Self Storage is a proposed commercial storage development on parcel, APN: 0477-051-10. The development of the commerical storage facility will cover a total area of 6.32 acres. Components of the private development will include: new buildings, new ac pavment, drive aisles, parking stalls, v gutter, drain basins, subsurface retention systems, a trash enclosure and paved walkways. The entire project covers 6.32 acres. The project when developed will drain to a series of proposed underground infiltration systems. The project site is located on the east side of Amethyst Street between Palmdale Road and Dos Palmas Road in the City of Victorville, San Bernardino County, California. Due to the size and nature of the project, the site is considered a "Priority Project" and will require a WQMP during the plan check process.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	The project lies within the Lohantan Regional Water Quality Control Board (Region 6). There are no known pre-existing water quality concerns within the project. The only treatment control BMP proposed for stormwater mitigation is the stormtech chamber. The system was sized to mitigate for the 100 year storm event in the drainage report which set the total storage at 39,008 ft3. This is larger than the 85th percentile DCV. This volume was determined to be 18,656 ft3 of total storage. 39,008 ft3 of storage is provided in the stormtech chambers.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

If the Project is greater than 5,000 square feet, and not on the excluded list as found on Section 1.4 of the TGD, the Project is a Regulated Development Project.

If the Project is creating and/or replacing greater than 2,500 square feet but less than 5,000 square feet of impervious surface area, then it is considered a Site Design Only project. This criterion is applicable to all development types including detached single family homes that create and/or replace greater than 2,500 square feet of impervious area and are not part of a larger plan of development.

Form 2.1-1 Description of Proposed Project

[1] Regulated Development Project Category (Select all that apply):

☒ #1 New development involving the creation of 5,000 ft² or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft² or more of impervious surface on an already developed site	☐ #3 Road Project – any road, sidewalk, or bicycle lane project that creates greater than 5,000 square feet of contiguous impervious surface	☐ #4 LUPs – linear underground/overhead projects that has a discrete location with 5,000 sq. ft. or more new constructed impervious surface

☐ Site Design Only (Project Total Square Feet > 2,500 but < 5,000 sq.ft.) Will require source control Site Design Measures. Use the "PCMP" Template. Do not use this WQMP Template.

[2] Project Area (ft2):	275,400	[3] Number of Dwelling Units:	0	[4] SIC Code:	4225

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

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:

Property is owned and managed by Chad McKillop of West Gate Plaza LLC. The proposed WQMP stormwater facilities consisting of the stormtech chamber system will likely be maintained by a sub contractor but will be the repsonsibility of West Gate Plaza LLC. The contact information is as follows:

Chad McKillop

1006 Straightway Court

Oceanside, CA. 92057

619-395-0907

2.3 Potential Stormwater Pollutants

Best Management Practices (BMP) measures for pollutant generating activities and sources shall be designed consistent with recommendations from the CASQA Stormwater BMP Handbook for New Development and Redevelopment (or an equivalent manual). Pollutant generating activities must be considered when determining the overall pollutants of concern for the Project as presented in Form 2.3-1.

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 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 ☐	Source include defaction from animals, waste facilties
Nutrients - Phosphorous	E ☒	N ☐	Sources include Fertilizer application, atmospheric deposition, animal feces.
Nutrients - Nitrogen	E ☒	N ☐	sources include Fertilizer application
Noxious Aquatic Plants	E ☐	N ☒	
Sediment	E ☒	N ☐	Sources include erosion of soil and degradation of pavement
Metals	E ☒	N ☐	Sources include metal fencing and roofs, vehicle parts and components, fuel and oils.
Oil and Grease	E ☒	N ☐	Sources include automobiles and machinery.
Trash/Debris	E ☒	N ☐	Sources include anthropogenic waste
Pesticides / Herbicides	E ☒	N ☐	Sources include pesticide and herbicide application
Organic Compounds	E ☒	N ☐	Sources include pesticide and herbicide application, pertoleum derived chemicals
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

Describe the project site conditions that will facilitate the selection of BMPs 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 Drainage Management Areas (DMAs)) is conveyed to the site outlet(s). Refer to Section 3.2 in the TGD for WQMP. The form below is provided as an example. Then complete Forms 3.2 and 3.3 for each DA on the project site. If the project has more than one drainage area for stormwater management, then complete additional versions of these forms for each DA / outlet. A map presenting the DMAs must be included as an appendix to the WQMP document.

Form 3-1 Site Location and Hydrologic Features

Site coordinates take GPS measurement at approximate center of site	Latitude 34.503844	Longitude -117.363092	Thomas Bros Map page
[1] San Bernardino County climatic region: ☒ Desert			
[2] Does the site have more than one drainage area (DA): Yes☐ No☒ If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached			

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property
DA1 DMA A to Outlet 1	DA 1 drains to stormtech chambers that fills and spills north to storm drain which outlets to the north.
DA1 DMA B to Outlet 1	
DA2 to Outlet 2	

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	275,400			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf	2			
4 Hydrologic soil group Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf	C			
5 Longest flowpath length (ft)	1145			
6 Longest flowpath slope (ft/ft)	0.02			
7 Current land cover type(s) Select from Fig C-3 of Hydrology Manual	Desert Brush			
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	Poor			

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA 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 County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf				
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 SWRCB site: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Mojave River
Applicable TMDLs http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	None
303(d) listed impairments http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml	Upper Narrows to Lower Narrows: Fluoride Sulfates TDS
Environmentally Sensitive Areas (ESA) Refer to Watershed Mapping Tool – http://sbcounty.permitrack.com/WAP	None
Hydromodification Assessment	☒ Yes Complete Hydromodification Assessment. Include Forms 4.2-2 through Form 4.2-5 and Hydromodification BMP Form 4.3-9 in submittal ☐ No

Section 4 Best Management Practices (BMP)

4.1 Source Control BMPs and Site Design BMP Measures

The information and data in this section are required for both Regulated Development and Site Design Only Projects. Source Control BMPs and Site Design BMP Measures are the basis of site-specific pollution management.

4.1.1 Source Control BMPs

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.

The identified list of source control BMPs correspond to the CASQA Stormwater BMP Handbook for New Development and Redevelopment.

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	
N1	Education of Property Owners, Tenants and Occupants on Stormwater BMPs	☒	☐	Owner to be provided WQMP and Educ Materials
N2	Activity Restrictions	☐	☒	There will not be a list of restricted activities
N3	Landscape Management BMPs	☒	☐	Landscape Management to be provided per SD-10 provided in Attachments
N4	BMP Maintenance	☒	☐	BMP Maintenance to be provided per Form 5.1
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Not applicable
N6	Local Water Quality Ordinances	☒	☐	By completing and complying with this WQMP the site will comply with all water quality ordinances
N7	Spill Contingency Plan	☒	☐	Spill Contingency Plan will consist of a spill kit available onsite at all times and annual training for all staff
N8	Underground Storage Tank Compliance	☐	☒	No storage underground
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous material 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	☒	☐	Site will comply with all fire code requirements
N11	Litter/Debris Control Program	☒	☐	Litter and debris will be deposited in appropriate covered receptacles. Any accumulated trash or debris onsite will be removed and disposed of by property owner.
N12	Employee Training	☒	☐	Owner will be provided a copy of the WQMP to train employees on post construction stormwater treatment management.
N13	Housekeeping of Loading Docks	☐	☒	No loading/unloading docks are proposed for this project.
N14	Catch Basin Inspection Program	☒	☐	Catch basins will be inspected and maintained per Form 5.1
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking lot will be swept bi monthly.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	Not a public agency project.
N17	Comply with all other applicable NPDES permits	☒	☐	SWPPP to be developed to comply with construction general permit

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Drains to River or Equivalent stenciling to be provided
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash/waste storage area to be covered
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 to be provided per landscape plan
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	landscape area finished surface to be 1-2" below top of adjacent finished surface
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☐	☒	No slopes or channels
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☒	☐	Dock areas to be managed per SD-31
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No Maintenance Bays
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No Vehicle wash areas
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas

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 areas
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	No fueling areas
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	No hillside landscaping onsite
S14	Wash water control for food preparation areas	☐	☒	No food preparation
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	No community car wash

4.1.2 Site Design BMPs

As part of the planning phase of a project, the site design practices associated with new LID requirements in the Phase II Small MS4 Permit must be considered. Site design BMP measures can result in smaller Design Capture Volume (DCV) to be managed by both LID and hydromodification control BMPs by reducing runoff generation.

As is stated in the Permit, it is necessary to evaluate site conditions such as soil type(s), existing vegetation and flow paths will influence the overall site design.

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 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: Impervious surface is proposed to cover 99% of site.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: Infiltration will be promoted through incorporation of stormtech chambers.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: Site drains to Mojave Drive and will continue to drain to Mojave Drive. Due to stormtech chambers storage times of concentration are expected to increase.
Disconnect impervious areas. Including rerouting of rooftop drainage pipes to drain stormwater to storage or infiltration BMPs instead of to storm drain : Yes ☒ No ☐ Explanation: Impervious surfaces will be dissconnected by conveying runoff to stormtech chambers.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement is infeasble due to heavy sediment blown by wind that clog porous pavement
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: All vegatation will be removed during grading. No sensitive areas.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: All landscaping will be drought tolerant.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: Compaction will be minmimzed under stormtech chambers.
Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: v gutters and stormdrain to convey surface flows.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: SWPPP will identify areas where compaction should be limited during construction
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: No rain barrels are proposed
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: Drainage course through site will be drained through a proposed stormdrain .

It is noted that, in the Phase II Small MS4 Permit, site design elements for green roofs and vegetative swales are required. Due to the local climatology in the Mojave River Watershed, proactive measures are taken to maximize the amount of drought tolerant vegetation. It is not practical in this region to have green roofs or vegetative swales. As part of site design the project proponent should utilize locally recommended vegetation types for landscaping. Typical landscaping recommendations are found in following local references:

San Bernardino County Special Districts:

Guide to High Desert Landscaping -
http://www.specialdistricts.org/Modules/ShowDocument.aspx?documentid=795

Recommended High-Desert Plants -
http://www.specialdistricts.org/modules/showdocument.aspx?documentid=553

Mojave Water Agency:

Desert Ranch: http://www.mojavewater.org/files/desertranchgardenprototype.pdf

Summertree: http://www.mojavewater.org/files/Summertree-Native-Plant-Brochure.pdf

Thornless Garden: http://www.mojavewater.org/files/thornlessgardenprototype.pdf

Mediterranean Garden: http://www.mojavewater.org/files/mediterraneangardenprototype.pdf

Lush and Efficient Garden: http://www.mojavewater.org/files/lushandefficientgardenprototype.pdf

Alliance for Water Awareness and Conservation (AWAC) outdoor tips – http://hdawac.org/save-outdoors.html

4.2 Treatment BMPs

After implementation and design of both Source Control BMPs and Site Design BMP measures, any remaining runoff from impervious DMAs must be directed to one or more on-site, treatment BMPs (LID or biotreatment) designed to infiltrate, evaportranspire, and/or bioretain the amount of runoff specified in Permit Section E.12.e (ii)(c) Numeric Sizing Criteria for Storm Water Retention and Treatment.

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small 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 from hydromodification.

If the project has more than one outlet for stormwater runoff, then complete additional versions of these forms for each DA / outlet.

It is noted that in the Phase II Small MS4 Permit jurisdictions, the LID BMP Design Capture Volume criteria is based on the 2-year rain event. The hydromodification performance criterion is based on the 10-year rain event.

Methods applied in the following forms include:

- For LID BMP Design Capture Volume (DCV), San Bernardino County requires use of the P_6 method (Form 4.2-1) For pre- and post-development hydrologic calculation, San Bernardino County 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 hydromodification 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)		
[1] Project area DA 1 (ft^2): 275,400	[2] Imperviousness after applying preventative site design practices (Imp%): 0.99	[3] Runoff Coefficient (Rc): _0.87 $R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.38 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.47 P_6 = Item 4 *C_1, where C_1 is a function of site climatic region specified in Form 3-1 Item 1 (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): 18,656 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 Hydromodification Assessment (DA 1)

Is the change in post- and pre- condition flows captured on-site? : Yes ☒ No ☐

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr 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- Addendum 1)

If "No," then proceed to Section 4.3 BMP Selection and Sizing

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] 39317 Form 4.2-3 Item 12	[2] 19.21 Form 4.2-4 Item 13	[3] 7.0 Form 4.2-5 Item 10
Post-developed	[4] 59760 Form 4.2-3 Item 13	[5] 9.94 Form 4.2-4 Item 14	[6] 11.66 Form 4.2-5 Item 14
Difference	[7] 20443 Item 4 – Item 1	[8] 9.27 Item 2 – Item 5	[9] 4.66 Item 6 – Item 3
Difference (as % of pre-developed)	[10] 52% Item 7 / Item 1	[11] 48% Item 8 / Item 2	[12] 67% Item 9 / Item 3

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

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

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

11 Precipitation for 10 yr, 24 hr storm (in):
Go to: http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html

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

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

14 Volume Reduction needed to meet hydromodification requirement, (ft^3):
Vhydro = (Item 13 * 0.95) – Item 12

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

Variables		Pre-developed DA to Project Outlet (Use additional forms if more than 3 DMA)			Post-developed DA to Project Outlet (Use additional forms if more than 3 DMA)		
		DMA A	DMA B	DMA C	DMA A	DMA B	DMA C
1 Rainfall Intensity for storm duration equal to time of concentration I_{peak} = 10^(LOG Form 4.2-1 Item 4 - 0.7 LOG Form 4.2-4 Item 5 /60)							
2 Drainage Area of each DMA (Acres) For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)							
3 Ratio of pervious area to total area For DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)							
4 Pervious area infiltration rate (in/hr) Use pervious area CN and antecedent moisture condition with Appendix C-3 of the TGD for WQMP							
5 Maximum loss rate (in/hr) F_m = Item 3 * Item 4 Use area-weighted F_m from DMA with outlet at project site outlet, include upstream DMA (Using example schematic in Form 3-1, DMA A will include drainage from DMA C)							
6 Peak Flow from DMA (cfs) Q_p =Item 2 * 0.9 * (Item 1 - Item 5)							
7 Time of concentration adjustment factor for other DMA to site discharge point Form 4.2-4 Item 12 DMA / Other DMA upstream of site discharge point (If ratio is greater than 1.0, then use maximum value of 1.0)	DMA A	n/a			n/a		
	DMA B		n/a			n/a	
	DMA C			n/a			n/a

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

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small 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 Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

- Site Design Measures (Form 4.3-2)
- Retention and Infiltration BMPs (Form 4.3-3) or
- Biotreatment BMPs (Form 4.3-4).

> Please note that the selected BMPs may also be used as dual purpose for on-site, hydromodification mitigation and management.

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 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 Form 4.3-2 to determine the feasibility of applicable Site Design 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 Site Design 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 site design, retention and/or infiltration BMPs is unable to mitigate the entire DCV, then the remainder of the volume-based performance criteria that cannot be achieved with site design, retention and/or infiltration BMPs must be managed through biotreatment BMPs. If biotreatment BMPs are used, then they must be sized to provide equivalent effectiveness based on Template Section 4.3.4.

4.3.1 Exceptions to Requirements for Bioretention Facilities

Contingent on a demonstration that use of bioretention or a facility of equivalent effectiveness is infeasible, other types of biotreatment or media filters (such as tree-box-type biofilters or in-vault media filters) may be used for the following categories of Regulated Projects:

1) Projects creating or replacing an acre or less of impervious area, and located in a designated pedestrian-oriented commercial district (i.e., smart growth projects), and having at least 85% of the entire project site covered by permanent structures;

2) Facilities receiving runoff solely from existing (pre-project) impervious areas; and

3) Historic sites, structures or landscapes that cannot alter their original configuration in order to maintain their historic integrity.

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 ten 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, Selection and Evaluation of Biotreatment 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, Site Design 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, Site Design BMPs.

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures 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 Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs 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 BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

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

Form 4.3-2 cont. Site Design BMPs (DA 1)

14 Implementation of Street Trees: Yes ☐ No ☐ If yes, complete Items 14-18. If no, proceed to Item 19	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
15 Number of Street Trees			
16 Average canopy cover over impervious area (ft^2)			
17 Runoff volume retention from street trees (ft^3) $V_{retention}$ = Item 15 * Item 16 * (0.05/12) assume runoff retention of 0.05 inches			
18 Runoff volume retention from street tree BMPs (ft^3): $V_{retention}$ = Sum of Item 17 for all BMPs			
19 Total Retention Volume from Site Design BMPs: 0 Sum of Items 5, 13 and 18			

4.3.3 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 C 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 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).

4.3.3.1 Allowed Variations for Special Site Conditions

The bioretention system design parameters of this Section may be adjusted for the following special site conditions:

1) Facilities located within 10 feet of structures or other potential geotechnical hazards established by the geotechnical expert for the project may incorporate an impervious cutoff wall between the bioretention facility and the structure or other geotechnical hazard.

2) Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities located where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner and may locate the underdrain discharge at the bottom of the subsurface drainage/storage layer (this configuration is commonly known as a “flow-through planter”).

3) Facilities located in areas of high groundwater, highly infiltrative soils or where connection of underdrain to a surface drain or to a subsurface storm drain are infeasible, may omit the underdrain.

4) Facilities serving high-risk areas such as fueling stations, truck stops, auto repairs, and heavy industrial sites may be required to provide adequate pretreatment to address pollutants of concern unless these high-risk areas are isolated from storm water runoff or bioretention areas with no chance of spill migration.

.

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

1 Remaining LID DCV not met by site design BMP (ft^3): V_{unmet} = Form 4.2-1 Item 7 - Form 4.3-2 Item19			
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 DMA A BMP Type Infiltration Basin	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
2 Infiltration rate of underlying soils (in/hr) See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods	1.8		
3 Infiltration safety factor See TGD Section 5.4.2 and Appendix D	2		
4 Design percolation rate (in/hr) P_{design} = Item 2 / Item 3	0.9		
5 Ponded water drawdown time (hr) Copy Item 6 in Form 4.2-1	48		
6 Maximum ponding depth (ft) BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details	4		
7 Ponding Depth (ft) d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6	3.6		
8 Infiltrating surface area, SA_{BMP} (ft^2) the lesser of the area needed for infiltration of full DCV or minimum space requirements from Table 5.7 of the TGD for WQMP	11,737		
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	0		
10 Amended soil porosity	0		
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	0.5		
12 Gravel porosity	40%		
13 Duration of storm as basin is filling (hrs) Typical ~ 3hrs	3		
14 Above Ground Retention Volume (ft^3) $V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]	0		
15 Underground Retention Volume (ft^3) Volume determined using manufacturer's specifications and calculations	37,419		
16 Total Retention Volume from LID Infiltration BMPs: DA 1 = 37,419 (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.			

4.3.4 Biotreatment BMP

Biotreatment BMPs may be considered if the full LID DCV cannot be met by maximizing retention and infiltration. 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 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

- Use Form 4.3-5 to compute biotreatment in small volume based biotreatment BMP (e.g. bioretention w/underdrains);
- Use Form 4.3-6 to compute biotreatment in large volume based biotreatment BMP (e.g. constructed wetlands);
- Use Form 4.3-7 to compute sizing criteria for flow-based biotreatment BMP (e.g. bioswales)

Form 4.3-4 Selection and Evaluation of Biotreatment BMP (DA 1)

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16	List pollutants of concern Copy from Form 2.3-1.	
2 Biotreatment BMP Selected (Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)	Volume-based biotreatment Use Forms 4.3-5 and 4.3-6 to compute treated volume	Flow-based biotreatment Use Form 4.3-7 to compute treated flow
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): Form 4.3-5 Item 15 + Form 4.3-6 Item 13	4 Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): Item 1 – Item 3	5 Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % Item 4 / Item 1
6 Flow-based biotreatment BMP capacity provided (cfs): Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.		

Form 4.3-5 Volume Based Biotreatment (DA 1) – Bioretention and Planter Boxes with Underdrains

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

Form 4.3-6 Volume Based Biotreatment (DA 1) – Constructed Wetlands and Extended Detention

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

Form 4.3-7 Flow Based Biotreatment (DA 1)

Biotreatment BMP Type Vegetated swale, vegetated filter strip, or other comparable proprietary BMP	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type (Use additional forms for more BMPs)
1 Pollutants addressed with BMP List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in TGD Table 5-5			
2 Flow depth for water quality treatment (ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
3 Bed slope (ft/ft) BMP specific, see Table 5-6 of the TGD for WQMP for reference to BMP design details			
4 Manning's roughness coefficient			
5 Bottom width (ft) b_w = (Form 4.3-5 Item 6 * Item 4) / (1.49 * Item 2^1.67 * 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 4.3-8 to demonstrate how on-site LID DCV is met with proposed site design, infiltration, 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 4.3-8 Conformance Summary and Alternative Compliance Volume Estimate (DA 1)

1 Total LID DCV for the Project DA-1 (ft^3): 18,656 Copy Item 7 in Form 4.2-1

2 On-site retention with site design BMP (ft^3): 0 Copy Item18 in Form 4.3-2

3 On-site retention with LID infiltration BMP (ft^3): 37,419 Copy Item 16 in Form 4.3-3

4 On-site biotreatment with volume based biotreatment BMP (ft^3): 0 Copy Item 3 in Form 4.3-4

5 Flow capacity provided by flow based biotreatment BMP (cfs): 0 Copy Item 6 in Form 4.3-4

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

- Full retention of LID DCV with site design or infiltration 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; therefore biotreatment BMP provides 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

7 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 Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 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)%

- Facilities, or a combination of facilities, of a different design than in Section E.12.e.(ii)(f) may be permitted if all of the following Phase II Small MS4 General Permit 2013-0001-DWQ 55 February 5, 2013 measures of equivalent effectiveness are demonstrated:
  1) Equal or greater amount of runoff infiltrated or evapotranspired; ☐
  2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment; ☐
  3) Equal or greater protection against shock loadings and spills; ☐
  4) Equal or greater accessibility and ease of inspection and maintenance. ☐

4.3.6 Hydromodification Control BMP

Use Form 4.3-9 to compute the remaining runoff volume retention, after Site Design BMPs are implemented, needed to address hydromodification, and the increase in time of concentration and decrease in peak runoff necessary to meet targets for protection of waterbodies with a potential hydromodification. Describe the proposed hydromodification treatment control BMP. Section 5.6 of the TGD for WQMP provides additional details on selection and evaluation of hydromodification control BMP.

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 17,455 (Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1	2 On-site retention with site design and infiltration, BMP (ft^3): 37,419 Sum of Form 4.3-8 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 hydromodification volume reduction
3 Remaining volume for hydromodification volume capture (ft^3): 0 Item 1 – Item 2	4 Volume capture provided by incorporating additional on-site BMPs (ft^3):

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

If yes, hydromodification 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 BMP ☒
- 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 ☐

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

If yes, hydromodification 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 retention BMPs ☒

4.4 Alternative Compliance Plan (if applicable)

Describe an alternative compliance plan (if applicable) for projects not fully able to infiltrate, 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 Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

1) Equal or greater amount of runoff infiltrated or evapotranspired;

2) Equal or lower pollutant concentrations in runoff that is discharged after biotreatment;

3) Equal or greater protection against shock loadings and spills;

4) Equal or greater accessibility and ease of inspection and maintenance.

The Project Proponent will need to obtain written approval for an alternative design from the Lahontan Regional Water Board Executive Officer (see Section 6 of the TGD for WQMP).

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

All BMPs 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 a Maintenance Agreement. The Maintenance Agreement must also be attached to the WQMP.

Note that at time of Project construction completion, the Maintenance Agreement must be completed, signed, notarized and submitted to the County Stormwater Department

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Landscape Managem nt	Chad McKillop	Landscaping to be maintained and any erosion stabilized. Inspection and maintenance will be performed by the same personel who are responsible for landscape maintenance.	Monthly
Stormtech Chambers	Chad McKillop	Maintain with JetVac process by flushing sediments to manhole for vacuuming.Use fixed nozzle with rear facing jets. Follows steps outlined in Attachment G for stormtech islotaor row. Document inspections on inspection form provided in Attachments	Biannual Inspection, Remove Sediment with Jetvac when sediment build up reaches greater than 4 inches.
Stormdrai n Stencil	Chad McKillop	Storm Drain stencil to be inpsected annually for degradation and wear. Faded or worn stencil that is not legible shall be repainted to ensure stencil is legible.	Annually
Litter Control	Chad McKillop	Site to be inspected and all litter be collected and disposed of in trash containers. Inspeciton and maintenance to be performed by ground maintenance staff.	Weekly

Driveways and Parking Areas	Chad McKillop	Clear and remove accumulated sand and debris in parking lots. Sweep pavement in lue of using hose or water spray.Ensure stormwater runoff is not impeded by deposit of debris and accumulated sediment. Inspeciton and maintenance to be performed by ground maintenance staff.	Inspect After wind storm or minmum monthly.

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

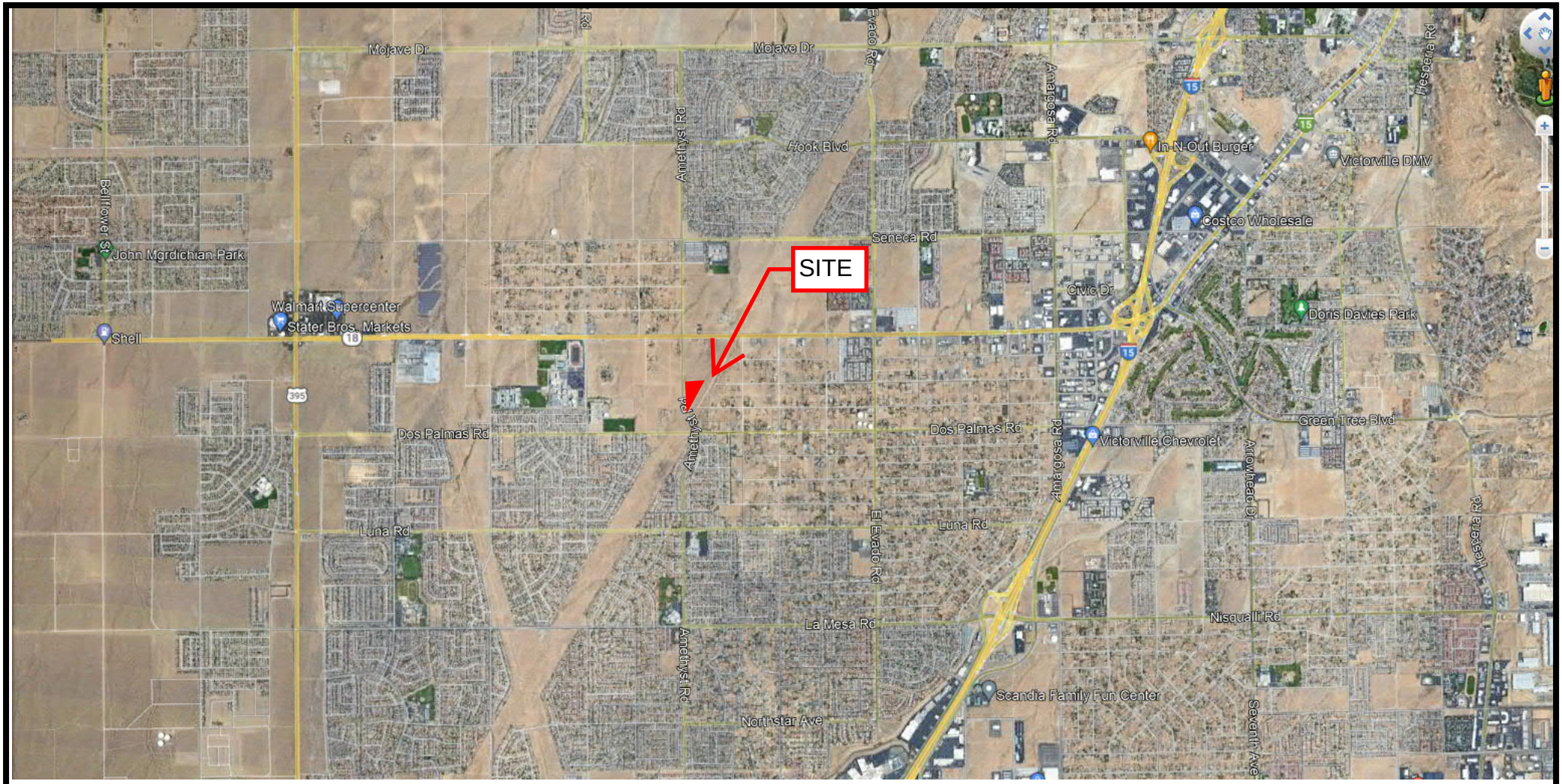
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

Attachment A - WQMP Exhibit

VICINITY EXHIBIT

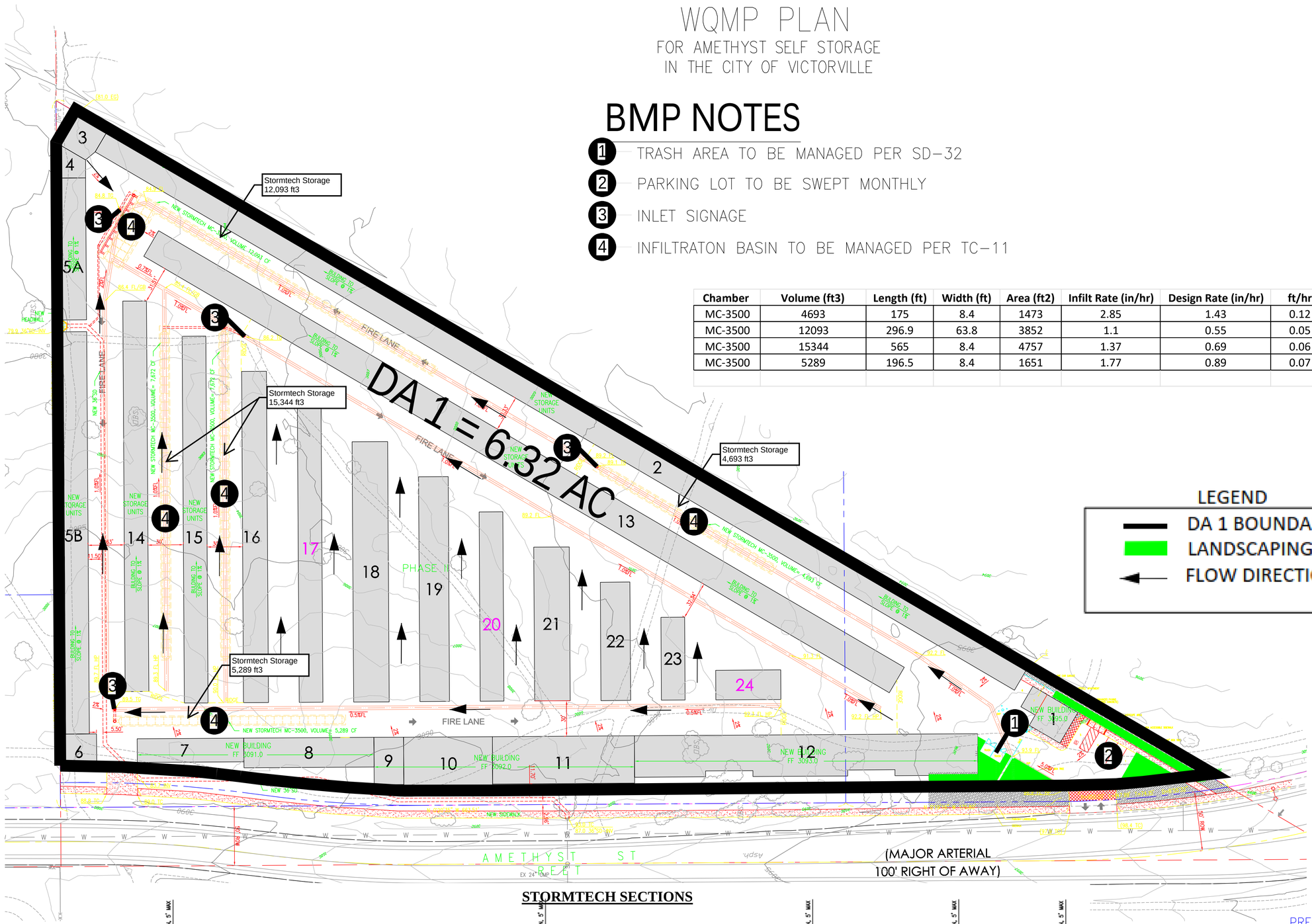


WQMP PLAN

FOR AMETHYST SELF STORAGE
IN THE CITY OF VICTORVILLE

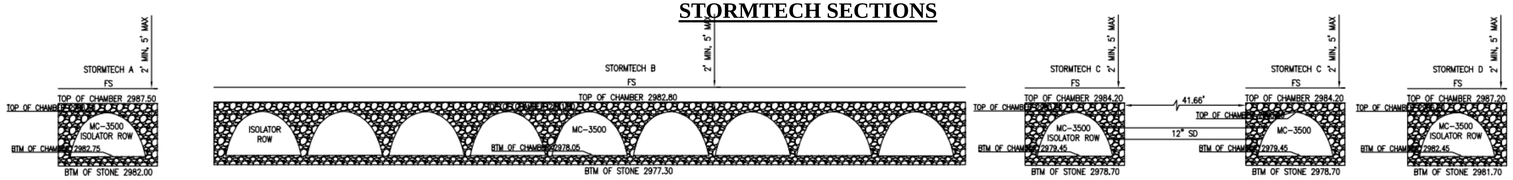
BMP NOTES

1. TRASH AREA TO BE MANAGED PER SD-32
2. PARKING LOT TO BE SWEPT MONTHLY
3. INLET SIGNAGE
4. INFILTRATON BASIN TO BE MANAGED PER TC-11



Chamber	Volume (ft3)	Length (ft)	Width (ft)	Area (ft2)	Infilt Rate (in/hr)	Design Rate (in/hr)	ft/hr	cf/hr	Drawdown (hours)
MC-3500	4693	175	8.4	1473	2.85	1.43	0.12	174.92	26.8
MC-3500	12093	296.9	63.8	3852	1.1	0.55	0.05	176.55	68.5
MC-3500	15344	565	8.4	4757	1.37	0.69	0.06	271.55	56.5
MC-3500	5289	196.5	8.4	1651	1.77	0.89	0.07	121.99	43.4

STORMTECH SECTIONS



PREPARED FOR

CHAD McKILLOP
WEST GATE PLAZA LLC
1006 STRAIGHTWAY COURT
OCEANSIDE, CA 92057
(619) 395-0907

APN

3105-291-01

LEGAL DESCRIPTION

BEING A PORTION OF THE SW ¼ OF SEC. 24, T5N, R5W

TOPOGRAPHY NOTE

TOPOGRAPHY SHOWN HEREON WAS PROVIDED BY EPIC ENGINEERING DATED 2/11/2021.

PREPARED BY

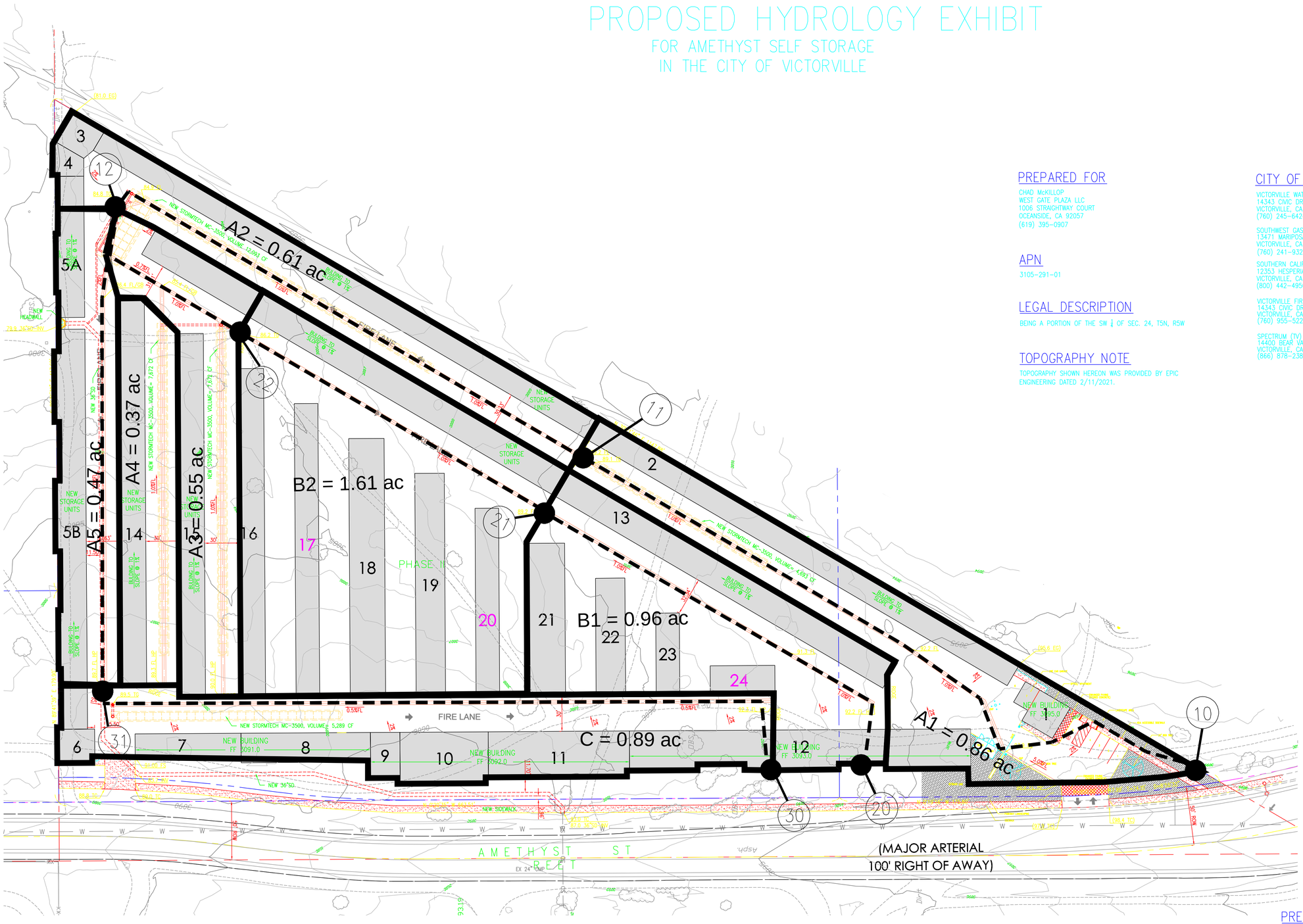
PREPARED DATE: DECEMBER 8, 2023

J.E. Miller & Associates
Civil Engineering · Planning · Surveying
17995 Outer HWY 18 S. Suite I Apple Valley, CA 92307
Phone (760) 242-6777 - info@jemillersurvey.com

E:\CLIENTS\JE MILLER\APN 3105-291-01 AMETHYST ROAD\INBOX\12-8-23\ARCHIVE (58)\0822.2654.01 PRELIM GP REV 5 - STANDARD\WQMP.DWG

PROPOSED HYDROLOGY EXHIBIT

FOR AMETHYST SELF STORAGE
IN THE CITY OF VICTORVILLE



PREPARED FOR

CHAD McKILLOP
WEST GATE PLAZA LLC
1006 STRAIGHTWAY COURT
OCEANSIDE, CA 92057
(619) 395-0907

APN

3105-291-01

LEGAL DESCRIPTION

BEING A PORTION OF THE SW ¼ OF SEC. 24, T5N, R5W

TOPOGRAPHY NOTE

TOPOGRAPHY SHOWN HEREON WAS PROVIDED BY EPIC ENGINEERING DATED 2/11/2021.

CITY OF VICTORVILLE, UTILITY NOTIFICATION LIST

VICTORVILLE WATER DISTRICT
14343 CIVIC DRIVE
VICTORVILLE, CA. 92392
(760) 245-6424

SOUTHWEST GAS CORPORATION
13471 MARIPOSA ROAD
VICTORVILLE, CA 92392
(760) 241-9321

SOUTHERN CALIFORNIA EDISON COMPANY
12353 HESPERIA ROAD
VICTORVILLE, CA 92392
(800) 442-4950

VICTORVILLE FIRE DEPARTMENT
14343 CIVIC DRIVE
VICTORVILLE, CA. 92392
(760) 955-5227

SPECTRUM (TV)
14400 BEAR VALLEY RD
VICTORVILLE, CA. 92392
(866) 878-2389

VERIZON (TELEPHONE)
15185 YUMA STREET
VICTORVILLE, CA 92392
(760) 245-0665 ENGINEERING
(760) 243-0200 SALES
(800) 922-0204 WIRELESS

CITY OF VICTORVILLE (SEWER)
14343 CIVIC DRIVE
VICTORVILLE, CA. 92392
(760) 955-5087

UNDERGROUND SERVICE ALERT
(800) 227-2600

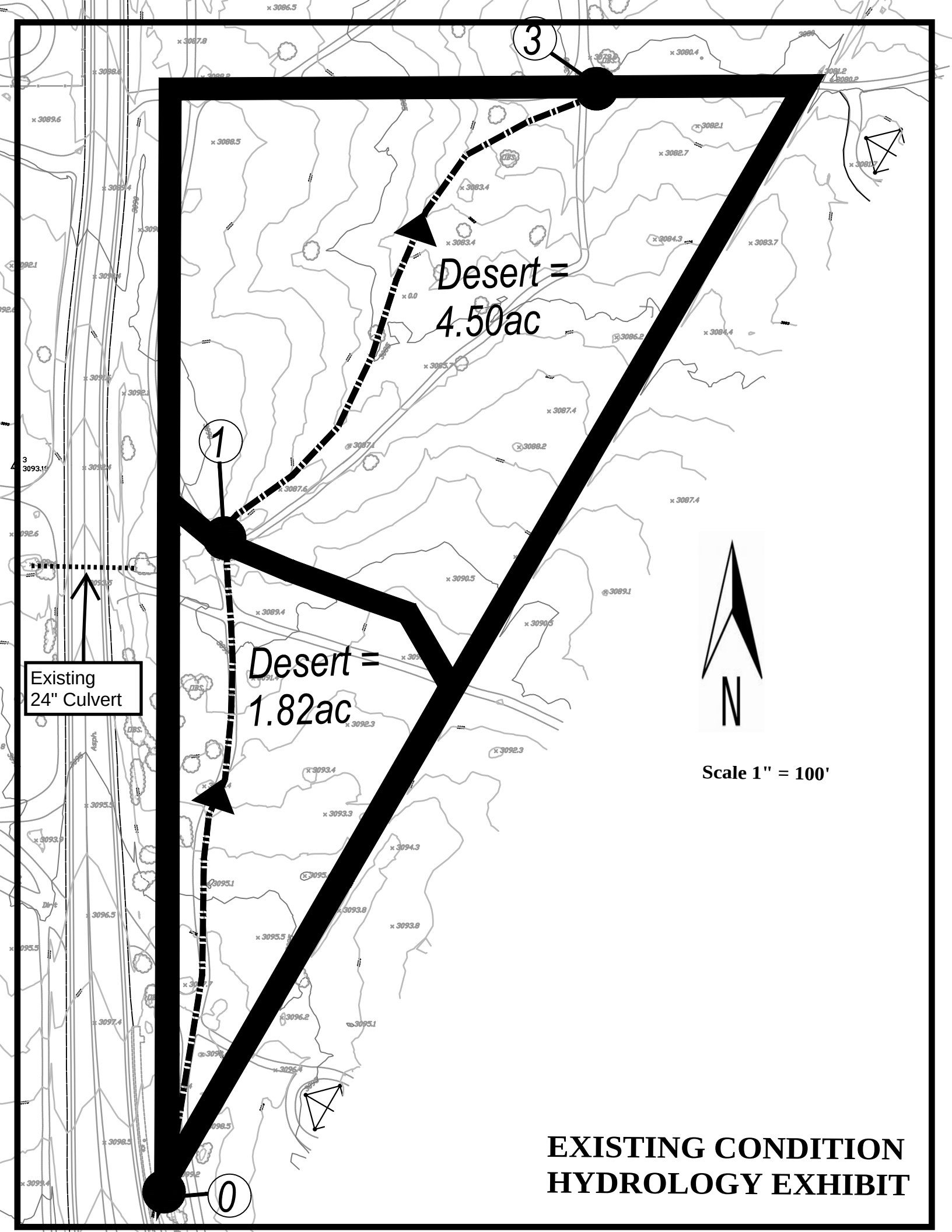
VICTORVILLE DISPOSAL, INC.
17080 STODDARD WELLS ROAD
VICTORVILLE, CA. 92392
(760) 955-5087

PREPARED BY

PREPARED DATE: DECEMBER 8, 2023

J.E. Miller & Associates
Civil Engineering · Planning · Surveying
17995 Outer HWY 18 S. Suite I Apple Valley, CA 92307
Phone (760) 242-6777 - info@jemillersurvey.com

E:\CLIENTS\JE MILLER\APN 3105-291-01 AMETHYST ROAD\INBOX\12-8-23\ARCHIVE (58)\0822.2654.01 PRELIM GP REV 5 - STANDARD\PROPHYDRO.DWG



Scale 1" = 100'

EXISTING CONDITION HYDROLOGY EXHIBIT

Attachment B - Hydrology Reference Material

General Information
Homepage
Progress Reports
FAQ
Glossary

Precipitation Frequency
Data Server
GIS Grids
Maps
Time Series
Temporals
Documents

Probable Maximum Precipitation
Documents

Miscellaneous
Publications
Storm Analysis
Record Precipitation

Contact Us
Inquiries

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth | Units: English | Time series type: Partial duration

Select location

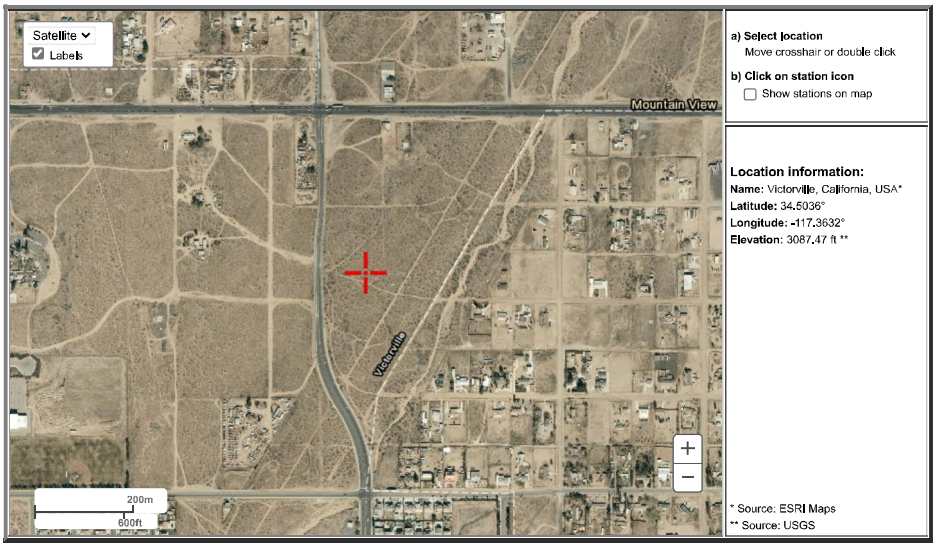
1) Manually:

a) **By location** (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) **By station** (list of CA stations): Select station

c) **By address** Search

2) Use map (if ESRI interactive map is not loading, try adding the host: **https://js.arcgis.com/** to the firewall, or contact us at hdsc.questions@noaa.gov):



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular | PF graphical | Supplementary information | Print page

PDS-based 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	**0.083** (0.069-0.102)	**0.119** (0.098-0.146)	**0.166** (0.137-0.204)	**0.206** (0.168-0.254)	**0.260** (0.205-0.332)	**0.302** (0.234-0.395)	**0.346** (0.261-0.463)	**0.392** (0.287-0.539)	**0.455** (0.320-0.652)	**0.504** (0.343-0.749)
10-min	**0.119** (0.099-0.146)	**0.170** (0.141-0.209)	**0.238** (0.196-0.293)	**0.295** (0.240-0.365)	**0.372** (0.294-0.476)	**0.433** (0.335-0.566)	**0.496** (0.374-0.664)	**0.561** (0.412-0.773)	**0.652** (0.459-0.935)	**0.723** (0.492-1.07)
15-min	**0.144** (0.119-0.177)	**0.206** (0.170-0.252)	**0.288** (0.237-0.354)	**0.356** (0.291-0.441)	**0.450** (0.356-0.576)	**0.524** (0.405-0.684)	**0.600** (0.453-0.803)	**0.679** (0.498-0.934)	**0.788** (0.555-1.13)	**0.874** (0.595-1.30)
30-min	**0.210** (0.173-0.257)	**0.299** (0.247-0.366)	**0.419** (0.345-0.514)	**0.518** (0.423-0.640)	**0.654** (0.517-0.837)	**0.761** (0.589-0.994)	**0.871** (0.658-1.17)	**0.986** (0.724-1.36)	**1.15** (0.806-1.64)	**1.27** (0.864-1.89)
60-min	**0.268** (0.222-0.328)	**0.383** (0.316-0.468)	**0.535** (0.441-0.657)	**0.661** (0.540-0.818)	**0.836** (0.660-1.07)	**0.972** (0.752-1.27)	**1.11** (0.840-1.49)	**1.26** (0.925-1.73)	**1.46** (1.03-2.10)	**1.62** (1.10-2.41)
2-hr	**0.375** (0.310-0.458)	**0.508** (0.419-0.622)	**0.690** (0.568-0.847)	**0.844** (0.689-1.05)	**1.06** (0.839-1.36)	**1.24** (0.956-1.62)	**1.42** (1.07-1.90)	**1.61** (1.19-2.22)	**1.89** (1.33-2.71)	**2.11** (1.43-3.13)
3-hr	**0.462** (0.382-0.565)	**0.616** (0.509-0.755)	**0.830** (0.683-1.02)	**1.01** (0.826-1.25)	**1.27** (1.00-1.63)	**1.48** (1.15-1.94)	**1.71** (1.29-2.29)	**1.95** (1.43-2.68)	**2.29** (1.61-3.28)	**2.56** (1.74-3.80)
6-hr	**0.627** (0.518-0.766)	**0.830** (0.685-1.02)	**1.11** (0.917-1.37)	**1.36** (1.11-1.68)	**1.72** (1.35-2.19)	**2.01** (1.55-2.62)	**2.32** (1.75-3.10)	**2.66** (1.95-3.66)	**3.14** (2.21-4.51)	**3.55** (2.41-5.26)
12-hr	**0.782** (0.646-0.956)	**1.07** (0.883-1.31)	**1.47** (1.21-1.81)	**1.82** (1.49-2.25)	**2.32** (1.83-2.97)	**2.73** (2.11-3.57)	**3.17** (2.39-4.25)	**3.65** (2.68-5.02)	**4.34** (3.05-6.22)	**4.90** (3.33-7.28)
24-hr	**1.04** (0.926-1.20)	**1.49** (1.32-1.71)	**2.10** (1.85-2.42)	**2.62** (2.30-3.06)	**3.38** (2.86-4.07)	**4.00** (3.32-4.91)	**4.65** (3.77-5.86)	**5.37** (4.23-6.95)	**6.39** (4.83-8.63)	**7.23** (5.28-10.1)
2-day	**1.14** (1.01-1.31)	**1.62** (1.43-1.87)	**2.29** (2.02-2.65)	**2.87** (2.52-3.35)	**3.71** (3.14-4.47)	**4.40** (3.65-5.40)	**5.13** (4.16-6.47)	**5.94** (4.68-7.69)	**7.10** (5.36-9.58)	**8.05** (5.88-11.3)
3-day	**1.22** (1.08-1.41)	**1.73** (1.53-2.00)	**2.45** (2.16-2.83)	**3.07** (2.69-3.57)	**3.96** (3.36-4.77)	**4.70** (3.90-5.78)	**5.49** (4.45-6.92)	**6.36** (5.01-8.23)	**7.61** (5.75-10.3)	**8.65** (6.32-12.1)
4-day	**1.31** (1.16-1.51)	**1.85** (1.64-2.13)	**2.62** (2.31-3.02)	**3.27** (2.87-3.81)	**4.22** (3.58-5.09)	**5.00** (4.15-6.15)	**5.84** (4.73-7.36)	**6.76** (5.32-8.75)	**8.09** (6.11-10.9)	**9.19** (6.71-12.8)
7-day	**1.41** (1.25-1.62)	**1.98** (1.75-2.28)	**2.78** (2.45-3.21)	**3.46** (3.04-4.04)	**4.45** (3.77-5.36)	**5.26** (4.36-6.46)	**6.11** (4.95-7.70)	**7.04** (5.55-9.12)	**8.37** (6.33-11.3)	**9.47** (6.91-13.2)
10-day	**1.50** (1.33-1.73)	**2.10** (1.86-2.42)	**2.93** (2.59-3.39)	**3.65** (3.20-4.25)	**4.68** (3.97-5.64)	**5.52** (4.58-6.78)	**6.41** (5.19-8.07)	**7.36** (5.80-9.53)	**8.73** (6.60-11.8)	**9.84** (7.19-13.8)
20-day	**1.78** (1.58-2.05)	**2.48** (2.20-2.86)	**3.48** (3.07-4.01)	**4.33** (3.79-5.04)	**5.56** (4.71-6.70)	**6.56** (5.44-8.06)	**7.62** (6.17-9.60)	**8.75** (6.89-11.3)	**10.4** (7.82-14.0)	**11.6** (8.51-16.3)
30-day	**2.05** (1.82-2.36)	**2.86** (2.53-3.29)	**4.00** (3.53-4.62)	**4.99** (4.37-5.81)	**6.43** (5.45-7.74)	**7.59** (6.30-9.33)	**8.82** (7.15-11.1)	**10.1** (7.99-13.1)	**12.0** (9.07-16.2)	**13.5** (9.86-18.9)
45-day	**2.40** (2.13-2.76)	**3.32** (2.94-3.83)	**4.63** (4.09-5.35)	**5.78** (5.06-6.73)	**7.46** (6.33-8.99)	**8.84** (7.34-10.9)	**10.3** (8.35-13.0)	**11.9** (9.35-15.4)	**14.1** (10.6-19.0)	**15.9** (11.6-22.1)
60-day	**2.68** (2.37-3.08)	**3.67** (3.25-4.22)	**5.10** (4.50-5.89)	**6.36** (5.57-7.41)	**8.21** (6.96-9.89)	**9.75** (8.09-12.0)	**11.4** (9.23-14.3)	**13.1** (10.4-17.0)	**15.6** (11.8-21.1)	**17.6** (12.8-24.6)

[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.

Estimates from the table in CSV format: Precipitation frequency estimates Submit

Main Link Categories:
Home | OWP

US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Water Prediction (OWP)
1325 East West Highway
Silver Spring, MD 20910
Page Author: HDSC webmaster
Page last modified: April 21, 2017

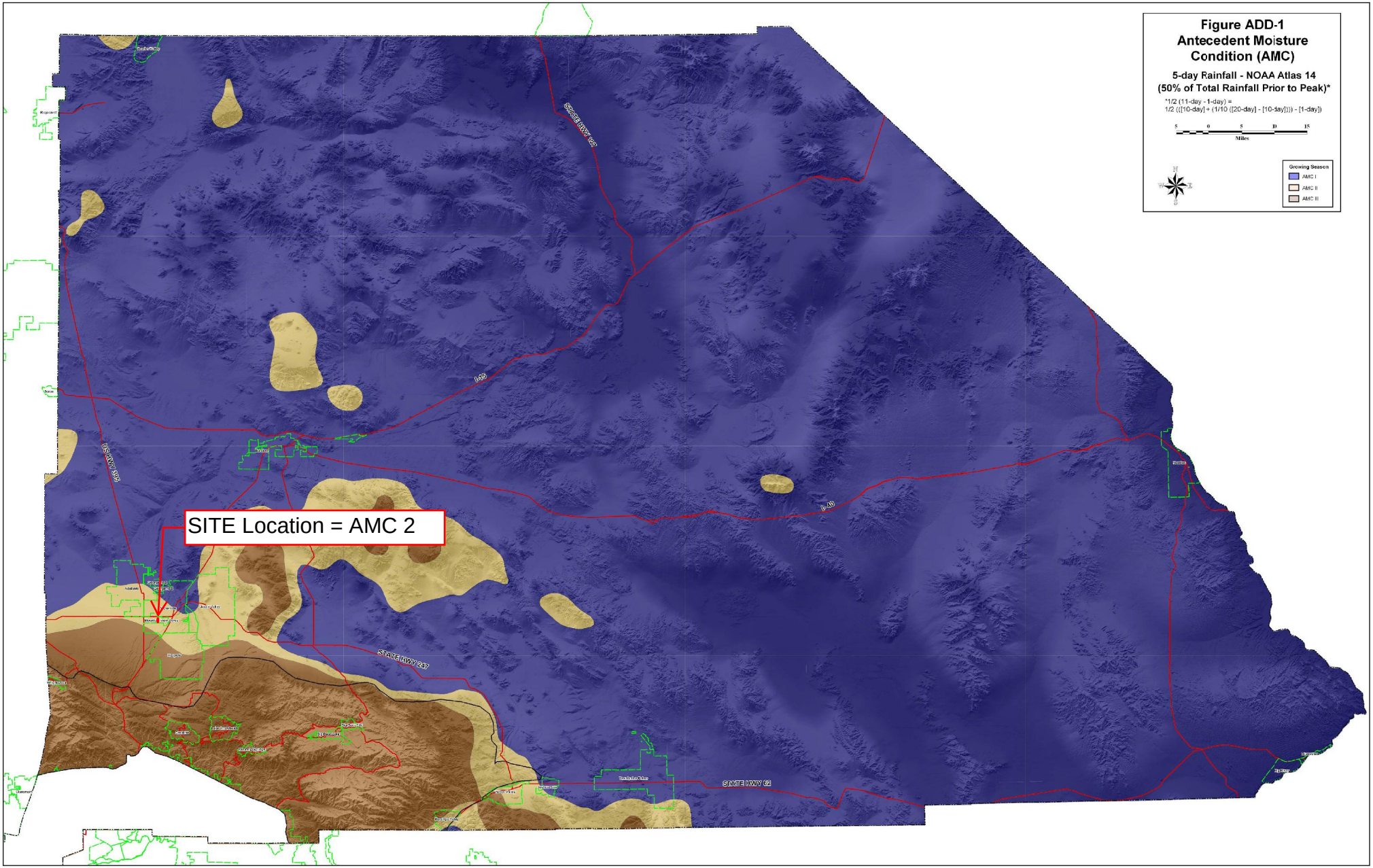
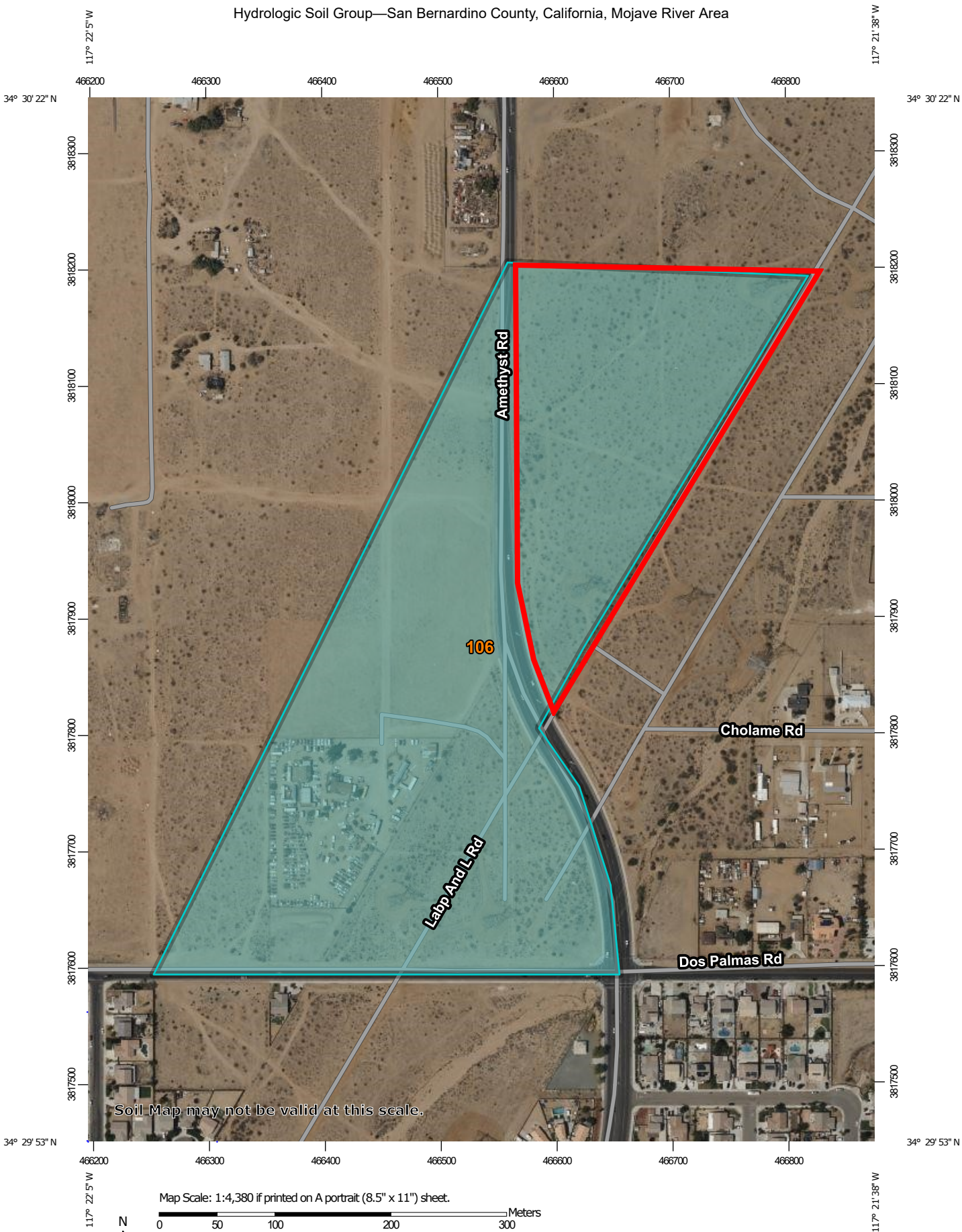


Figure ADD-1
Antecedent Moisture Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
*1/2 (11-day - 1-day) =
1/2 ([10-day] + (1/10 ([20-day] - [10-day]))) - [1-day])
5 0 5 10 15
Miles
Growing Season
AMC I
AMC II
AMC III
SITE Location = AMC 2
STATE HWY 237
STATE HWY 62
I-40


117° 22' 5" W
117° 21' 38" W
466200
466300
466400
466500
466600
466700
466800
34° 30' 22" N
34° 29' 53" N
3818300
3818200
3818100
3818000
3817900
3817800
3817700
3817600
3817500
Amethyst Rd
106
Cholame Rd
Labp And L Rd
Dos Palmas Rd
Soil Map may not be valid at this scale.
Map Scale: 1:4,380 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
Feet
0 200 400 800 1200
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Lines

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Soil Rating Points

A

A/D

B

B/D

C

C/D

D

Not rated or not available

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 14, Sep 1, 2022

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
106	BRYMAN LOAMY FINE SAND, 2 TO 5 PERCENT SLOPES	C	41.1	100.0%
Totals for Area of Interest			**41.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Attachment C – Soil Information

Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

December 1, 2023 **Project No. 112-23140**

Mr. Chad McKillop
1006 Straightaway Court
Oceanside, CA 92057
(619) 395-0907
chad@mckillopsales.ws

RE: Infiltration Testing
Proposed Self Storage Victorville
APN: 3105-291-01
Victorville, California

Dear Mr. McKillop:

In accordance with your request and authorization we have performed infiltration testing at the subject site in Victorville, San Bernardino County, California. Our services included performance of infiltration testing at the subject site. It is understood that the design and evaluation of the proposed infiltration system will be performed by others.

Infiltration testing was performed at five (5) locations within the proposed infiltration areas located at the subject site. The infiltration testing was performed in general accordance with the San Bernardino County Technical Guidance Document for Water Quality Management Plans. The approximate test locations are identified on the attached site plan. In order to perform these tests, five (5) eight-inch diameter borings were drilled to a depth of approximately 5 feet below existing site grades. Infiltration testing has been performed at each of the boring locations. Infiltration testing has been performed using open borehole percolation testing specified in the San Bernardino County Technical Guidance Document for Water Quality Management Plans. The infiltration rates have been calculated from the percolation rates using the Inverse Borehole procedures. Infiltration rates presented represent vertical flow at each test location.

Prior to infiltration testing, approximately four inches of gravel was placed at the bottom of each borehole. The boreholes were pre-soaked prior to testing using clean water in accordance with the San Bernardino County Technical Guidance Document for Water Quality Management Plans. The depth of the borehole was measured at each reading to verify the overall depth. The depth of water in the borehole was measured at each reading using a water level indicator or well sounder.

Infiltration Test Results

The estimated infiltration rates were determined using the results of open borehole percolation testing at each location at the subject site. The depth of each boreholes were approximately 5 feet below current site grades. The infiltration rates have been calculated from percolation rates using the Inverse Borehole procedures.

The conversion equation is used:

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

The infiltration rates at the end of the tests indicated infiltration rates of approximately 0.63, 0.67, 1.10, 1.37, and 2.85 inches per hour at a depth of approximately 5 feet below current site grades. The soil infiltration rates are based on tests conducted with clean water. The infiltration rates may vary with time as a result of soil clogging from water impurities. A factor of safety should be incorporated into the design of the infiltration system to compensate for these factors as determined appropriate by the designer. In addition, routine maintenance consisting of clearing the system of clogged soils and debris should be expected.

It is recommended that the location of the infiltration systems not be closer than ten feet (10') as measured laterally from the edge of the adjacent property line, ten feet (10') from the outside edge of any foundation and five (5') from the edge of any right-of way to the outside edges of the infiltration system.

If the infiltration location is within ten feet (10') from the proposed foundation, it is recommended that this infiltration system should be impervious from the finished ground surface to a depth that will achieve a diagonal distance of a minimum of ten feet (10') below the bottom of the closest footing in the project.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

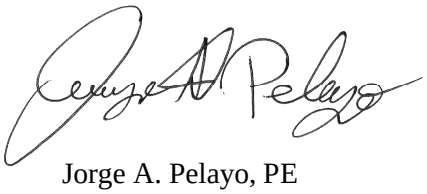
Conclusion

Silty sand/sand material was encountered in our boring locations up to the maximum depth explored of 5 feet below existing grades. This type of soil is classified under Group B based on the San Bernardino County Hydrology Manual. Group B is for soils having moderate infiltration rates when thoroughly wetter and consisting chiefly of moderately deep to deep, moderately well to well drained sandy-loam soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. Infiltration within the sandy materials found on-site are feasible across the site assuming the infiltration system is located within the areas tested. We recommend that the engineer apply an appropriate factor of safety to account for both site variability and siltation.

The conclusions, recommendations, and opinions presented herein are: (1) based upon our evaluation and interpretations of the limited data obtained from our field and laboratory programs; (2) based upon an interpolation of soil conditions between and beyond the borings and trenches; (3) are subject to confirmation of the actual conditions encountered during construction; and, (4) are based upon the assumption that sufficient observation and testing will be provided during the grading, infrastructure installation and building phases of site development.

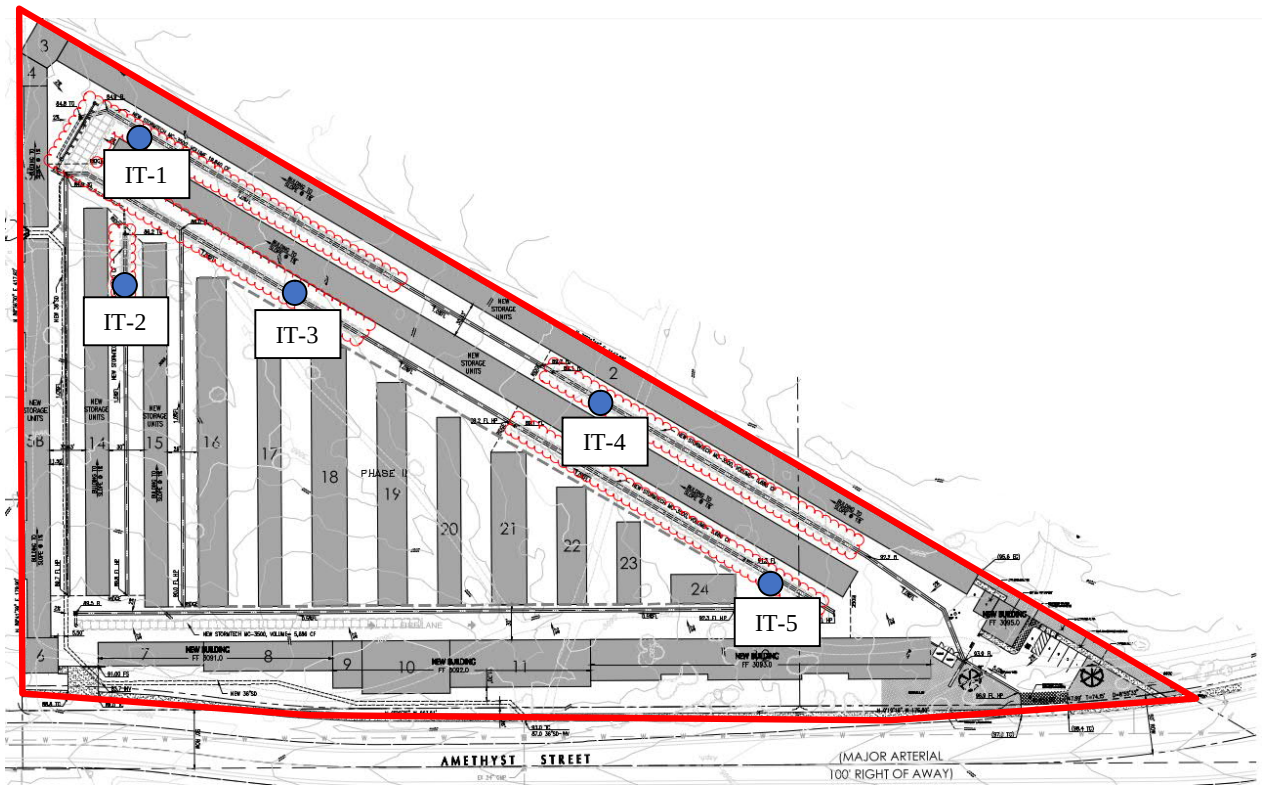
If there are any questions or if we can be of further assistance, please do not hesitate to contact our office at (951) 273-1011.

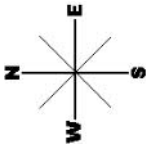
Respectfully submitted,
KRAZAN & ASSOCIATES, INC.



Jorge A. Pelayo, PE
Project Engineer
RCE No. 91269

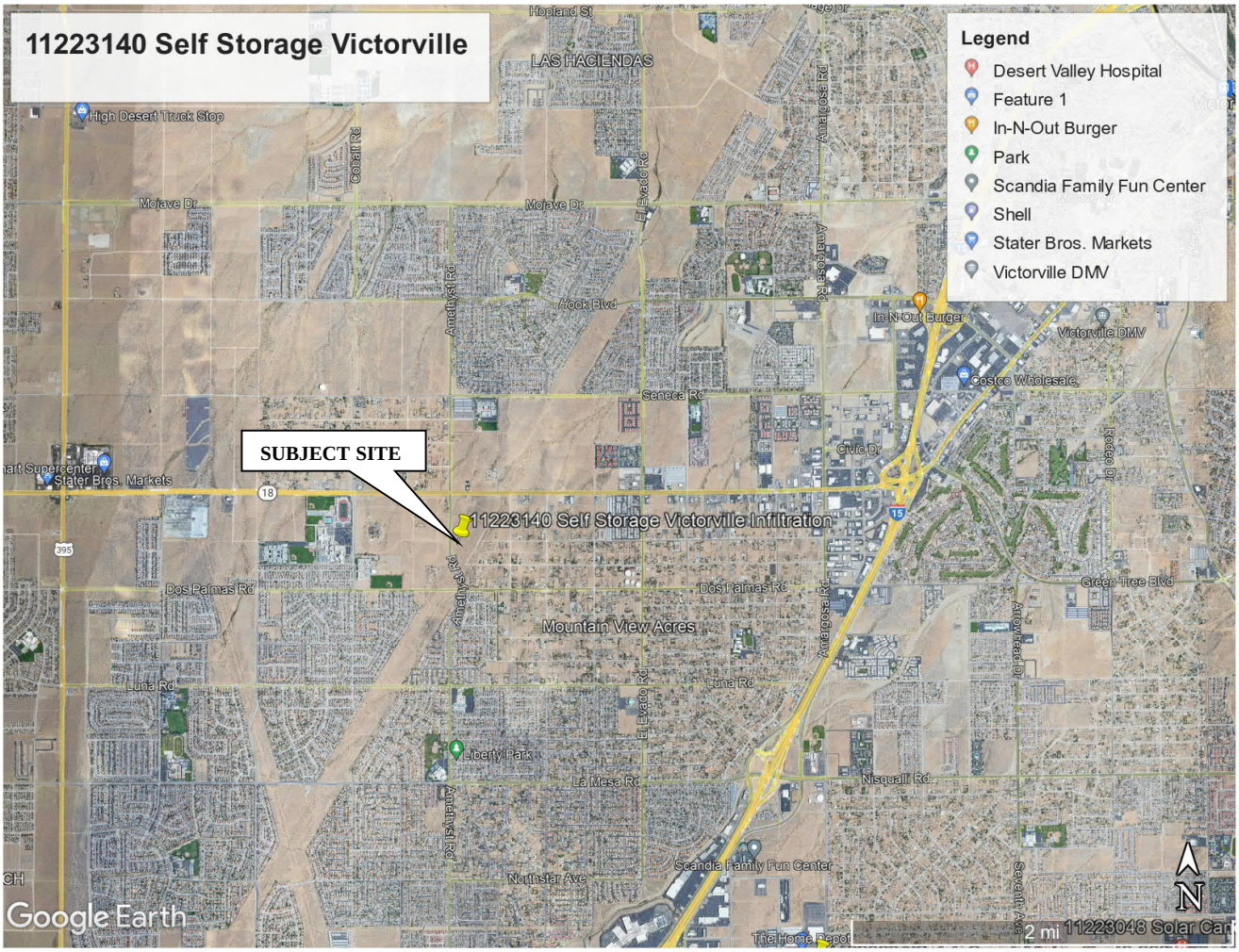
Attachment: Infiltration Test Results and Site Map

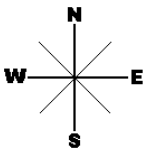




APPROXIMATE INFILTRATION TESTING LOCATION

SITE MAP	**Scale:** NTS	**Date:** Nov., 2023	Krazan GEOTECHNICAL ENGINEERING
PROPOSED SELF STORAGE FACILITY APN: 3105-291-01 VICTORVILLE, CALIFORNIA	**Drawn by:** GR	**Approved by:** JAP	
	Project No. 112-23140	**Figure No.** 1	

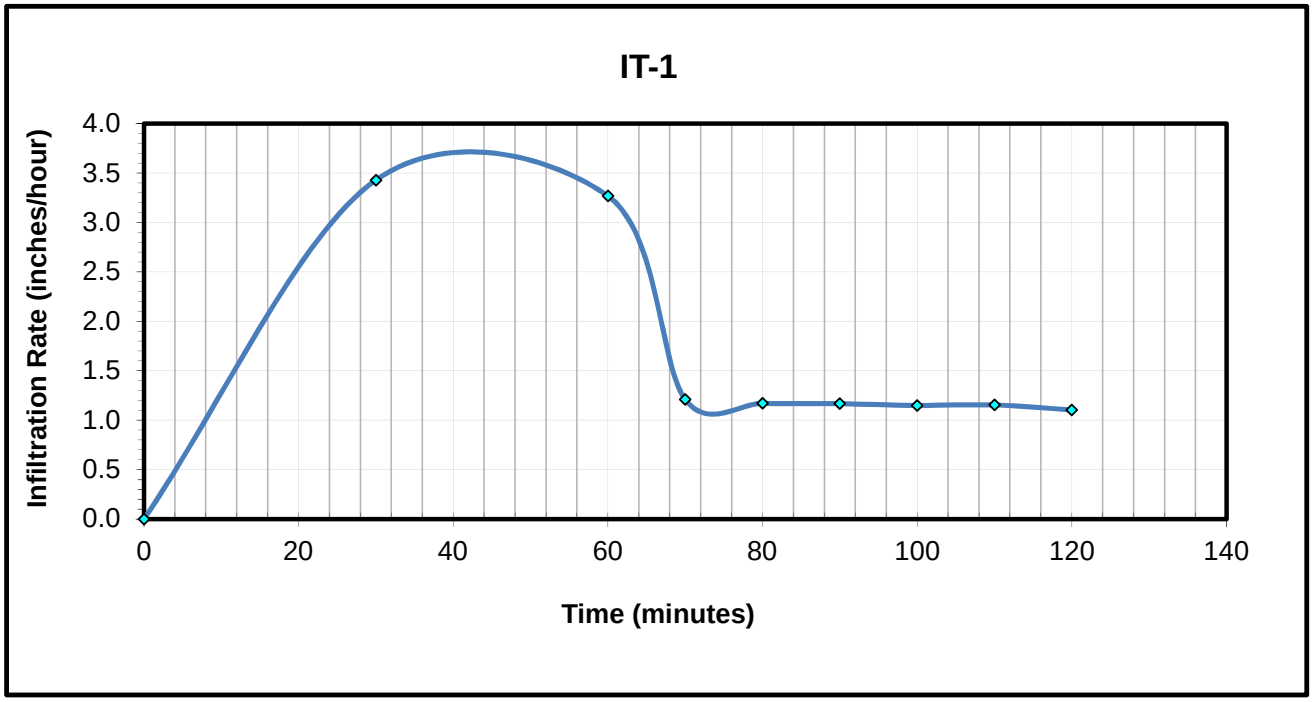




VICINITY MAP	Scale: NTS	Date: Nov., 2023	Krazan GEOTECHNICAL ENGINEERING
PROPOSED SELF STORAGE FACILITY APN: 3105-291-01 VICTORVILLE, CALIFORNIA	Drawn by: GR	Approved by: JAP	
	Project No. 112-23140	Figure No. 2	

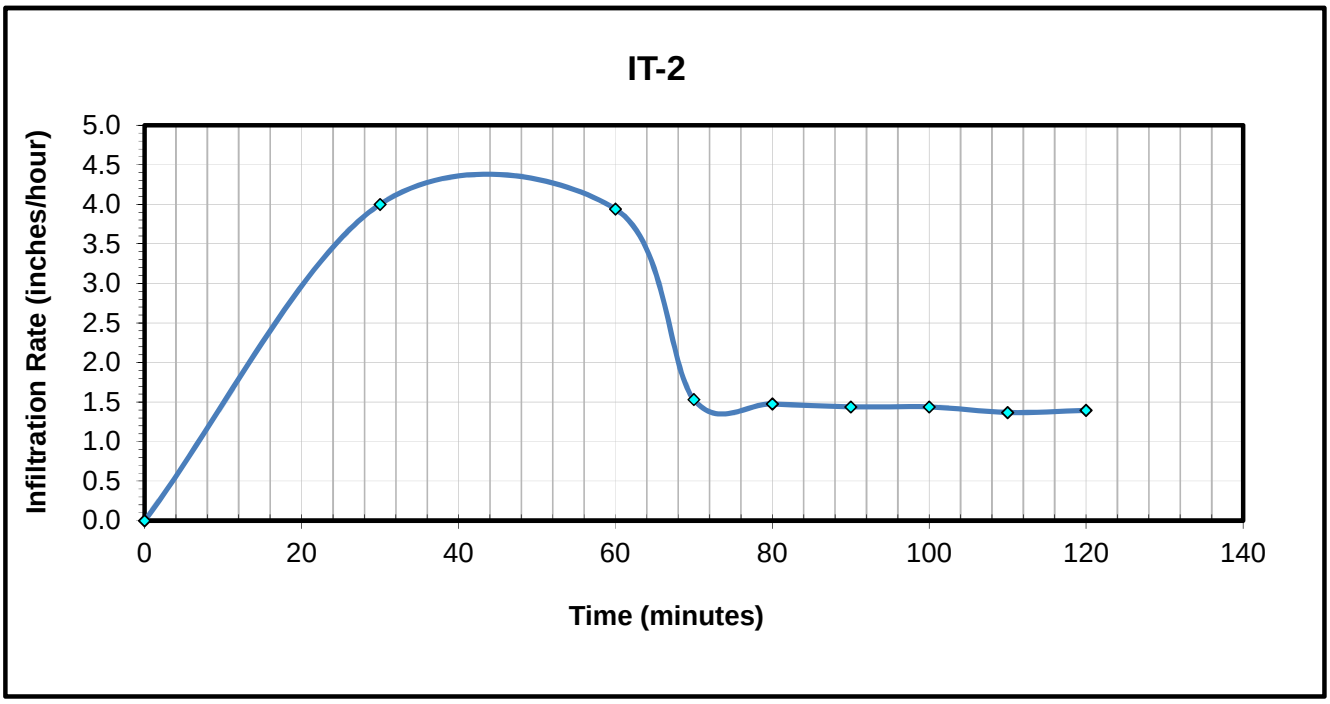
RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE						
Project #	**112-23140**				**Date**	**11/30/2023**
Project Name	Proposed Self Storage Victorville					
Project Address	APN: 3105-291-01, Victorville, CA					
Test No:	IT-1	**Total Depth (in.)**		60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM/SP		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0		12.0	--	--
1	30	30	12.0	42.0	30.00	3.43
2	60	30	12.0	41.0	29.00	3.27
3	70	10	12.0	16.8	4.80	1.21
4	80	10	16.8	21.0	4.20	1.17
5	90	10	21.0	24.8	3.80	1.17
6	100	10	24.8	28.2	3.40	1.15
7	110	10	28.2	31.3	3.10	1.15
8	120	10	31.3	34.0	2.70	1.10
	Infiltration Rate in Inches per Hour					**1.10**



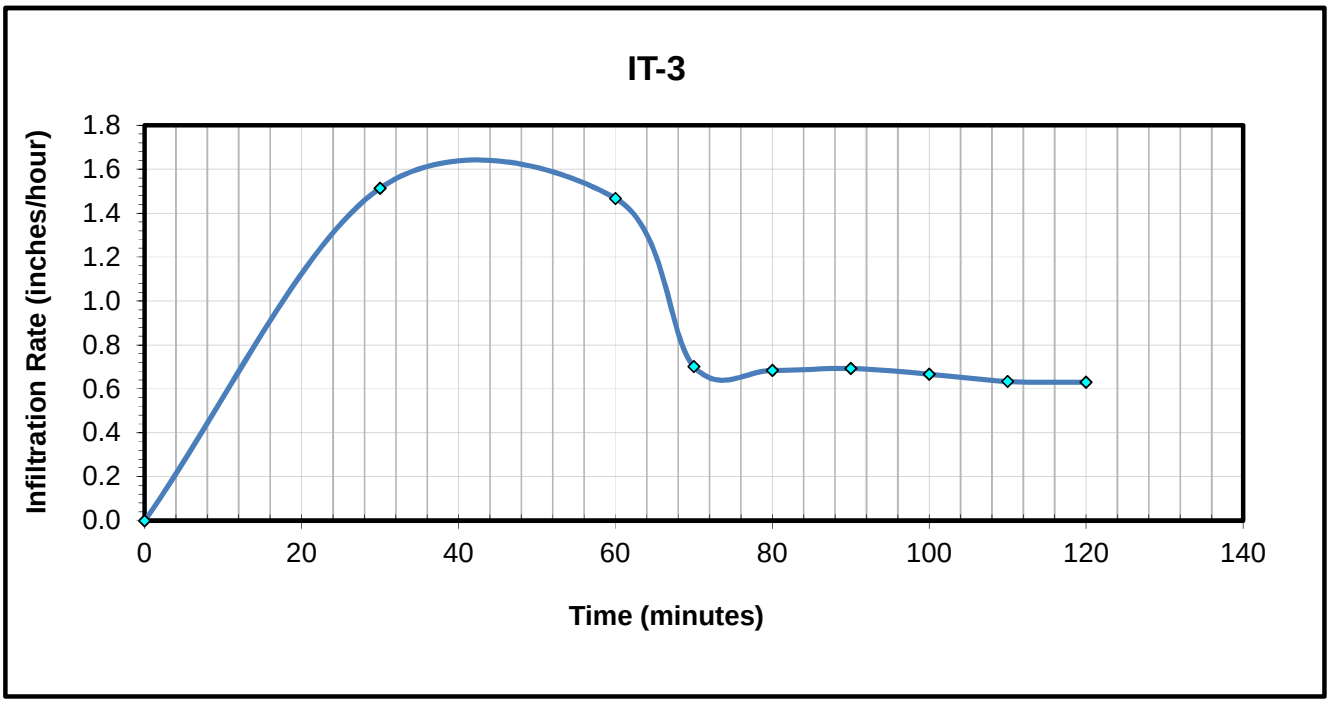
RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE						
Project #	**112-23140**				**Date**	**11/30/2023**
Project Name	Proposed Self Storage Victorville					
Project Address	APN: 3105-291-01, Victorville, CA					
Test No:	IT-2	**Total Depth (in.)**		60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM/SP		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0		11.0	--	--
1	30	30	11.0	45.0	34.00	4.00
2	60	30	12.0	45.0	33.00	3.94
3	70	10	12.0	18.0	6.00	1.53
4	80	10	18.0	23.1	5.10	1.48
5	90	10	23.1	27.5	4.40	1.44
6	100	10	27.5	31.4	3.90	1.44
7	110	10	31.4	34.7	3.30	1.37
8	120	10	34.7	37.7	3.00	1.40
	Infiltration Rate in Inches per Hour					**1.37**



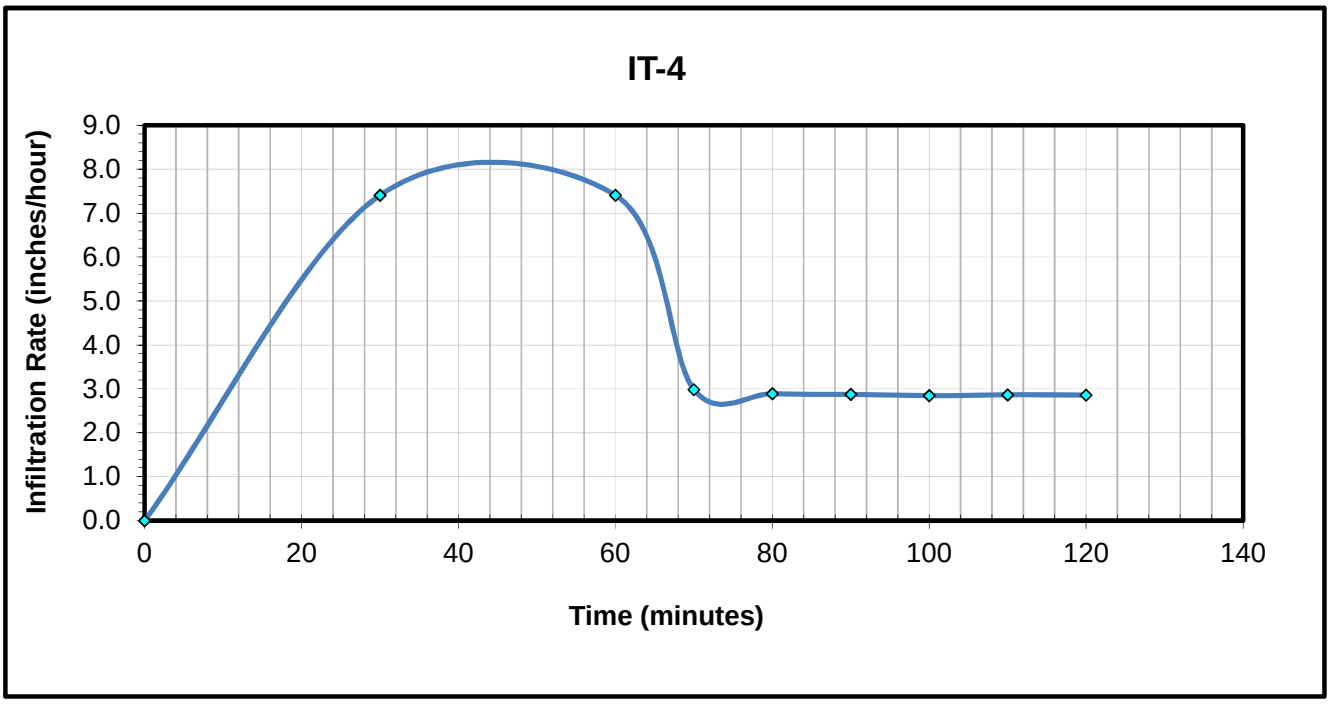
RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE						
Project #	**112-23140**				**Date**	**11/30/2023**
Project Name	Proposed Self Storage Victorville					
Project Address	APN: 3105-291-01, Victorville, CA					
Test No:	IT-3	**Total Depth (in.)**		60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM/SP		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0		18.0	--	--
1	30	30	18.0	32.0	14.00	1.51
2	60	30	12.0	27.5	15.50	1.47
3	70	10	18.0	20.5	2.50	0.70
4	80	10	20.5	22.8	2.30	0.68
5	90	10	22.8	25.0	2.20	0.69
6	100	10	25.0	27.0	2.00	0.67
7	110	10	27.0	28.8	1.80	0.63
8	120	10	28.8	30.5	1.70	0.63
	Infiltration Rate in Inches per Hour					**0.63**



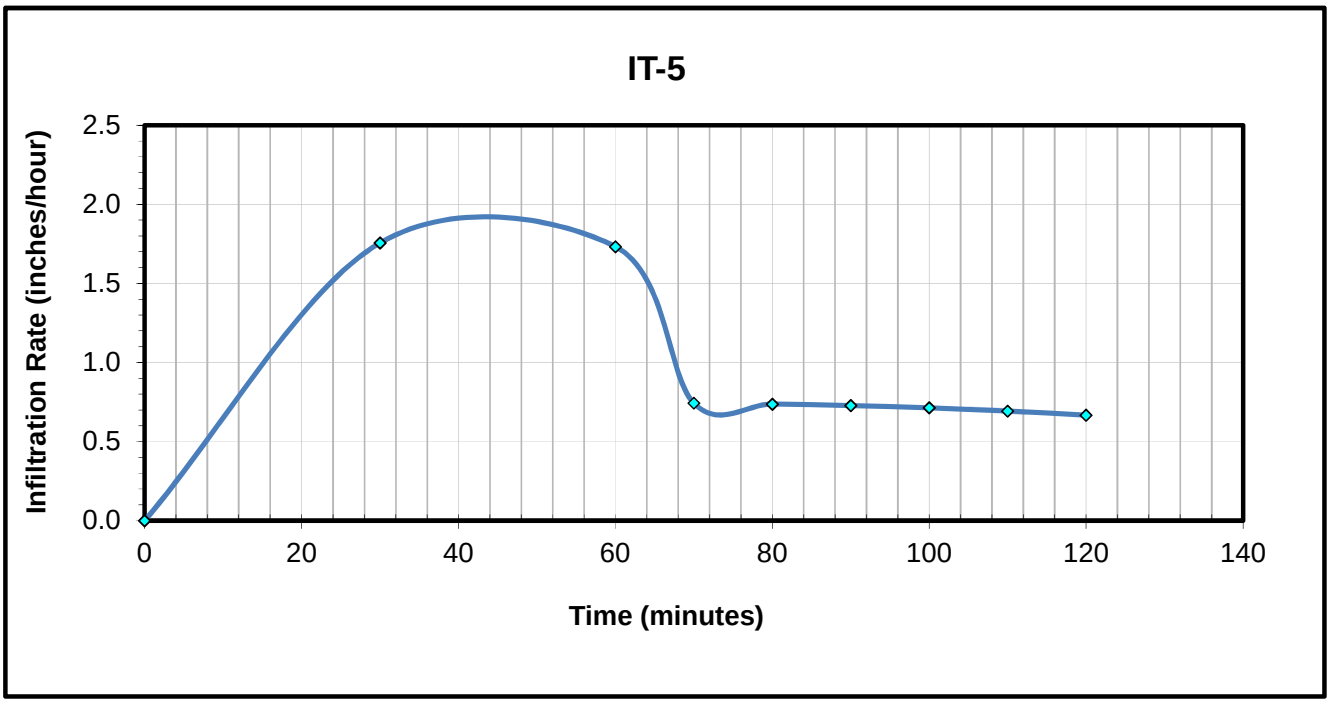
RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE						
Project #	**112-23140**				**Date**	**11/30/2023**
Project Name	Proposed Self Storage Victorville					
Project Address	APN: 3105-291-01, Victorville, CA					
Test No:	IT-4	**Total Depth (in.)**		60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM/SP		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0		10.0	--	--
1	30	30	10.0	60.0	50.00	7.41
2	60	30	10.0	60.0	50.00	7.41
3	70	10	10.0	21.5	11.50	2.98
4	80	10	21.5	30.2	8.70	2.89
5	90	10	30.2	37.0	6.80	2.87
6	100	10	37.0	42.3	5.30	2.85
7	110	10	42.3	46.5	4.20	2.86
8	120	10	46.5	49.8	3.30	2.86
	Infiltration Rate in Inches per Hour					**2.85**



RESULTS OF INFILTRATION TESTS - REVERSE BOREHOLE						
Project #	**112-23140**				**Date**	**11/30/2023**
Project Name	Proposed Self Storage Victorville					
Project Address	APN: 3105-291-01, Victorville, CA					
Test No:	IT-5	**Total Depth (in.)**		60	**Test Size (in)**	8
Depth To Water	>>50'	**Soil Classification**		SM/SP		

Reading	Elasped Time(min.)	Incremental Time (min.)	Initial Depth To Water(in.)	Final Depth To Water(in.)	Incremental Fall of Water(in.)	Incremental Infiltration Rate (in/hr)
Start	0	0		12.0	--	--
1	30	30	12.0	30.0	18.00	1.76
2	60	30	12.0	29.8	17.80	1.73
3	70	10	12.0	15.0	3.00	0.74
4	80	10	15.0	17.8	2.80	0.74
5	90	10	17.8	20.4	2.60	0.73
6	100	10	20.4	22.8	2.40	0.71
7	110	10	22.8	25.0	2.20	0.69
8	120	10	25.0	27.0	2.00	0.67
	Infiltration Rate in Inches per Hour					**0.67**



Patel & Associates, Inc.
12284 Industrial Blvd Suite 2-A, Victorville CA 92395
(760) 243-1436

August 1, 2022

Project No. V22095-10A

Mr. Chad McKillop

Subject: **Preliminary Geotechnical Interpretive Report, Proposed Commercial Development, Assessor's Parcel Number 3105-291-01-0000, Located on Amethyst Road, Victorville Area, San Bernardino County, California**

Patel & Associates is pleased to present our preliminary geotechnical interpretive report for the proposed commercial development, Assessor's Parcel Number 3105-291-01-0000, located on Amethyst Road in the Victorville Area, San Bernardino County, California. This work was performed in accordance with the scope of work described in our proposal, dated January 21, 2022. The purpose of this study is to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development.

Patel & Associates appreciates the opportunity to offer our consultation and advice on this project. In the event that you have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Respectfully submitted,

PATEL & ASSOCIATES, INC.

Stephen M. Poole, PE, GE
Principal Engineer

SMP/mw/vh/sez

TABLE OF CONTENTS

Section **Page**

Attachments:

INTRODUCTION

Patel & Associates is pleased to present our preliminary geotechnical interpretive report for the proposed development. The purpose of this study was to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development, and then provide preliminary grading and foundation design recommendations based on the plans you provided. The general location of the subject property is indicated on the Vicinity Map, Figure 1. The plans you provided were used as the base map to show geologic conditions within the subject site, see Geotechnical Map, Plate 1.

SITE DESCRIPTION

The subject property is located on Amethyst Road in the Victorville Area, San Bernardino County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

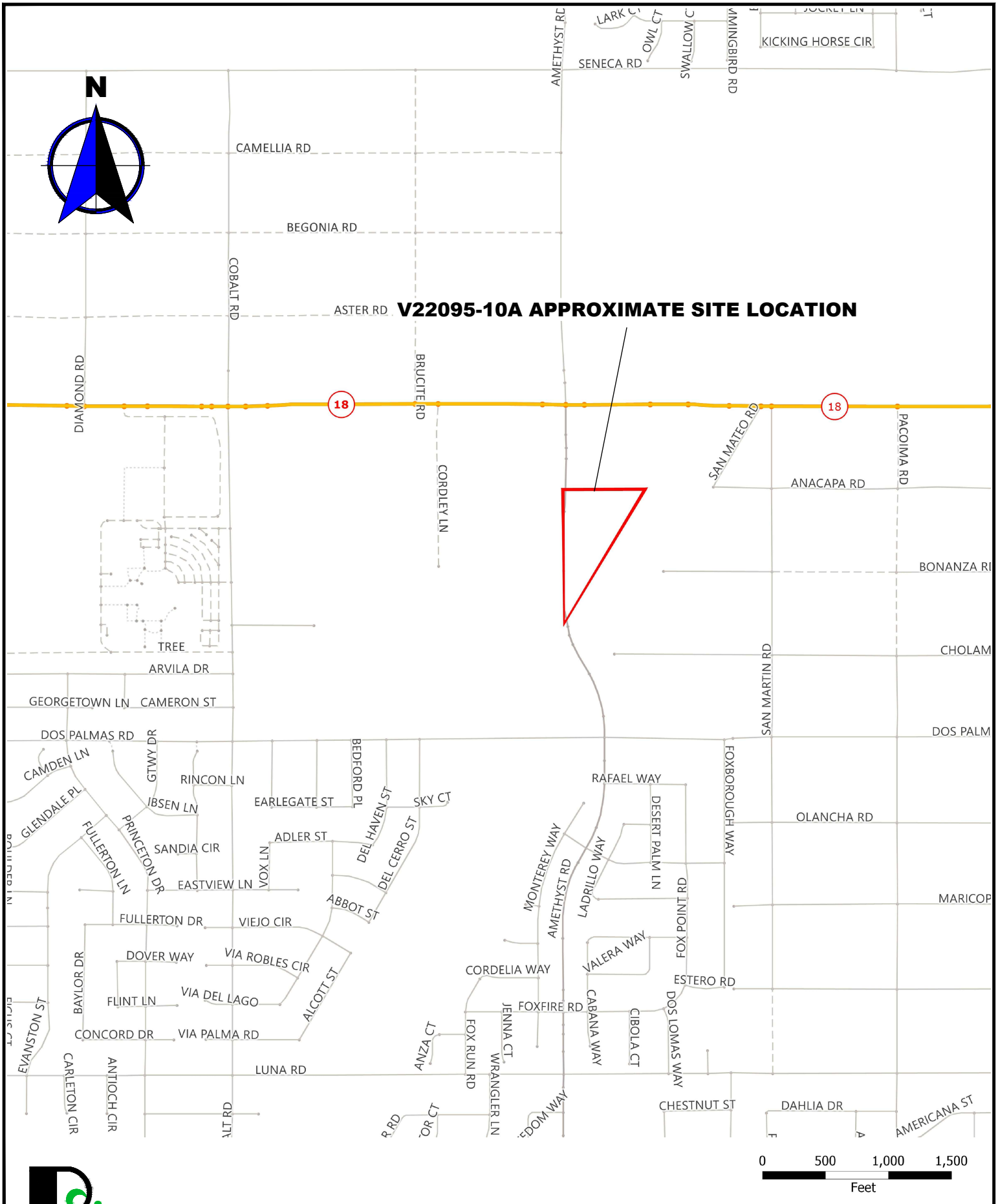
The subject property is comprised of approximately 8.14-acres of undeveloped land. Topographic relief at the subject property is relatively low with the terrain being generally flat. Elevations at the site range from approximately 3,076 to 3,094 feet above mean sea level (msl), for a difference of about 18± feet across the entire site. Drainage within the subject property generally flows to the northwest.

The site is currently bordered by vacant property to the North, East, South and West. Most of the vegetation on the site consists of moderate to dense amounts of annual weeds/grasses.

PROPOSED DEVELOPMENT AND GRADING

The proposed commercial development is expected to consist of concrete, wood or steel framed one- and/or two-story structures utilizing slab on grade construction with associated streets, landscape areas, and utilities. The current development plans include fourteen (14) building pads positioned throughout the site.

Formal plans have not been prepared and await the conclusions and recommendations of this report.



D&A INC.

Commitment of Excellence through Engineered Solution

PROPOSED COMMERCIAL DEVELOPMENT	V22095-10A
VICINITY MAP	SEE BAR SCALE
	JULY 2022 / FIGURE 1

FIELD EXPLORATION AND LABORATORY TESTING

Field Exploration

Subsurface exploration within the subject site was performed on February 10, 2022 for the exploratory excavations. A truck mounted hollow-stem-auger drill rig was utilized to drill 5 borings throughout the site to a maximum depth of 40 feet.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions may have been reconciled to reflect laboratory test results with regard to ASTM D 2487.

Associated with the subsurface exploration was the collection of bulk (disturbed) samples and relatively undisturbed samples of earth materials for laboratory testing and analysis. The relatively undisturbed samples were obtained with a 3 inch outside diameter modified California split-spoon sampler lined with 1-inch-high brass rings. Samples obtained using a hollow stem auger drill rig, were mechanically driven with successive 30 inch drops of a 140-pound automatic trip safety hammer. The blow count per one-foot increment was recorded in the boring logs. The central portions of the driven samples were placed in sealed containers and transported to our laboratory for testing and analysis. The approximate exploratory locations are shown on Plate 1 and descriptive logs are presented in Appendix B.

Laboratory Testing

Maximum dry density/optimum moisture content, expansion potential, R-value, pH, resistivity, sulfate content, chloride content, and in-situ density/moisture content were determined for selected undisturbed and bulk samples of earth materials, considered representative of those encountered. An evaluation of the test data is reflected throughout the Conclusions and Recommendations section of this report. A brief description of laboratory test criteria and summaries of test data are presented in Appendix C.

FINDINGS

Mojave Desert Province

Regionally, the site is located in the Mojave Desert Province of California. The Mojave Desert Province is located in the southeastern corner of the state with the left lateral, vertical Garlock Fault making up the northern boundary of the province. The province is characterized by a more subdued topography due to extensive and deeper erosion than the Basin and Range Province. Due to a greater predominance of alluvial cover, the Mojave Desert Province has fewer exposures of all bedrock units, and a lack of the extension that has affected the Basin and Range Province. The topography is primarily a result of climatic changes during the last million years which are largely responsible for most landscape features in the Mojave region today. The character of modern alluvial fans, pediment surfaces, and playas, and the vegetation they support, reflect conditions that have evolved primarily within the past several thousand years. In addition to climate, the physical characteristics of the modern topographic features are tied to the properties of bedrock and tectonic history of any particular location. A map of the regional geology is presented on the Regional Geologic Map, Figure 2.

Local Geology

The earth materials on the site are primarily comprised of Quaternary alluvial materials. A general description of the dominant earth materials observed on the site is provided below:

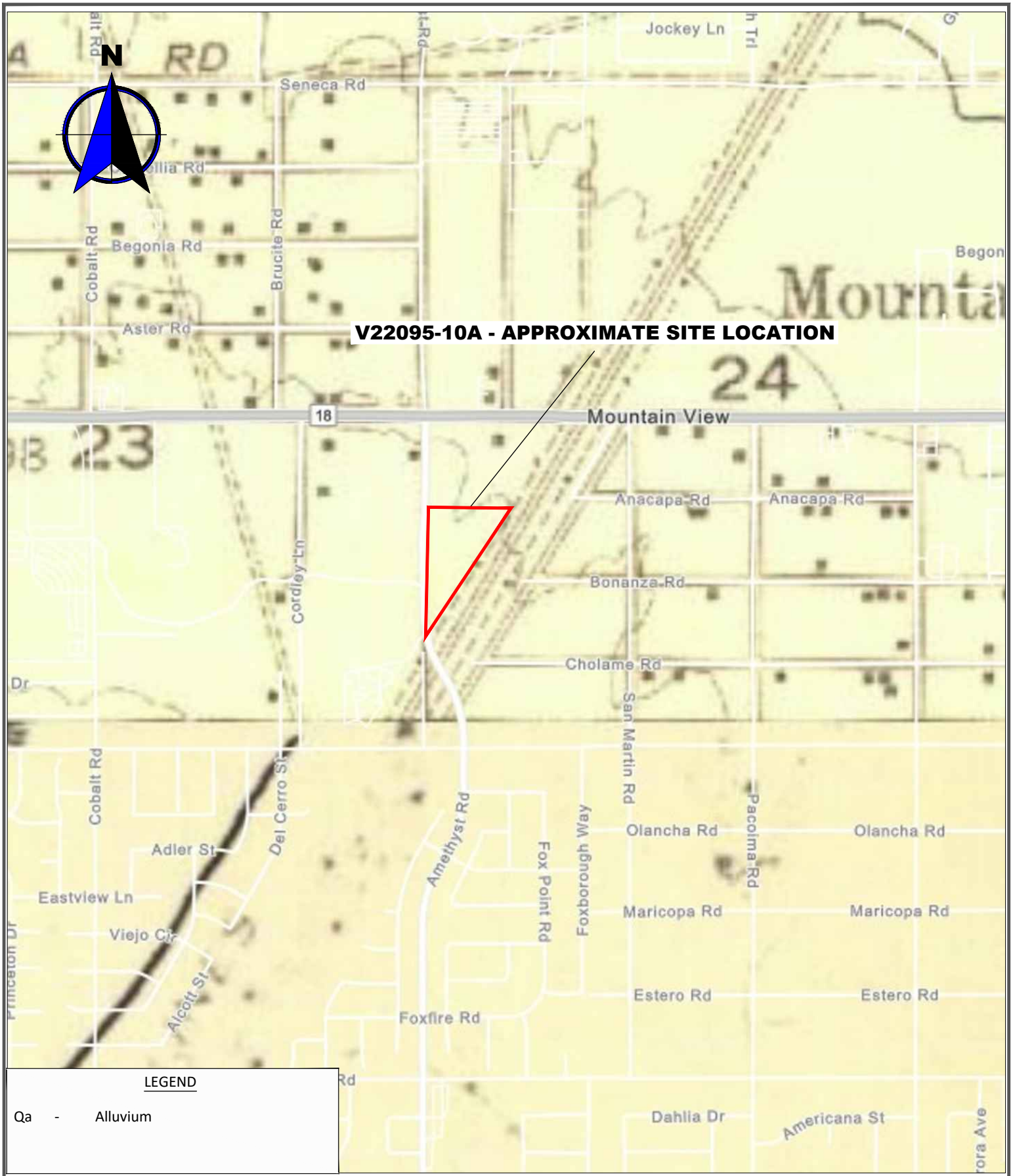
- Quaternary Alluvium (map symbol Qal): Quaternary alluvium was encountered to a maximum depth of 21.5 feet. These alluvial deposits consist predominately of interlayered light brown to light tab, clayey sand, and occasional sandy silt. These deposits were generally noted to be in a slightly moist, dense state.

Faulting

The project is located in a seismically active region and as a result, significant ground shaking will likely impact the site within the design life of the proposed project. The geologic structure of the entire southern California area is dominated by northwest-trending faults associated with the San Andreas Fault system, which accommodates for most of the right lateral movement associated with the relative motion between the Pacific and North American tectonic plates. Known active faults within this system include the Newport-Inglewood, Whittier-Elsinore, San Jacinto and San Andreas Faults.

No active faults are known to project through the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone, established by the State of California to restrict the construction of new habitable structures across identifiable traces of known active faults. An active fault is defined by the State of California as having surface displacement within the past 11,000 years or during the Holocene geologic time period. Based on our mapping of the subject site, review of current and historical aerial imagery, lack of lineaments indicative of active faulting, and the data compiled during the preparation of this report, it is our interpretation that the potential for surface rupture to adversely impact the proposed structures is very low to remote.

Based on our review of regional geologic maps and applicable computer programs (USGS Seismic Design Maps, Caltrans ARS online, and USGS Earthquake Hazard Programs), the North Frontal Fault with an approximate source to site distance of 18.51 kilometers is the closest known active fault anticipated to produce the highest ground accelerations, with an anticipated maximum modal magnitude of 7.20. A list of faults as well as a list of significant historical seismic events within a 100km radius of the subject site are included in Appendix D.



LEGEND

Qa - Alluvium

REFERENCES: Dibblee, T.W., 1960, Preliminary geologic map of the Victorville quadrangle, California, U.S. Geological Survey, Mineral Investigations Field Studies Map MF-229, 1:62,500.

D&A INC.
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PROPOSED COMMERCIAL DEVELOPMENT		V22095-10A
REGIONAL GEOLOGIC MAP	SCALE 1:40,625	
	JULY 2022	FIGURE 2

Landslides

Landslide debris was not observed during our subsurface exploration and no ancient landslides are known to exist on the site. No landslides are known to exist, or have been mapped, in the vicinity of the site. Geologic mapping of the site conducted during our investigation, and review of aerial imagery of the site, reveal no geomorphic expressions indicative of landsliding.

CONCLUSIONS AND RECOMMENDATIONS

General

From geotechnical and engineering geologic points of view, the subject property is considered suitable for the proposed development, provided the following conclusions and recommendations are incorporated into the plans and are implemented during construction.

Earthwork

Earthwork and Grading

The provisions of the 2019 California Building Code (CBC), including the General Earthwork and Grading Specifications in the last Appendix of this report, should be applied to all earthwork and grading operations, as well as in accordance with all applicable grading codes and requirements of the appropriate reviewing agency. Unless specifically revised or amended herein, grading operations should also be performed in accordance with applicable provisions of our General Earthwork and Grading Specifications within the last appendix of this report.

Clearing and Grubbing

Vegetation including trees, grasses, weeds, brush, shrubs, or any other debris should be stripped from the areas to be graded and properly disposed of offsite. In addition, laborers should be utilized to remove any roots, branches, or other deleterious materials during grading operations.

Patel & Associates should be notified at the appropriate times to provide observation and testing services during Clearing and Grubbing operations. Any buried structures or unanticipated conditions should be brought to our immediate attention.

Excavation Characteristics

Based on the results of our exploration and experience with similar projects in similar settings, the near surface earth materials, will be readily excavated with conventional earth moving equipment.

Groundwater

Groundwater was not observed during our subsurface exploration and should not be a factor during grading operations.

Ground Preparation for Fill Areas

For each area to receive compacted fill, the removal of low density, compressible earth materials, such as topsoil, upper alluvial materials, and undocumented artificial fill, should continue until firm competent alluvium is encountered. Removal excavations are subject to verification by the project engineer, geologist or their representative. Prior to placing compacted fills, the exposed bottom in each removal area should be scarified to a depth of 6 inches or more, watered or air dried as necessary to achieve near optimum moisture conditions and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557.

The intent of remedial grading is to diminish the potential for hydro-consolidation, slope instability, and/or settlement. Remedial grading should extend beyond the perimeter of the proposed structures a horizontal distance equal to the depth of excavation or a minimum of 5 feet, whichever is greater. For cursory purposes the anticipated removal depths are shown on the enclosed Geotechnical Map, Plate 1. In general, the anticipated removal depths should vary from 3 to 5 feet below existing grade in structural areas, and 2 to 3 feet in parking and drive aisle areas.

Wet Removals

Wet alluvial materials will probably not be encountered within the low lying areas of the site. If removals of wet alluvial materials are required, special grading equipment and procedures can greatly reduce overall costs. Careful planning by an experienced grading contractor can reduce the need for special equipment, such as swamp cats, draglines, excavators, pumps, and top loading earthmovers. Possible solutions may include the placement of imported angular rock and/or geotextile ground reinforcement. More specific recommendations can be provided based on the actual conditions encountered. Drying or mixing of wet materials with dry materials will be needed to bring the wet materials to near optimum moisture prior to placing wet materials into compacted fills.

Oversize Rock

Oversize rock is not expected to be encountered during grading. Oversize rock that is encountered (i.e., rock exceeding a maximum dimension of 12 inches) should be disposed of offsite or stockpiled onsite and crushed for future use. The disposal of oversize rock is discussed in greater detail in General Earthwork and Grading Specifications within the last appendix of this report.

Compacted Fill Placement

Compacted fill materials should be placed in 6 to 8 inch maximum (uncompacted) lifts, watered or air dried as necessary to achieve uniform near optimum moisture content and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557.

Import Earth Materials

Should import earth materials be needed to achieve final design grades, all potential import materials should be free of deleterious/oversize materials, non-expansive, and approved by the project geotechnical consultant prior to delivery onsite.

Fill Slopes

When properly constructed, fill slopes up to 10 feet high with inclinations of 2:1 (h:v) or flatter are considered to be grossly stable. Keyways are required at the toe of all fill slopes higher than 5 feet and steeper than 5:1 (h:v). Keyways should be a minimum of 10 feet wide and 2 feet into competent earth materials, as measured on the downhill side. In order to establish keyway removals, backcuts should be cut no steeper than 1:1 or as recommended by the geotechnical engineer or engineering geologist. Compacted fill should be benched into competent earth materials.

Cut Slopes

When properly constructed, cut slopes into alluvium up to 10 feet high with inclinations of 2:1 (h:v) or flatter are considered generally stable. Cut slopes should be observed by the engineering geologist or his representative during grading, but are anticipated to be stable.

Stabilization Fills

Currently, stabilization fills will not be required for cut slopes in the alluvium. Our engineering geologist or his representative should be called to evaluate all slopes during grading. In the event that unfavorable geologic conditions are encountered, recommendations for stabilization fills or flatter slopes will be provided.

Fill Over Cut Slopes

The fill portion of fill over cut slopes should not be constructed until the cut portion of the slope has been cut to finish grade. The earth materials and geologic structure exposed along the cut slope should be evaluated with regard to suitability for compacted fills or foundations and for stability. If the cut materials are determined to be competent, then the construction of the keyway and subdrain system may commence or additional remedial recommendations will be provided.

Cut/Fill Transitions

Cut/fill transitions should be eliminated from all building areas where the depth of fill placed within the "fill" portion exceeds proposed footing depths. This is to diminish distress to structures resulting from excessive differential settlement. The entire foundation of each structure should be founded on a uniform bearing material. This should be accomplished by overexcavating the "cut" portion and replacing the excavated materials as properly compacted fill. Refer to the following table for recommended depths of overexcavation.

DEPTH OF FILL ("fill" portion)	DEPTH OF OVEREXCAVATION ("cut" portion)
Up to 5 feet	Equal Depth
5 to 10 feet	5 feet
Greater than 10 feet	One-half the thickness of fill placed on the "fill" portion (10 feet maximum)

Overexcavation of the "cut" portion should extend beyond the building perimeter a horizontal distance equal to the depth of overexcavation or a minimum of 5 feet, whichever is greater.

Cut Areas

In cut areas, an area a minimum of 5 feet beyond the footprint of the proposed structures should overexcavated until; competent bottoms are achieved; to a minimum 3 feet below the proposed foundations; or per the Overexcavation Table above; (whichever is greater) and replaced with compacted fill. Final determination of areas that require overexcavation should be determined in the field by a representative of Patel & Associates.

Shrinkage, Bulking and Subsidence

Volumetric changes in earth material quantities will occur when poorly consolidated earth materials are replaced with properly compacted fill. Estimates of the percent shrinkage/bulking factors for the various geologic units observed on the subject property are based on in-place densities and on the estimated average percent of relative compaction achieved during grading.

GEOLOGIC UNIT	SHRINKAGE (%)
Alluvium	5 to 10

Subsidence from scarification and recompaction of exposed bottom surfaces is expected to be negligible to approximately 0.01 foot.

The estimates of shrinkage/bulking and subsidence are intended as an aid for project engineers in determining earthwork quantities. Since many variables can affect the accuracy of these estimates, they should be used with caution and contingency plans should be in place for balancing the project.

Geotechnical Observations

Clearing operations, removal of unsuitable materials, and general grading procedures should be observed by the project geotechnical consultant or his representative. No compacted fill should be placed without observations by the geotechnical consultant or his representative to verify the adequacy of the removals.

The project geotechnical consultant or his representative should be present to observe grading operations and to check that minimum compaction requirements and proper lift thicknesses are being met, as well as to verify compliance with the other recommendations presented herein.

Post Grading Considerations

Slope Landscaping and Maintenance

Adequate slope and building pad drainage is essential for the long term performance of the subject site. The gross stability of graded slopes should not be adversely affected, provided all drainage provisions are properly constructed and maintained. Engineered slopes should be landscaped with deep rooted, drought tolerant maintenance free plant species, as recommended by the project landscape architect.

Site Drainage

Control of site drainage is important for the performance of the proposed project. Roof gutters are recommended for the proposed structures. Pad and roof drainage should be collected and transferred to driveways, adjacent streets, storm-drain facilities, or other locations approved by the building official in non-erosive drainage devices. Drainage should not be allowed to pond on the pad or against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters located within retaining wall backfill should be sealed to prevent moisture intrusion into the backfill. Planters located next to structures should be sealed to the depth of the footings. Drainage control devices require periodic cleaning, testing and maintenance to remain effective.

At a minimum, pad drainage should be designed at the minimum gradients required by the CBC. To divert water away from foundations, the ground surface adjacent to foundations should also be graded at the minimum gradients required per the CBC.

Utility Trenches

All utility trench backfill should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557. For utility trench backfill within pavement areas the upper 6 inches of subgrade materials should be compacted to 95 percent of the maximum dry density determined by ASTM D 1557. This includes within the street right-of-ways, utility easements, under footings, sidewalks, driveways and building floor slabs, as well as within or adjacent to any slopes. Backfill should be placed in approximately 6 to 8 inch maximum loose lifts and then mechanically compacted with a hydro-hammer, rolling with a sheepsfoot, pneumatic tampers, or similar equipment. The utility trenches should be tested by the project geotechnical engineer or their representative to verify minimum compaction requirements are obtained.

In order to minimize the penetration of moisture below building slabs, all utility trenches should be backfilled with compacted fill, lean concrete or concrete slurry where they undercut the perimeter foundation. Utility trenches that are proposed parallel to any building footings (interior and/or exterior trenches), should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the footing.

SEISMIC DESIGN CONSIDERATIONS

Ground Motions

Structures are required to be designed and constructed to resist the effects of seismic ground motions as provided in the 2019 California Building Code Section 1613. The design is dependent on the site class, occupancy category I, II, III, or IV, mapped spectral accelerations for short periods (S_s), and mapped spectral acceleration for a 1-second period (S_1).

In order for structural design to comply with the 2019 CBC, the USGS "US Seismic Design Maps" online tool was used to compile spectral accelerations for the subject property based on data and maps jointly compiled by the United States Geological Survey (USGS) and the California Geological Survey (CGS). The data found in the following table is based on the Maximum Considered Earthquake (MCE) with 5% damped ground motions having a 2% probability of being exceeded in 50 years (2,475 year return period).

The seismic design coefficients were determined by a combination of the site class, mapped spectral accelerations, and occupancy category. The following seismic design coefficients should be implemented during design of the proposed structures. Summaries of the Seismic Hazard Deaggregation graphs and test data are presented in Appendix D.

2019 CBC	FACTOR (ASCE 7-16)
Site Location	Latitude: 34.504134° (North) Longitude: -117.363748°(West)
Site Class	D - Default
Mapped Spectral Accelerations for short periods, S_s	1.227g
Mapped Spectral Accelerations for 1-Second Period, S_1	0.476g
Maximum Considered Earthquake Spectral Response Acceleration for Short Periods, S_{ms}	1.472g
Maximum Considered Earthquake Spectral Response Acceleration for 1-Second Period, S_{m1}	Null – Section 11.4.8*
Design Spectral Response Acceleration for Short Periods, S_{DS}	0.982g
Design Spectral Response Acceleration for 1-Second Period, S_{D1}	Null – Section 11.4.8*
Seismic Design Category	D
Importance Factor Based on Occupancy Category	II

*2019 CBC

We performed the probabilistic seismic hazard assessment for the site in accordance with the 2019 CBC, Section 1803.5.11 and 1803.5.12. The probabilistic seismic hazard maps and data files were jointly prepared by the United States Geological Survey (USGS) and the California Geological Survey (CGS) and can be found at the CGS Probabilistic Seismic Hazards Mapping Ground Motion Page. Actual ground shaking intensities at the site may be substantially higher or lower based on complex variables such as the near source directivity effects, depth and consistency of earth materials, topography, geologic structure, direction of fault rupture, and seismic wave reflection, refraction, and attenuation rates. The mean peak ground acceleration was calculated to be 0.6g.

Secondary Seismic Hazards

Secondary effects of seismic shaking considered as potential hazards include several types of ground failure as well as induced flooding. Different types of ground failure, which could occur as a consequence of severe ground shaking at the site, include landslides, ground lurching, shallow ground rupture, and liquefaction/lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, the state of subsurface earth materials, groundwater conditions, and other factors. Based on our experience, subsurface exploration, and laboratory testing, all of the above secondary effects of seismic activity are considered unlikely.

Seismically induced flooding is normally a consequence of a tsunami (seismic sea wave), a seiche (i.e., a wave-like oscillation of surface water in an enclosed basin that may be initiated by a strong earthquake) or failure of a major reservoir or retention system up gradient of the site. Since the site is at an elevation of more than 3,000 feet above mean sea level and is located more than 70 miles inland from the nearest coastline of the Pacific Ocean, the potential for seismically induced flooding due to a tsunami is considered nonexistent. Since no enclosed bodies of water lie adjacent to or up gradient of the site, the likelihood for induced flooding due to a dam failure or a seiche overcoming the dam's freeboard is considered nonexistent.

Liquefaction and Lateral Spreading

Liquefaction occurs as a result of a substantial loss of shear strength or shearing resistance in loose, saturated, cohesionless earth materials subjected to earthquake induced ground shaking. Potential impacts from liquefaction include loss of bearing capacity, liquefaction related settlement, lateral movements, and surface manifestation such as sand boils. Seismically induced settlement occurs when loose sandy soils become denser when subjected to shaking during an earthquake. The three factors determining whether a site is likely to be subject to liquefaction include seismic shaking, type and consistency of earth materials, and groundwater level. The proposed structures will be supported by compacted fill and competent alluvium, with no shallow groundwater. As such, the potential for earthquake induced liquefaction and lateral spreading beneath the proposed structures is considered very low to remote due to the recommended compacted fill, relatively low groundwater level, and the dense nature of the deeper onsite earth materials.

TENTATIVE FOUNDATION DESIGN RECOMMENDATIONS

General

Provided grading is performed in accordance with the recommendations of this report, shallow foundations are considered feasible for support of the proposed structures. Tentative foundation recommendations are provided herein and graphic presentations of relevant recommendations may also be included on the enclosed map.

Allowable Bearing Values

An allowable bearing value of 3,000 pounds per square foot (psf) is recommended for design of 24-inch square pad footings and 12-inch-wide continuous footings founded at a minimum depth of 12 inches below

the lowest adjacent final grade. This value may be increased by 20 percent for each additional 1-foot of width and/or depth to a maximum value of 3,500 psf. Recommended allowable bearing values include both dead and frequently applied live loads and may be increased by one third when designing for short duration wind or seismic forces.

Settlement

Based on the settlement characteristics of the earth materials that underlie the building sites and the anticipated loading, we estimate that the maximum total settlement of the footings will be less than approximately ¾ inch. Differential settlement is expected to be about ½ inch over a horizontal distance of approximately 20 feet, for an angular distortion ratio of 1:480. It is anticipated that the majority of the settlement will occur during construction or shortly after the initial application of loading.

The above settlement estimates are based on the assumption that the grading and construction are performed in accordance with the recommendations presented in this report and that the project geotechnical consultant will observe or test the earth material conditions in the footing excavations.

Lateral Resistance

Passive earth pressure of 250 psf per foot of depth to a maximum value of 2,500 psf may be used to establish lateral bearing resistance for footings. For areas covered with hardscape, passive earth pressure may be taken from the surface. For areas without hardscape, the first 12-inches feet of the soil profile must be neglected when calculating passive earth pressure. A coefficient of friction of 0.36 times the dead load forces may be used between concrete and the supporting earth materials to determine lateral sliding resistance. The above values may be increased by one-third when designing for short duration wind or seismic forces. When combining passive and friction for lateral resistance, the passive component should be reduced by one third. In no case shall the lateral sliding resistance exceed one-half the dead load for clay, sandy clay, sandy silty clay, silty clay, and clayey silt.

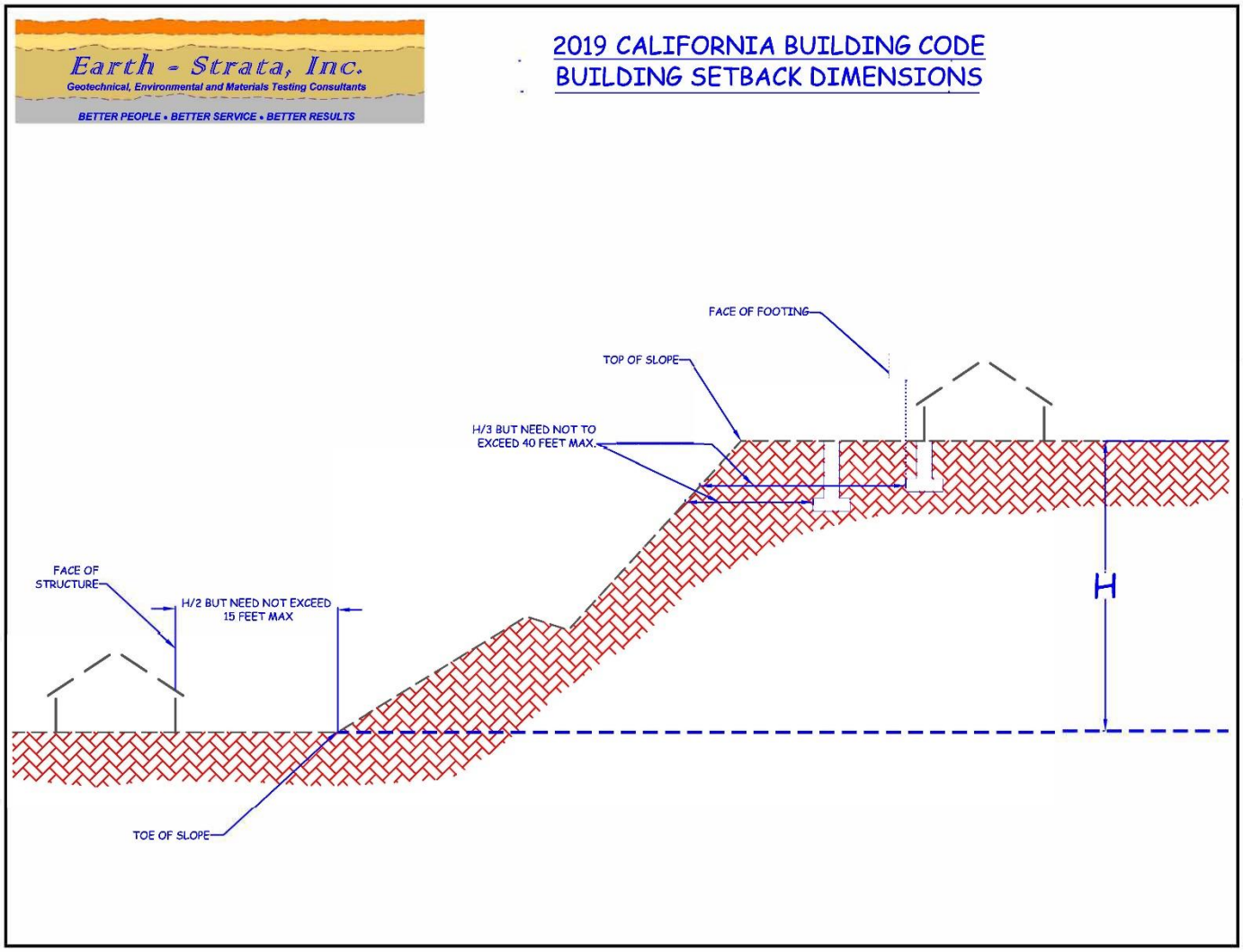
The above lateral resistance values are based on footings for an entire structure being placed directly against compacted fill.

Structural Setbacks and Building Clearance

Structural setbacks are required per the 2019 California Building Code (CBC). Additional structural setbacks are not required due to geologic or geotechnical conditions within the site. Improvements constructed in close proximity to natural or properly engineered and compacted slopes can, over time, be affected by natural processes including gravity forces, weathering, and long term secondary settlement. As a result, the CBC requires that buildings and structures be setback or footings deepened to resist the influence of these processes.

For structures that are planned near ascending and descending slopes, the footings should be embedded to satisfy the requirements presented in the CBC, Section 1808.7 as illustrated in the following Foundation Clearances from Slopes diagram.

FOUNDATION CLEARANCES FROM SLOPES



When determining the required clearance from ascending slopes with a retaining wall at the toe, the height of the slope shall be measured from the top of the wall to the top of the slope.

Foundation Observations

In accordance with the 2019 CBC and prior to the placement of forms, concrete, or steel, all foundation excavations should be observed by the geologist, engineer, or his representative to verify that they have been excavated into competent bearing materials. The excavations should be per the approved plans, moistened, cleaned of all loose materials, trimmed neat, level, and square. Any moisture softened earth materials should be removed prior to steel or concrete placement.

Earth materials from foundation excavations should not be placed in slab on grade areas unless the materials are tested for expansion potential and compacted to a minimum of 90 percent of the maximum dry density.

Expansive Soil Considerations

Preliminary laboratory test results indicate onsite earth materials exhibit an expansion potential of **VERY LOW** as classified in accordance with 2019 CBC Section 1803.5.3 and ASTM D 4829. Additional, testing for expansive soil conditions should be conducted upon completion of rough grading. The following recommendations should be considered the very minimum requirements, for the earth materials tested. It is common practice for the project architect or structural engineer to require additional slab thickness, footing sizes, and/or reinforcement.

Very Low Expansion Potential (Expansion Index of 20 or Less)

Our laboratory test results indicate that the earth materials onsite exhibit a **VERY LOW** expansion potential as classified in accordance with 2019 CBC Section 1803.5.3 and ASTM D 4829. Since the onsite earth materials exhibit expansion indices of 20 or less, the design of slab on ground foundations is exempt from the procedures outlined in Section 1808.6.1 or 1808.6.2.

Footings

- Exterior continuous footings may be founded at the minimum depths below the lowest adjacent final grade (i.e. 12-inch minimum depth for one-story, 18-inch minimum depth for two-story, and 24-inch minimum depth for three-story construction). Interior continuous footings for one-, two-, and three-story construction may be founded at a minimum depth of 12 inches below the lowest adjacent final grade. All continuous footings should have a minimum width of 12, 15, and 18 inches, for one-, two-, and three-story structures, respectively per Table 1809.7 of the 2019 CBC, and should be reinforced with a minimum of four (4) No. 4 bars, two (2) top and two (2) bottom.

- Exterior pad footings intended to support roof overhangs, such as second story decks, patio covers and similar construction should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. No special reinforcement of the pad footings will be required.

Building Floor Slabs

- Building floor slabs should be a minimum of 4 inches thick and reinforced with a minimum of No. 3 bars spaced a maximum of 24 inches on center, each way. All floor slab reinforcement should be supported on concrete chairs or bricks to ensure the desired placement at mid-depth.

- Interior floor slabs, within moisture sensitive areas, should be underlain by a minimum 10-mil thick moisture/vapor barrier to help reduce the upward migration of moisture from the underlying earth materials. The moisture/vapor barrier used should meet the performance standards of an ASTM E 1745 Class A material, and be properly installed in accordance with ACI publication 318. It is the responsibility of the contractor to ensure that the moisture/vapor barriers are free of openings, rips, or punctures prior to placing concrete. As an option for additional moisture reduction, higher strength concrete, such as a minimum 28-day compressive strength of 5,000 pounds per square inch (psi) may be used. Ultimately, the design

of the moisture/vapor barrier system and recommendations for concrete placement and curing are the purview of the foundation engineer, taking into consideration the project requirements provided by the architect and owner.

- Garage floor slabs should be a minimum of 5-inches thick and should be reinforced in a similar manner as living area floor slabs. Garage floor slabs should be placed separately from adjacent wall footings with a positive separation maintained with ⅜ inch minimum felt expansion joint materials and quartered with weakened plane joints. A 12-inch-wide turn down founded at the same depth as adjacent footings should be provided across garage entrances. The turn down should be reinforced with a minimum of four (4) No. 4 bars, two (2) top and two (2) bottom.

- The subgrade earth materials below all floor slabs should be pre-watered to promote uniform curing of the concrete and minimize the development of shrinkage cracks, prior to placing concrete. The pre-watering should be verified by Patel & Associates during construction.

Corrosivity

Corrosion is defined by the National Association of Corrosion Engineers (NACE) as "a deterioration of a substance or its properties because of a reaction with its environment." From a geotechnical viewpoint, the "substances" are the reinforced concrete foundations or buried metallic elements (not surrounded by concrete) and the "environment" is the prevailing earth materials in contact with them. Many factors can contribute to corrosivity, including the presence of chlorides, sulfates, salts, organic materials, different oxygen levels, poor drainage, different soil types, and moisture content. It is not considered practical or realistic to test for all of the factors which may contribute to corrosivity.

The potential for concrete exposure to chlorides is based upon the recognized Caltrans reference standard "Bridge Design Specifications", under Subsection 8.22.1 of that document, Caltrans has determined that "Corrosive water or soil contains more than 500 parts per million (ppm) of chlorides". Based on limited preliminary laboratory testing, the onsite earth materials have chloride contents *less* than 500 ppm. As such, specific requirements resulting from elevated chloride contents are not required.

Specific guidelines for concrete mix design are provided in 2019 CBC Section 1904.1 and ACI 318, Section 4.3 Table 4.3.1 when the soluble sulfate content of earth materials exceeds 0.1 percent by weight. Based on limited preliminary laboratory testing, the onsite earth materials are classified in accordance with Table 4.3.1 as having a *negligible* sulfate exposure condition. Therefore, structural concrete in contact with onsite earth materials should utilize Type I or II.

Based on our laboratory testing of resistivity, the onsite earth materials in contact with buried steel should be considered *corrosive*. Additionally, pH values below 5.6 and above 9.1 are recognized as being corrosive to many common metallic components. The pH values for the earth materials tested were *lower* than 9.1 and *higher* than 5.6.

The preliminary test results for corrosivity are based on limited samples, and the initiation of grading may blend various earth materials together. This blending or imported material could alter and increase the detrimental properties of the onsite earth materials. Accordingly, additional testing for chlorides and sulfates along with testing for pH and resistivity should be performed upon completion of grading. Laboratory test results are presented in Appendix C.

RETAINING WALLS

Active and At-Rest Earth Pressures

Foundations may be designed in accordance with the recommendations provided in the Tentative Foundation Design Recommendation section of this report. The following table provides the minimum recommended equivalent fluid pressures for design of retaining walls a maximum of 8 feet high. The active earth pressure should be used for design of unrestrained retaining walls, which are free to tilt slightly. The at-rest earth pressure should be used for design of retaining walls that are restrained at the top, such as basement walls, curved walls with no joints, or walls restrained at corners. For curved walls, active pressure may be used if tilting is acceptable and construction joints are provided at each angle point and at a minimum of 15 foot intervals along the curved segments.

MINIMUM STATIC EQUIVALENT FLUID PRESSURES (pcf)		
PRESSURE TYPE	BACKSLOPE CONDITION	
	LEVEL	2:1 (h:v)
Active Earth Pressure	40	63
At-Rest Earth Pressure	60	95

The retaining wall parameters provided do not account for hydrostatic pressure behind the retaining walls. Therefore, the subdrain system is a very important part of the design. All retaining walls should be designed to resist surcharge loads imposed by other nearby walls, structures, or vehicles should be added to the above earth pressures, if the additional loads are being applied within a 1.5:1 (h:v) plane projected up from the heel of the retaining wall footing. As a way of minimizing surcharge loads and the settlement potential of nearby buildings, the footings for the building can be deepened below the 1.5:1 (h:v)plane projected up from the heel of the retaining wall footing.

Upon request and under a separate scope of work, more detailed analyses can be performed to address equivalent fluid pressures with regard to stepped retaining walls, actual retaining wall heights, actual backfill inclinations, specific backfill materials, higher retaining walls requiring earthquake design motions, etc.

Subdrain System

We recommend a perforated pipe and gravel subdrain system be provided behind all proposed retaining walls to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. The perforated pipe should consist of 4-inch minimum diameter Schedule 40 PVC or ABS SDR-35, placed with the perforations facing down. The pipe should be surrounded by 1 cubic foot per foot of ¾- or 1½ inch open

graded gravel wrapped in filter fabric. The filter fabric should consist of Mirafi 140N or equivalent to prevent infiltration of fines and subsequent clogging of the subdrain system.

In lieu of a perforated pipe and gravel subdrain system, weep holes or open vertical masonry joints may be provided in the lowest row of block exposed to the air to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. Weep holes should be a minimum of 3 inches in diameter and provided at intervals at least every 6 feet along the wall. Open vertical masonry joints should be provided at a minimum of 32 inch intervals. A continuous gravel fill, a minimum of 1 cubic foot per foot, should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric consisting of Mirafi 140N or equivalent.

The retaining walls should be adequately coated on the backfilled side of the walls with a proven waterproofing compound by an experienced professional to inhibit infiltration of moisture through the walls.

Temporary Excavations

All excavations should be made in accordance with Cal-OSHA requirements. Patel & Associates is not responsible for job site safety.

Retaining Wall Backfill

Retaining wall backfill materials should be approved by the geotechnical engineer or his representative prior to placement as compacted fill. Retaining wall backfill should be placed in lifts no greater than 6 to 8 inches, watered or air dried as necessary to achieve near optimum moisture contents. All retaining wall backfill should be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D 1557. Retaining wall backfill should be capped with a paved surface drain.

CONCRETE FLATWORK

Thickness and Joint Spacing

Concrete sidewalks and patio type slabs should be at least 3½ inches thick and provided with construction or expansion joints every 6 feet or less, to reduce the potential for excessive cracking. Concrete driveway slabs should be at least 4 inches thick and provided with construction or expansion joints every 10 feet or less.

Subgrade Preparation

In order to reduce the potential for unsightly cracking, subgrade earth materials underlying concrete flatwork should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557 and then moistened to optimum or slightly above optimum moisture content. This moisture should extend to a depth of 12 inches below subgrade and be maintained prior to placement of concrete. Pre-watering of the earth materials prior to placing concrete will promote uniform curing of the concrete and minimize the development of shrinkage cracks. The project geotechnical

engineer or his representative should verify the density and moisture content of the earth materials and the depth of moisture penetration prior to placing concrete.

Cracking within concrete flatwork is often a result of factors such as the use of too high a water to cement ratio and/or inadequate steps taken to prevent moisture loss during the curing of the concrete. Concrete distress can be reduced by proper concrete mix design and proper placement and curing of the concrete. Minor cracking within concrete flatwork is normal and should be expected.

PRELIMINARY ASPHALTIC CONCRETE PAVEMENT DESIGN

Laboratory testing of representative earth materials indicate an R-value of 19 may be used for preliminary pavement design. The following table includes our minimum recommended asphaltic concrete pavement sections calculated in accordance with the State of California design procedures using assumed Traffic Indices. Final pavement design should be based on sampling and testing of post grading conditions. Alternative pavement sections and calculation sheets have been provided within the appendices of this report.

PRELIMINARY ASPHALTIC CONCRETE PAVEMENT DESIGN			
PARAMETERS	**AUTO PARKING**	**AUTO DRIVES**	**ENTRANCES/TRUCK DRIVES**
Assumed Traffic Index	5.0	6.0	7.0
Design R-Value	19	19	19
AC Thickness (inches)	3	3	4
AB Thickness (inches)	7.2	10.8	12

Notes: AC – Asphaltic Concrete
AB – Aggregate Base

The subgrade earth materials immediately below the aggregate base (base) should be compacted to a minimum of 95 percent of the maximum dry density determined by ASTM D 1557 to a minimum depth of 12 inches. Base materials should be compacted to a minimum of 95 percent of the maximum dry density determined by ASTM D 1557.

The minimum requirements for the Portland cement shall be a six-sack mix and 3,500 pounds per square inch at 28 days.

PRELIMINARY PORTLAND CONCRETE PAVEMENT DESIGN		
Design R-Value	**Traffic Index**	**Pavement Section**
19	6.0	8-inches PCC over 6" AB

Notes: PPC – Portland Cement Concrete

Base materials should consist of Class 2 aggregate base conforming to Section 26-1.02B of the State of California Standard Specifications or crushed aggregate base conforming to Section 200-2 of the Standard Specifications for Public Works Construction (Greenbook). Base materials should be compacted at or

slightly below optimum moisture content. Asphaltic concrete materials and construction operations should conform to Section 203 of the Greenbook.

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **Mr. Chad McKillop** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Patel & Associates should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Patel & Associates not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

We recommend that Patel & Associates be retained to provide geologic and geotechnical engineering services during grading and foundation excavation phases of the work. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Patel & Associates should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Patel & Associates based on the conditions revealed during grading and construction.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

APPENDIX A

REFERENCES

APPENDIX A

References

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APPENDIX B

EXPLORATORY LOGS

Geotechnical Boring Log B-1

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	39	2.5'	108.8	2.0	SC	Clayey SAND; light brown, slightly moist, dense
					SM	Silty SAND; light tan, slightly moist, dense
5	48	5'	113.5	5.4		
	33	7.5'	107.1	0.5		
					SP-SM	Poorly-Graded SAND with Silt; light tan, slightly moist, dense
10	52	10'	115.4	0.4		
					SM	Silty SAND; brown, slightly moist, dense
15	36	15'	118.9	0.7		
20	49	20'	128.7	0.5		
25						
30						

Geotechnical Boring Log B-1

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-2

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	47	2.5'	119.4	0.6	SC	Clayey SAND; light brown, slightly moist, dense
5	35	5'	-	-		No Recovery
	34	7.5'	107.5	1.7	SM	Silty SAND; orange, slightly moist, dense
					SM	Silty SAND; light tan, slightly moist, dense
10	33	10'	119.8	0.5		
15	37	15'	122.2	2.8		
20						
25						
30						

Geotechnical Boring Log B-2

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-3

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
					SM	Silty SAND; brown, slightly moist, medium dense
	61	2.5'	116.3	1.8		
					SM	Silty SAND; brown, slightly moist, medium dense
5	30	5'	108.4	0.6		
	41	7.5'	114.3	0.6		
10	47	10'	104.9	0.6		
					SM	Silty SAND; tan, slightly moist, dense
15	48	15'	115.9	0.5		
20						
25						
30						

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Geotechnical Boring Log B-3

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-4

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	76	2.5'	117.4	2.2	SC	Clayey SAND; brown, slightly moist, dense, silt
5	70	5'	95.8	1.4	SM	Silty SAND; brown, slightly moist, dense
	56	7.5'	118.0	0.8		
10	52	10'	114.1	0.8		
					SM	Silty SAND; tan, slightly moist, dense
15	55	15'	106.1	1.2		
20						
25						
30						

Geotechnical Boring Log B-4

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-5

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
					SM	Silty SAND; brown, slightly moist, dense
	52	2.5'	-	-		
5	51	5'	114.7	1.7		
	73/11"	7.5'	118.1	1.5		
					SM	Silty SAND; brown, slightly moist, very dense, gravel
10	60	10'	104.2	1.6		
					SM	Silty SAND; tan, slightly moist, dense
15	63	15'	111.7	1.4		
20						
25						
30						

Geotechnical Boring Log B-5

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

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APPENDIX C

LABORATORY PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Procedures and Test Results

Laboratory testing provided quantitative and qualitative data involving the relevant engineering properties of the representative earth materials selected for testing. The representative samples were tested in general accordance with American Society for Testing and Materials (ASTM) procedures and/or California Test Methods (CTM).

Soil Classification: Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions were reconciled to reflect laboratory test results with regard to ASTM D 2487.

Moisture and Density Tests: For select samples moisture content was determined using the guidelines of ASTM D 2216 and dry density determinations were made using the guidelines of ASTM D 2937. These tests were performed on relatively undisturbed samples and the test results are presented on the exploratory logs.

Maximum Density Tests: The maximum dry density and optimum moisture content of representative samples were determined using the guidelines of ASTM D 1557. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-1 @ 0 - 4 feet	Clayey SAND	128.5	8.5

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 0 - 4 feet	Clayey SAND	6	Very Low

R-Value: The R-value of representative samples was determined using the guidelines of CTM 301. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	R-VALUE
B-1 @ 0 - 4 feet	Clayey SAND	19

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
B-1 @ 0 - 4 feet	Clayey SAND	7.2	530

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
B-1 @ 0 - 4 feet	Clayey SAND	0.003	Negligible

Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
B-1 @ 0 - 4 feet	Clayey SAND	90

APPENDIX D

SEISMICITY

ARS Online V3.0.2

Using the tool: Specify latitude and longitude in decimal degrees in the input boxes below. Alternatively, **Google Maps** can be used to find the site location. Specify the time-averaged shear-wave velocity in the upper 30m (Vs30) in the input box. After submitting the data, the USGS 2014 hazard data for a 975-year return period will be reported along with adjustment factors required by Caltrans Seismic Design Criteria (SDC) V2.0.

Latitude: 34.504134 **Longitude:** -117.363748 **Vs30 (m/s):** 270 Submit

Caltrans Design Spectrum (5% damping)

Period(s)	Sa_{2008}(g)	Sa_{2014}(g)	$Basin_{2008}$	$Basin_{2014}$	Near Fault Amp	Design Sa_{2008}(g)	Design Sa_{2014}(g)
PGA	0.51	0.49	1	1	1	0.51	0.49
0.10	0.89	0.85	1	1	1	0.89	0.85
0.20	1.1	1.15	1	1	1	1.1	1.15
0.30	1.1	1.25	1	1	1	1.1	1.25
0.50	0.96	1.14	1	1	1	0.96	1.14
0.75	0.8	0.91	1	1	1	0.8	0.91
1.0	0.66	0.73	1	1	1	0.66	0.73
2.0	0.38	0.39	1	1	1	0.38	0.39
3.0	0.26	0.26	1	1	1	0.26	0.26
4.0	0.19	0.19	1	1	1	0.19	0.19
5.0	0.16	0.15	1	1	1	0.16	0.15

Copy table

Deaggregation (based on 2014 hazard)

mean magnitude (for PGA)	7.1
mean site-source distance (km, for Sa at 1s)	27.5

Option: recalculate Near Fault amplification with user specified distance

Site-source distance (km): 27.5 Update

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Kilometers	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
18.51	North Frontal (West)	CA	1	49	S	reverse	0	16	50
23.33	Cleghorn	CA	3	90	V	strike slip	0	16	25
24.48	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
26.54	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
26.54	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
26.54	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
26.54	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
26.54	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
26.54	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
26.54	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
26.54	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
26.54	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
26.54	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
26.54	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
26.54	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
26.54	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
26.54	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
26.54	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike	0.2	12	206

						slip			
26.54	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512
26.54	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
26.54	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
26.54	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
26.54	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
26.54	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
26.54	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
26.54	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
26.54	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
26.54	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
26.54	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
26.54	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390
26.54	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
26.96	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
26.96	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
26.96	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306
26.96	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
26.96	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
26.96	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
29.84	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
29.84	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45

29.84	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
29.84	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
29.84	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
29.84	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
29.84	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
36.62	Cucamonga	CA	5	45	N	thrust	0	8	28
41.36	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13	43
41.36	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12	170
41.36	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13	101
47.24	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145
52.71	San Jose	CA	0.5	74	NW	strike slip	0	15	20
53.19	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
54.69	Sierra Madre	CA	2	53	N	reverse	0	14	57
54.69	Sierra Madre Connected	CA	2	51		reverse	0	14	76
54.99	North Frontal (East)	CA	0.5	41	S	thrust	0	16	27
55.25	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
55.25	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
55.25	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	136
55.25	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
55.25	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170
55.25	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196
55.76	Landers	CA	0.6	90	V	strike slip	0	15	95
56.36	Gravel Hills-Harper Lk	CA	0.7	90	V	strike slip	0	11	65

61.31	Johnson Valley (No)	CA	0.6	90	V	strike slip	0	16	35
63.00	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
63.14	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
63.97	Blackwater	CA	0.5	90	V	strike slip	0	12	60
67.24	Calico-Hidalgo	CA	1.8	90	V	strike slip	0	14	117
69.01	Raymond	CA	1.5	79	N	strike slip	0	16	22
71.98	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16	118
71.98	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	178
71.98	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15	152
71.98	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17	118
71.98	San Jacinto;A	CA	9	90	V	strike slip	0	17	71
75.63	So Emerson-Copper Mtn	CA	0.6	90	V	strike slip	0	14	54
76.69	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46
76.69	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
76.69	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
76.69	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
76.69	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
77.35	Pinto Mtn	CA	2.5	90	V	strike slip	0	16	74
77.77	Elsinore;GI+T	CA	5	90	V	strike slip	0	14	78
77.77	Elsinore;GI	CA	5	90	V	strike slip	0	13	37
77.77	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17	153

77.77	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
80.06	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12	125
80.06	S. San Andreas;BG	CA	n/a	58		strike slip	0	13	56
81.77	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
83.30	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
83.70	Verdugo	CA	0.5	55	NE	reverse	0	15	29
86.82	San Gabriel	CA	1	61	N	strike slip	0	15	71
87.65	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
87.65	Pisgah-Bullion Mtn-Mesquite Lk	CA	0.8	90	V	strike slip	0	13	88
89.31	Sierra Madre (San Fernando)	CA	2	45	N	thrust	0	13	18
90.52	Hollywood	CA	1	70	N	strike slip	0	17	17
92.02	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
92.81	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
92.81	Elsinore;T	CA	5	90	V	strike slip	0	14	52
92.81	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
95.44	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
95.79	Northridge	CA	1.5	35	S	thrust	7.4	17	33
97.25	Burnt Mtn	CA	0.6	67	W	strike slip	0	16	21
98.67	Eureka Peak	CA	0.6	90	V	strike slip	0	15	19
99.98	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27

Search Results

13 earthquakes.

Only List Earthquakes Shown on Map

Format: Magnitude

Sort: Newest First

6.3	7km SSE of Big Bear City, CA 1992-06-28 15:05:30 (UTC)	3.6 km
7.3	Landers, California Earthquake 1992-06-28 11:57:34 (UTC)	-0.1 km
6.0	6km SSW of Morongo Valley, CA 1986-07-08 09:20:44 (UTC)	9.5 km
6.6	10km SSW of Agua Dulce, CA 1971-02-09 14:00:41 (UTC)	8.9 km
6.5	34km SSE of Fort Irwin, CA 1947-04-10 15:58:05 (UTC)	6.0 km
6.8	2 km W of Hemet, California 1918-04-21 22:32:25 (UTC)	
6.7	Near San Jacinto, California 1899-12-25 12:25:00 (UTC)	
6.4	Cajon Pass area, northwest of ... 1899-07-22 20:32:00 (UTC)	
6.2	Northwest of San Bernardino, C... 1894-07-30 05:12:00 (UTC)	
6.0	Near San Bernardino, California 1858-12-16 10:00:00 (UTC)	
6.3	Near Palmdale, California 1857-01-16 16:53:00 (UTC)	
6.0	Near San Gabriel, California 1855-07-11 04:15:00 (UTC)	
7.5	Northwest of San Bernardino, C... 1812-12-08 15:00:00 (UTC)	

DOWNLOAD

Didn't find what you were looking for?

- Check your Settings.
- Which earthquakes are included on the map and list?
- Felt something not shown – report it here.

5000 km
3000 mi

47.517°N : 14.063°W

Hazards by Location

Search Information

Coordinates:	34.504134, -117.363748
Elevation:	3088 ft
Timestamp:	2022-02-24T22:36:32.655Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

Basic Parameters

Name	Value	Description
S_S	1.227	MCE_R ground motion (period=0.2s)
S_1	0.476	MCE_R ground motion (period=1.0s)
S_{MS}	1.472	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.982	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.935	Coefficient of risk (0.2s)
CR_1	0.918	Coefficient of risk (1.0s)
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	1.227	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.312	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.476	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.519	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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APPENDIX E

ASPHALTIC CONCRETE PAVEMENT CALCULATIONS

PAVING DESIGN

PATEL & ASSOCIATES, INC.

JN: **V22095-10A** CONSULT: **SMP**

PROJECT: **Amethyst**

CALCULATION SHEET # **Auto Drive**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	19	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	19	
Input Traffic Index (TI)	6	
Calculated Total Gravel Equivalent (GE)	1.5552	feet
Calculated Total Gravel Equivalent (GE)	18.6624	inches
Calculated Gravel Factor (Gf) for A/C paving	2.31	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent			INCHES		FEET	
GE (feet)	GE (inches)	Delta (inches)	A/C Section Thickness (inches)	Minimum Base (inches)	A/C Section Thickness (feet)	Minimum Base (feet)
0.58	6.94	11.72	3.0	10.8	0.25	0.90
0.67	8.10	10.56	3.5	9.6	0.29	0.80
0.69	8.33	10.33	3.6	9.6	0.30	0.80
0.77	9.26	9.41	4.0	8.4	0.33	0.70
0.81	9.72	8.94	4.2	8.4	0.35	0.70
0.87	10.41	8.25	4.5	7.2	0.38	0.60
0.93	11.11	7.56	4.8	6.6	0.40	0.55
0.96	11.57	7.09	5.0	6.6	0.42	0.55
1.16	13.88	4.78	6.0	4.2	0.50	0.35
1.93	23.14	-4.48	10.0		0.83	
2.31	27.77	-9.10	12.0		1.00	

PAVING DESIGN

PATEL & ASSOCIATES, INC.

JN: **V22095-10A** CONSULT: **SMP**

PROJECT: **Amethyst**

CALCULATION SHEET # **Entrance**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	19	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	19	
Input Traffic Index (TI)	7	
Calculated Total Gravel Equivalent (GE)	1.8144	feet
Calculated Total Gravel Equivalent (GE)	21.7728	inches
Calculated Gravel Factor (Gf) for A/C paving	2.14	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent			INCHES		FEET	
GE (feet)	GE (inches)	Delta (inches)	A/C Section Thickness (inches)	Minimum Base (inches)	A/C Section Thickness (feet)	Minimum Base (feet)
0.54	6.43	15.35	3.0	13.8	0.25	1.15
0.62	7.50	14.27	3.5	13.2	0.29	1.10
0.64	7.71	14.06	3.6	12.6	0.30	1.05
0.71	8.57	13.20	4.0	12.0	0.33	1.00
0.75	9.00	12.78	4.2	11.4	0.35	0.95
0.80	9.64	12.13	4.5	10.8	0.38	0.90
0.86	10.28	11.49	4.8	10.2	0.40	0.85
0.89	10.71	11.06	5.0	10.2	0.42	0.85
1.07	12.85	8.92	6.0	8.4	0.50	0.70
1.79	21.42	0.35	10.0	0.6	0.83	0.05
2.14	25.71	-3.93	12.0		1.00	

PAVING DESIGN

PATEL & ASSOCIATES, INC.

JN: **V22095-10A** CONSULT: **SMP**

PROJECT: **Amethyst**

CALCULATION SHEET # **Auto Drive**

CALTRANS METHOD FOR DESIGN OF FLEXIBLE PAVEMENT

Input "R" value or "CBR" of native soil	19	
Type of Index Property - "R" value or "CBR" (C or R)	R	R Value
R Value used for Caltrans Method	19	
Input Traffic Index (TI)	5	
Calculated Total Gravel Equivalent (GE)	1.296	feet
Calculated Total Gravel Equivalent (GE)	15.552	inches
Calculated Gravel Factor (Gf) for A/C paving	2.53	
Gravel Factor for Base Course (Gf)	1.1	

Pavement sections provided below are considered equal; but, do not reflect reviewing agency minimums.

Gravel Equivalent GE (feet)	GE (inches)	Delta (inches)	INCHES A/C Section Thickness (inches)	INCHES Minimum Base (inches)	FEET A/C Section Thickness (feet)	FEET Minimum Base (feet)
0.63	7.60	7.95	3.0	7.2	0.25	0.60
0.74	8.87	6.68	3.5	6.0	0.29	0.50
0.76	9.13	6.43	3.6	6.0	0.30	0.50
0.84	10.14	5.41	4.0	4.8	0.33	0.40
0.89	10.65	4.91	4.2	4.2	0.35	0.35
0.95	11.41	4.15	4.5	3.6	0.38	0.30
1.01	12.17	3.39	4.8	3.0	0.40	0.25
1.06	12.67	2.88	5.0	2.4	0.42	0.20
1.27	15.21	0.34	6.0	0.6	0.50	0.05
2.11	25.35	-9.80	10.0		0.83	
2.53	30.42	-14.87	12.0		1.00	

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

PATEL & ASSOCIATES INC.

General Earthwork and Grading Specifications

General

Intent: These General Earthwork and Grading Specifications are intended to be the minimum requirements for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These General Earthwork and Grading Specifications should be considered a part of the recommendations contained in the geotechnical report(s) and if they are in conflict with the geotechnical report(s), the specific recommendations in the geotechnical report shall supersede these more general specifications. Observations made during earthwork operations by the project Geotechnical Consultant may result in new or revised recommendations that may supersede these specifications and/or the recommendations in the geotechnical report(s).

The Geotechnical Consultant of Record: The Owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant), prior to commencement of grading or construction. The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading or construction.

Prior to commencement of grading or construction, the Owner shall coordinate with the Geotechnical Consultant, and Earthwork Contractor (Contractor) to schedule sufficient personnel for the appropriate level of observation, mapping, and compaction testing.

During earthwork and grading operations, the Geotechnical Consultant shall observe, map, and document the subsurface conditions to confirm assumptions made during the geotechnical design phase of the project. Should the observed conditions differ significantly from the interpretive assumptions made during the design phase, the Geotechnical Consultant shall recommend appropriate changes to accommodate the observed conditions, and notify the reviewing agency where required.

The Geotechnical Consultant shall observe the moisture conditioning and processing of the excavations and fill materials. The Geotechnical Consultant should perform periodic relative density testing of fill materials to verify that the attained level of compaction is being accomplished as specified.

The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of earth materials to receive compacted fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall be provided with the approved grading plans and geotechnical report(s) for his review and acceptance of responsibilities, prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the approved grading plans and geotechnical report(s). Prior to commencement of grading, the Contractor shall prepare and submit to the Owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site. The Contractor shall inform the Owner and the Geotechnical Consultant of work schedule changes and revisions to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. No assumptions shall be made by the Contractor with regard to whether the Geotechnical Consultant is aware of all grading operations.

It is the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the earthwork operations in accordance with the applicable grading codes and agency ordinances, these specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). At the sole discretion of the Geotechnical Consultant, any unsatisfactory conditions, such as unsuitable earth materials, improper moisture conditioning, inadequate compaction, insufficient buttress keyway size, adverse weather conditions, etc., resulting in a quality of work less than required in the approved grading plans and geotechnical report(s), the Geotechnical Consultant shall reject the work and may recommend to the Owner that grading be stopped until conditions are corrected.

Preparation of Areas for Compacted Fill

Clearing and Grubbing: Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed in a method acceptable to the Owner, Geotechnical Consultant, and governing agencies.

The Geotechnical Consultant shall evaluate the extent of these removals on a site by site basis. Earth materials to be placed as compacted fill shall not contain more than 1 percent organic materials (by volume). No compacted fill lift shall contain more than 10 percent organic matter.

Should potentially hazardous materials be encountered, the Contractor shall stop work in the affected area, and a hazardous materials specialist shall immediately be consulted to evaluate the potentially hazardous materials, prior to continuing to work in that area.

It is our understanding that the State of California defines most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) as hazardous waste. As such, indiscriminate dumping or spillage of these fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall be prohibited. The contractor is responsible for all hazardous waste related to his operations. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Owner should contract the services of a qualified environmental assessor.

Processing: Exposed earth materials that have been observed to be satisfactory for support of compacted fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Exposed earth materials that are not observed to be satisfactory shall be removed or alternative recommendations may be provided by the Geotechnical Consultant. Scarification shall continue until the exposed earth materials are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction. The earth materials should be moistened or air dried to near optimum moisture content, prior to compaction.

Overexcavation: The Cut Lot Typical Detail and Cut/Fill Transition Lot Typical Detail, included herein provides a graphic illustration that depicts typical overexcavation recommendations made in the approved geotechnical report(s) and/or grading plan(s).

Keyways and Benching: Where fills are to be placed on slopes steeper than 5:1 (horizontal to vertical units), the ground shall be thoroughly benched as compacted fill is placed. Please see the three Keyway and Benching Typical Details with subtitles Cut Over Fill Slope, Fill Over Cut Slope, and Fill Slope for a graphic illustration. The lowest bench or smallest keyway shall be a minimum of 10 feet wide (or ½ the proposed slope height) and at least 2 feet into competent earth materials as advised by the Geotechnical Consultant. Typical benches shall be excavated a minimum height of 4 feet into competent earth materials or as recommended by the Geotechnical Consultant. Fill placed on slopes steeper than 5:1 should be thoroughly benched or otherwise excavated to provide a flat subgrade for the compacted fill.

Evaluation/Acceptance of Bottom Excavations: All areas to receive compacted fill (bottom excavations), including removal excavations, processed areas, keyways, and benching, shall be observed, mapped, general elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive compacted fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to placing compacted fill. A licensed surveyor shall provide the survey control for determining elevations of bottom excavations, processed areas, keyways, and

benching. The Geotechnical Consultant is not responsible for erroneously located, fills, subdrain systems, or excavations.

Fill Materials

General: Earth material to be used as compacted fill should to a large extent be free of organic matter and other deleterious substances as evaluated and accepted by the Geotechnical Consultant.

Oversize: Oversize material is rock that does not break down into smaller pieces and has a maximum diameter greater than 12 inches. Oversize rock shall not be included within compacted fill unless specific methods and guidelines acceptable to the Geotechnical Consultant are followed. For examples of methods and guidelines of oversize rock placement see the enclosed Oversize Rock Disposal Detail. The inclusion of oversize materials in the compacted fill shall only be acceptable if the oversize material is completely surrounded by compacted fill or thoroughly jetted granular materials. No oversize material shall be placed within 10 vertical feet of finish grade or within 2 feet of proposed utilities or underground improvements.

Import: Should imported earth materials be required, the proposed import materials shall meet the requirements of the Geotechnical Consultant. Well graded, very low expansion potential earth materials free of organic matter and other deleterious substances are usually sought after as import materials. However, it is generally in the Owners best interest that potential import earth materials are provided to the Geotechnical Consultant to determine their suitability for the intended purpose. At least 48 hours should be allotted for the appropriate laboratory testing to be performed, prior to starting the import operations.

Fill Placement and Compaction Procedures

Fill Layers: Fill materials shall be placed in areas prepared to receive fill in nearly horizontal layers not exceeding 8 inches in loose thickness. Thicker layers may be accepted by the Geotechnical Consultant, provided field density testing indicates that the grading procedures can adequately compact the thicker layers. Each layer of fill shall be spread evenly and thoroughly mixed to obtain uniformity within the earth materials and consistent moisture throughout the fill.

Moisture Conditioning of Fill: Earth materials to be placed as compacted fill shall be watered, dried, blended, and/or mixed, as needed to obtain relatively uniform moisture contents that are at or slightly above optimum. The maximum density and optimum moisture content tests should be performed in accordance with the American Society of Testing and Materials (ASTM test method D1557-00).

Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it should be uniformly compacted to a minimum of 90 percent of maximum dry density as determined by ASTM test method D1557-00. Compaction equipment shall be adequately sized and be either specifically designed for compaction of earth materials or be proven to consistently achieve the required level of compaction.

Compaction of Fill Slopes: In addition to normal compaction procedures specified above, additional effort to obtain compaction on slopes is needed. This may be accomplished by backrolling of slopes with sheepsfoot rollers as the fill is being placed, by overbuilding the fill slopes, or by other methods producing results that are satisfactory to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill and the slope face shall be a minimum of 90 percent of maximum density per ASTM test method D1557-00.

Compaction Testing of Fill: Field tests for moisture content and relative density of the compacted fill earth materials shall be periodically performed by the Geotechnical Consultant. The location and frequency of tests shall be at the Geotechnical Consultant's discretion based on field observations. Compaction test locations will not necessarily be random. The test locations may or may not be selected to verify minimum compaction requirements in areas that are typically prone to inadequate compaction, such as close to slope faces and near benching.

Frequency of Compaction Testing: Compaction tests shall be taken at minimum intervals of every 2 vertical feet and/or per 1,000 cubic yards of compacted materials placed. Additionally, as a guideline, at least one (1) test shall be taken on slope faces for each 5,000 square feet of slope face and/or for each 10 vertical feet of slope. The Contractor shall assure that fill placement is such that the testing schedule described herein can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork operations to a safe level so that these minimum standards can be obtained.

Compaction Test Locations: The approximate elevation and horizontal coordinates of each test location shall be documented by the Geotechnical Consultant. The Contractor shall coordinate with the Surveyor to assure that sufficient grade stakes are established. This will provide the Geotechnical Consultant with sufficient accuracy to determine the approximate test locations and elevations. The Geotechnical Consultant can not be responsible for staking erroneously located by the Surveyor or Contractor. A minimum of two grade stakes should be provided at a maximum horizontal distance of 100 feet and vertical difference of less than 5 feet.

Subdrain System Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the approved grading plan, and the typical details provided herein. The Geotechnical Consultant may recommend additional subdrain systems and/or changes to the subdrain systems described herein, with regard to the extent, location, grade, or material depending on conditions encountered during grading or other factors. All subdrain systems shall be surveyed by a licensed land surveyor (except for retaining wall subdrain systems) to verify line and grade after installation and prior to burial. Adequate time should be allowed by the Contractor to complete these surveys.

Excavation

All excavations and over-excavations for remedial purposes shall be evaluated by the Geotechnical Consultant during grading operations. Remedial removal depths indicated on the geotechnical plans are estimates only. The actual removal depths and extent shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading operations. Where fill over cut slopes are planned, the cut portion of the slope shall be excavated, evaluated, and accepted by the Geotechnical Consultant prior to placement of the fill portion of the proposed slope, unless specifically addressed by the Geotechnical Consultant. Typical details for cut over fill slopes and fill over cut slopes are provided herein.

Trench Backfill

1) The Contractor shall follow all OHSA and Cal/OSHA requirements for trench excavation safety.

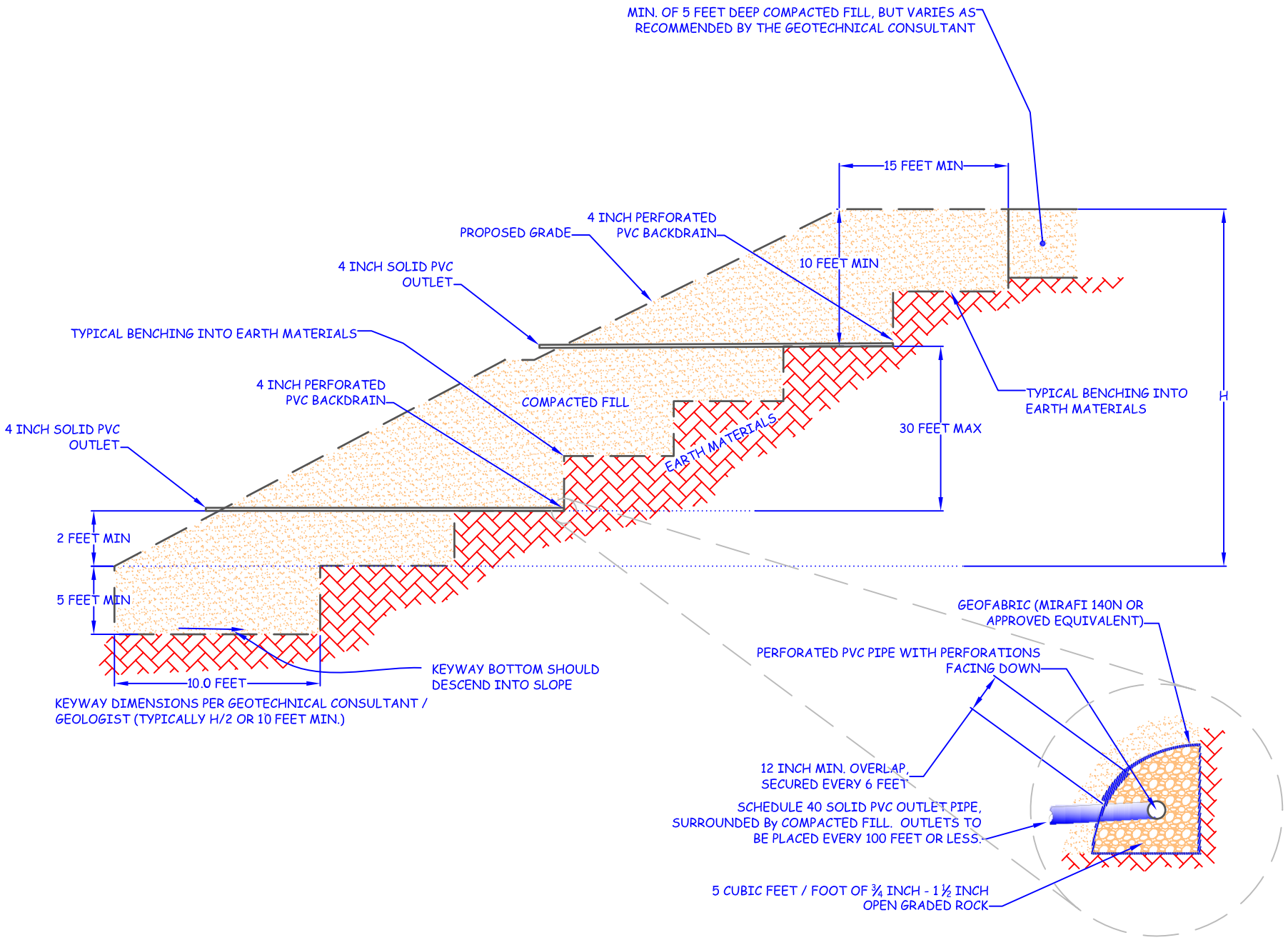
2) Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions in the Standard Specifications of Public Works Construction. Bedding materials shall have a Sand Equivalency more than 30 (SE>30). The bedding shall be placed to 1 foot over the conduit and thoroughly jetting to provide densification. Backfill should be compacted to a minimum of 90 percent of maximum dry density, from 1 foot above the top of the conduit to the surface.

3) Jetting of the bedding materials around the conduits shall be observed by the Geotechnical Consultant.

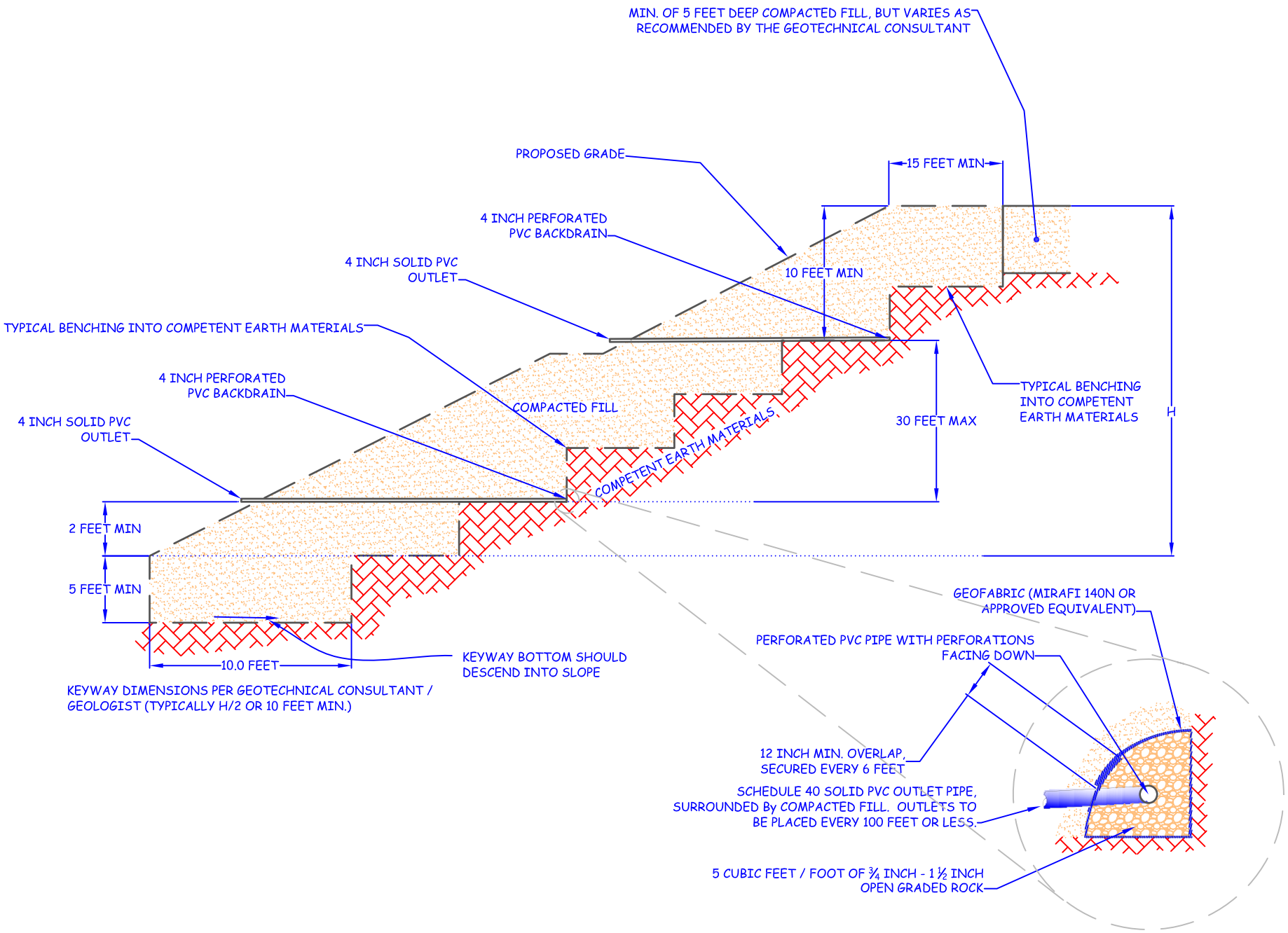
4) The Geotechnical Consultant shall test trench backfill for the minimum compaction requirements recommended herein. At least one test should be conducted for every 300 linear feet of trench and for each 2 vertical feet of backfill.

5) For trench backfill the lift thicknesses shall not exceed those allowed in the Standard Specifications of Public Works Construction, unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment or method.

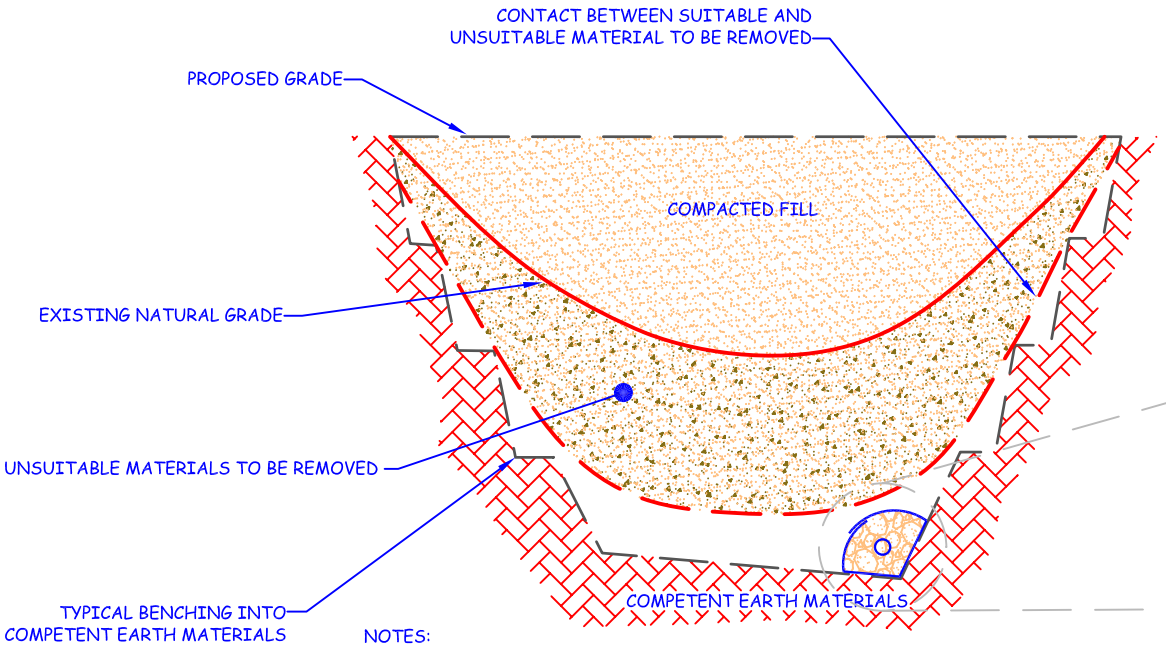
STABILIZATION FILL TYPICAL DETAIL

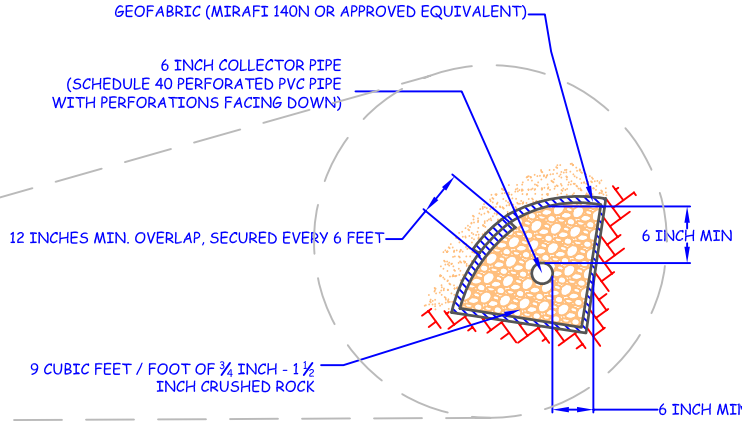


BUTTRESS TYPICAL DETAIL



CANYON SUBDRAIN SYSTEM TYPICAL DETAIL

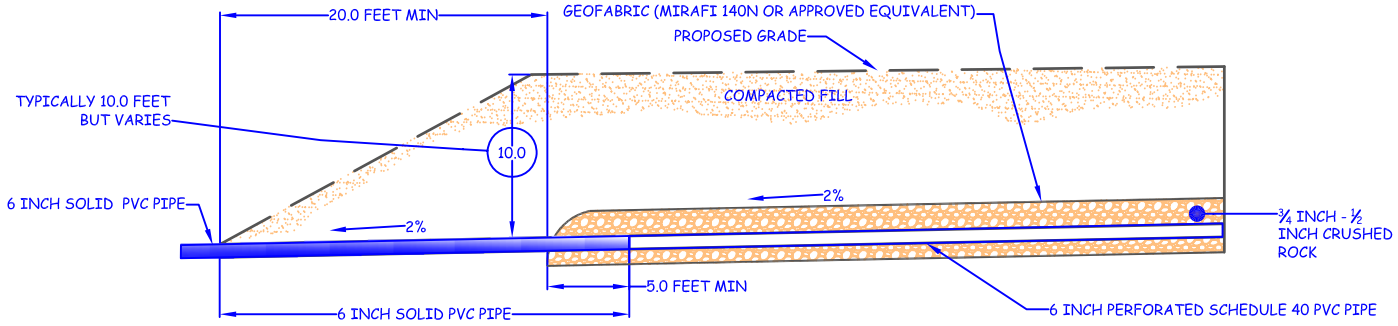




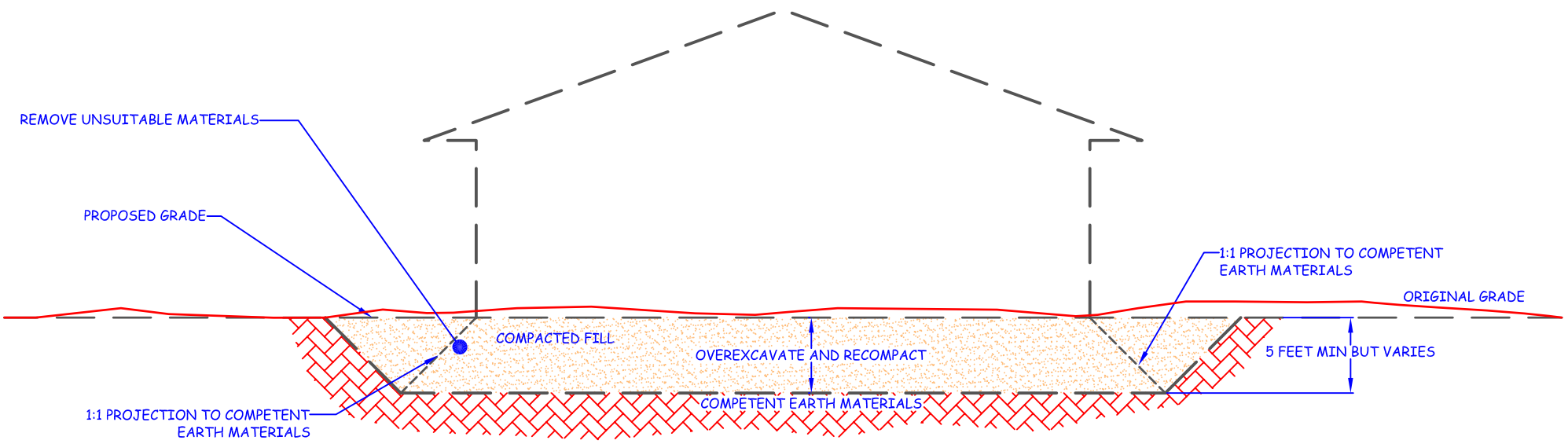
NOTES:
1 - CONTINUOUS RUNS IN EXCESS OF 500 FEET LONG WILL REQUIRE AN 8 INCH DIAMETER PIPE.

2 - FINAL 20 FEET OF PIPE AT OUTLET WILL BE SOLID AND BACKFILLED WITH COMPACTED FINE-GRAINED EARTH MATERIALS.

CANYON SUBDRAIN TYPICAL OUTLET



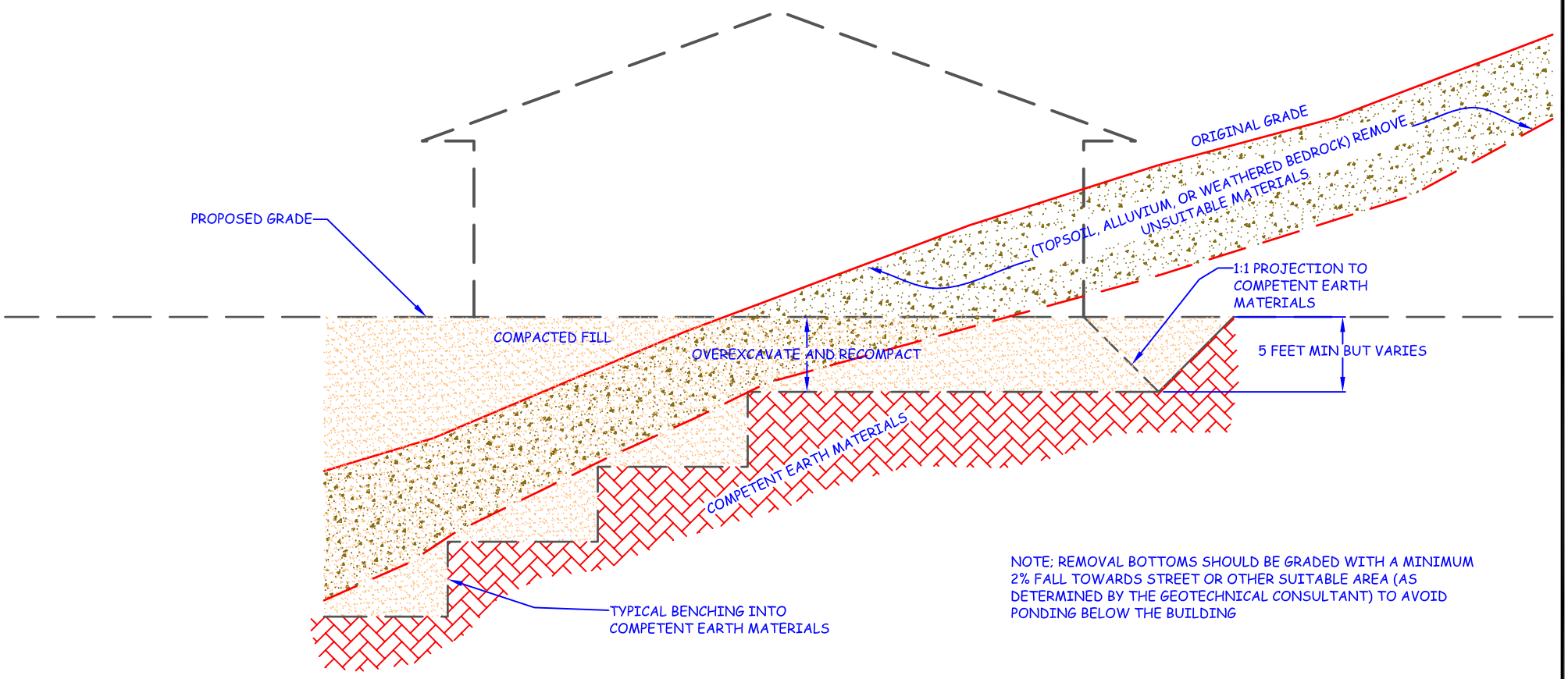
CUT LOT TYPICAL DETAIL



NOTE: REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

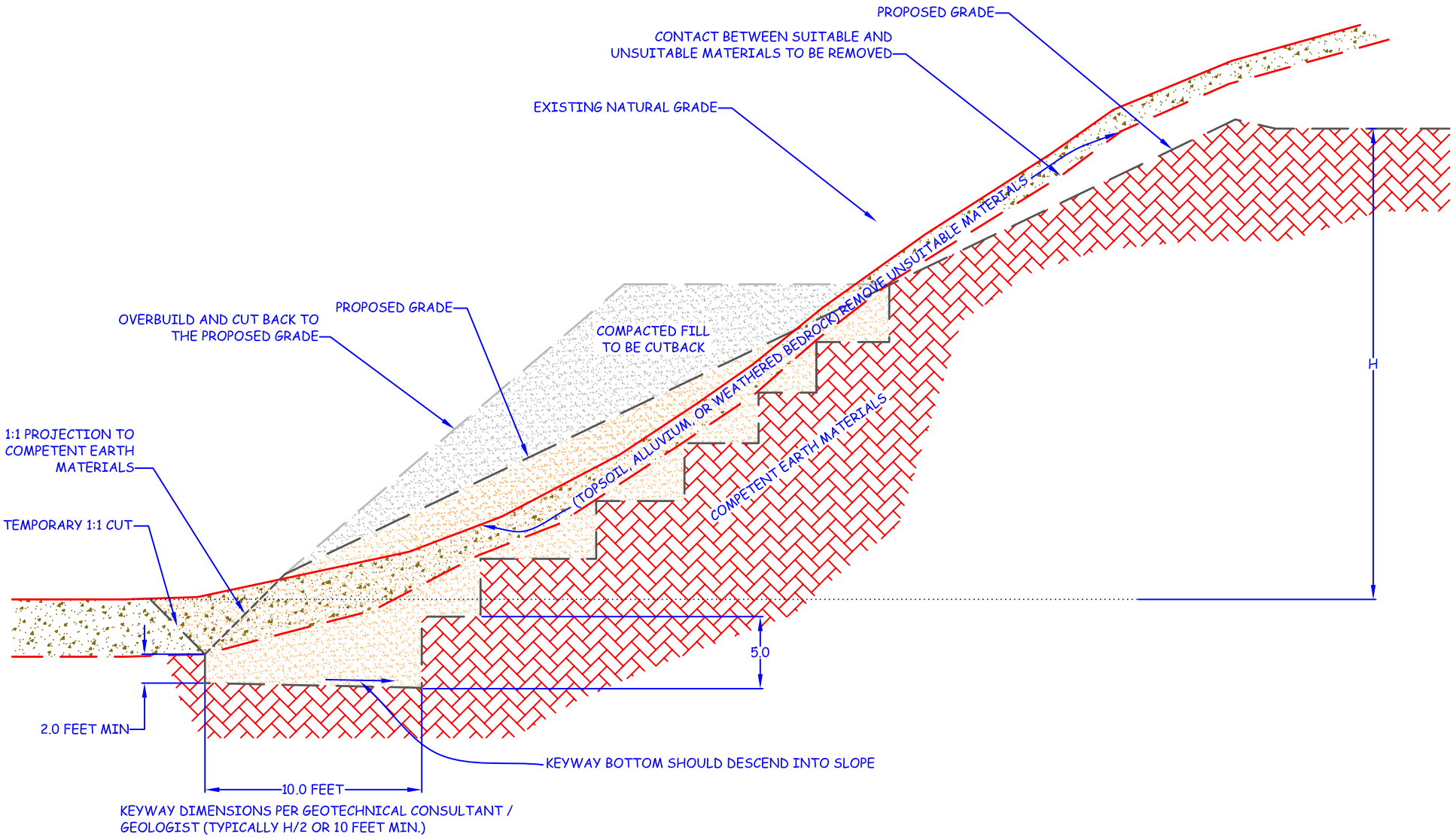
CUT / FILL TRANSITION LOT TYPICAL DETAIL



NOTE; REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

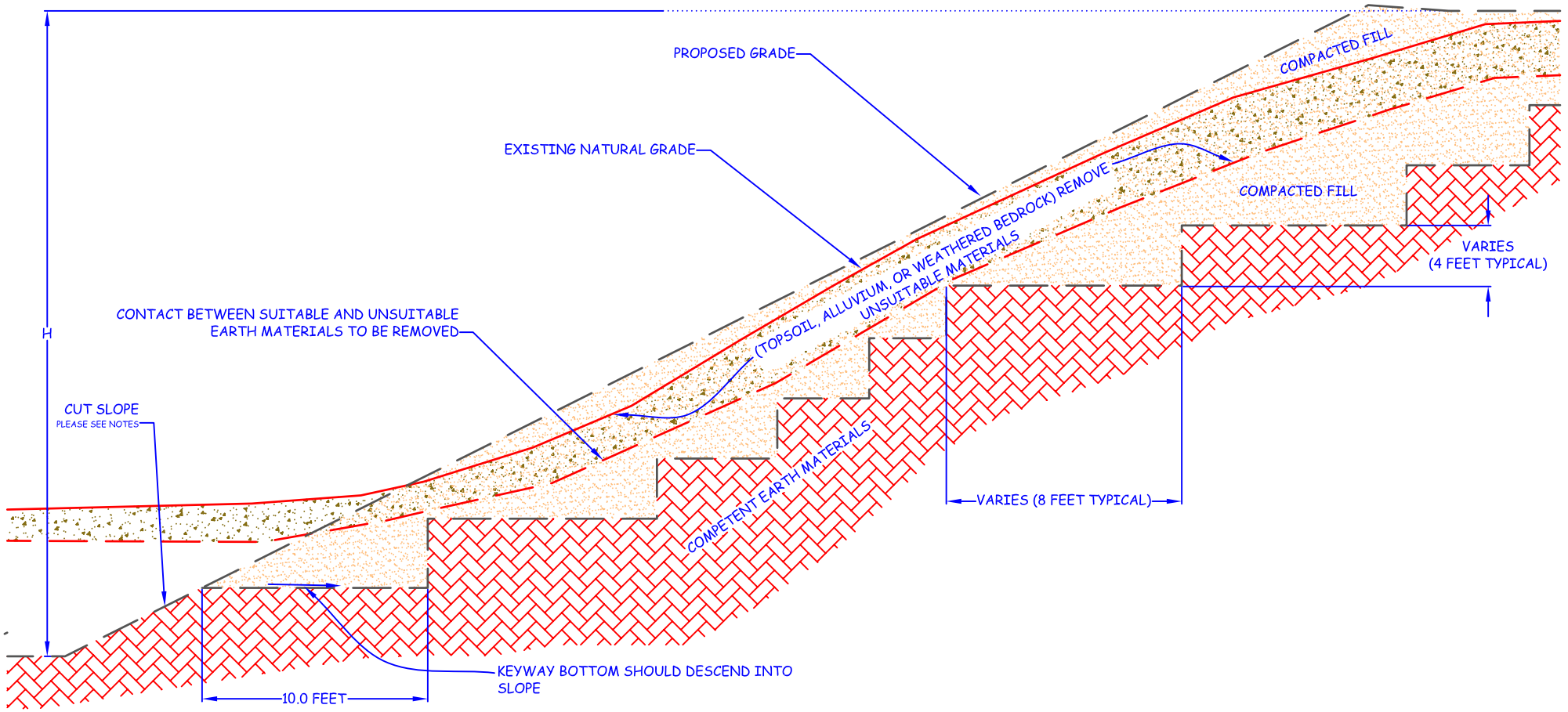
KEYWAY & BENCHING TYPICAL DETAILS
CUT OVER FILL SLOPE



NOTE:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

KEYWAY & BENCHING TYPICAL DETAILS
FILL OVER CUT SLOPE



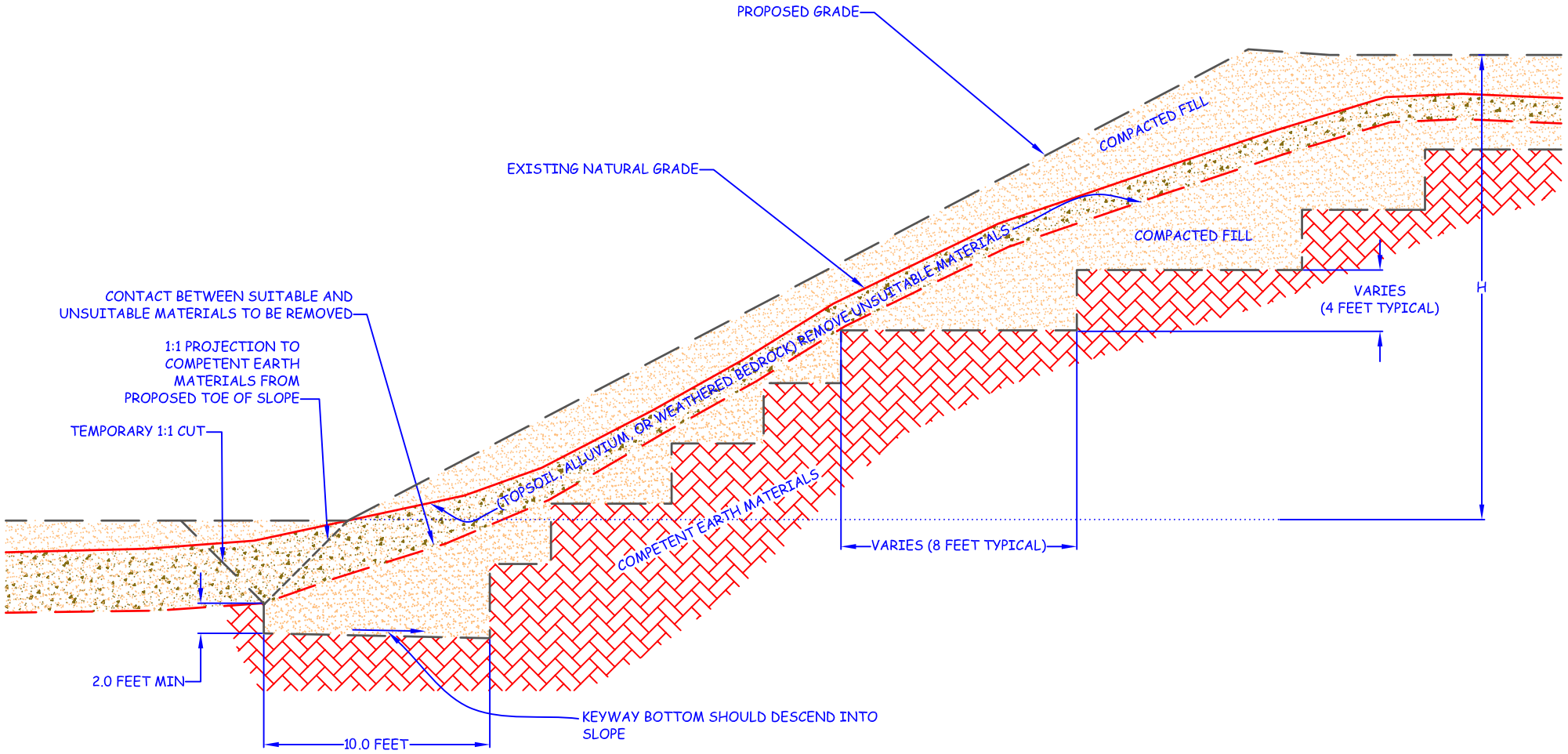
KEYWAY DIMENSIONS PER GEOTECHNICAL CONSULTANT / GEOLOGIST (TYPICALLY H/2 OR 10 FEET MIN.)

NOTES:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

THE CUT SLOPE MUST BE CONSTRUCTED FIRST

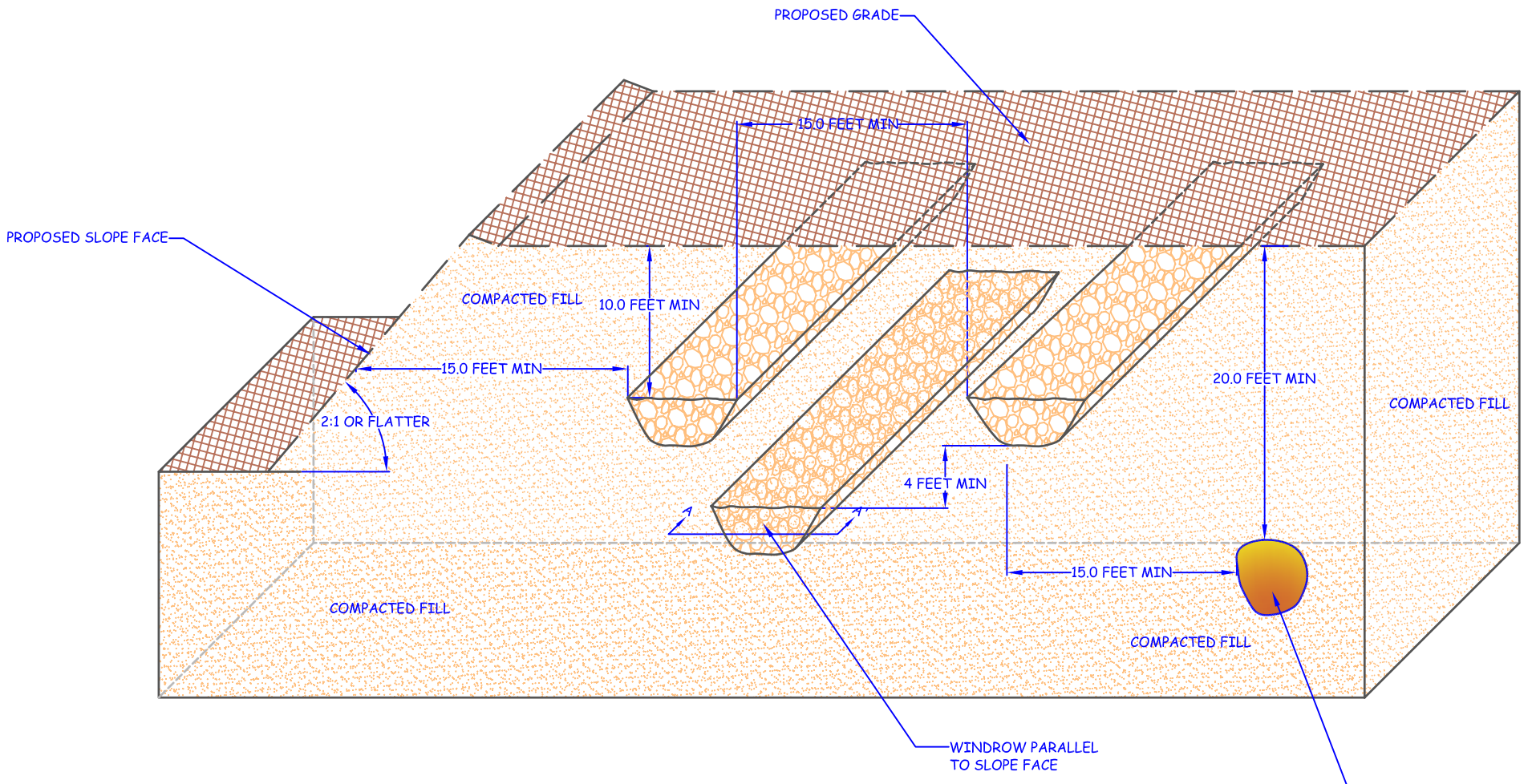
KEYWAY & BENCHING TYPICAL DETAILS
FILL SLOPE



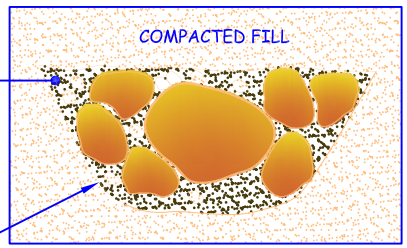
NOTES:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

OVERSIZE ROCK TYPICAL DETAIL



CROSS SECTION A-A'



NOTES:

OVERSIZE ROCK IS LARGER THAN
8 INCHES IN MAX DIAMETER

LEGEND

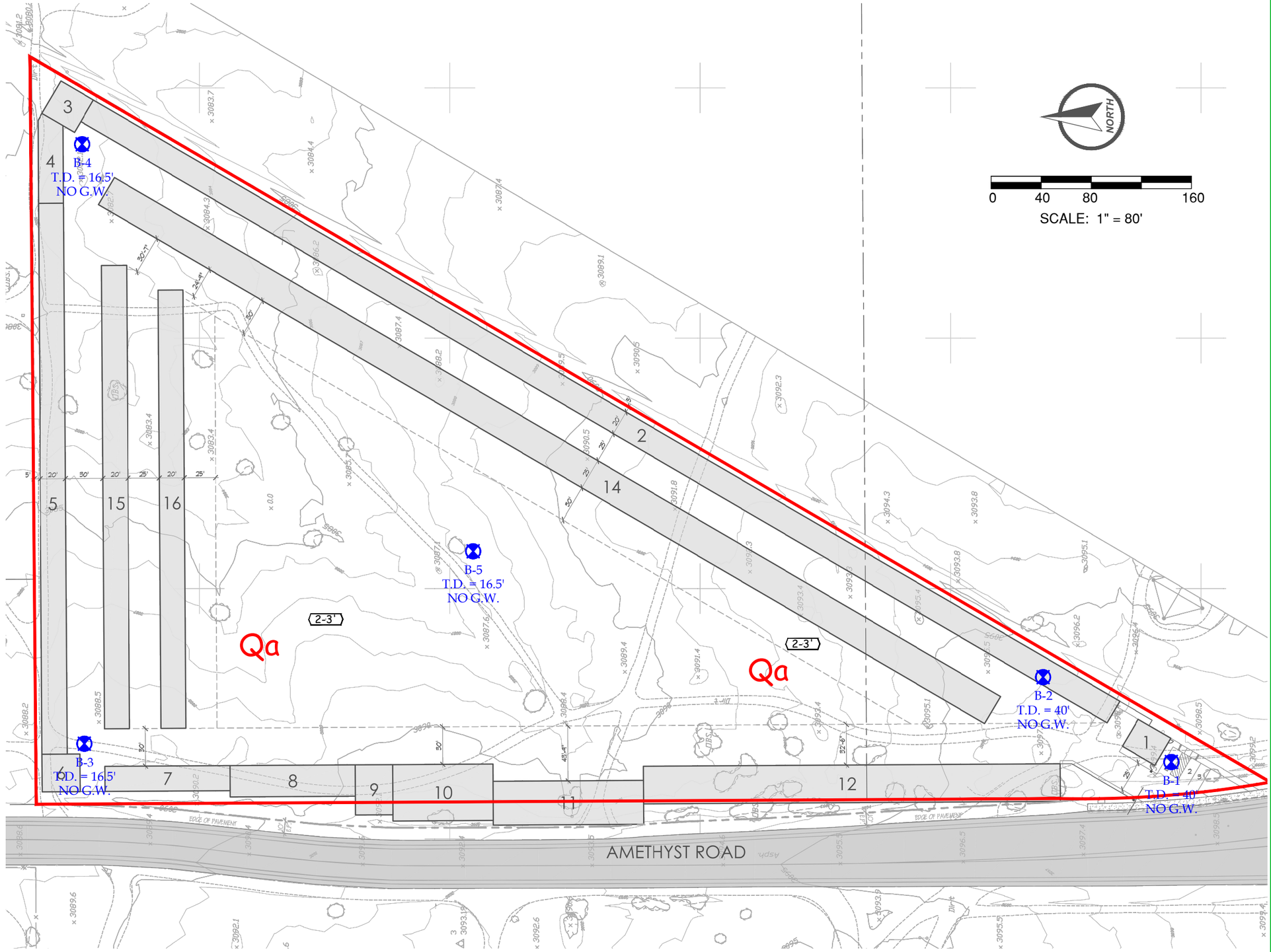
Locations are Approximate

Geologic Units

Qa - Alluvium

Symbols

- Limits of Report
- B-5 T.D. = 16.5' NO G.W. - Boring Location Including Total Depth and Depth to Groundwater
- 2-3' - Recommended Removal Depth



NORTH

0 40 80 160

SCALE: 1" = 80'

D&A INC.

Commitment of Excellence
through Engineered Solution

GEOTECHNICAL MAP

LOCATED ON AMETHYST ROAD
VICTORVILLE AREA, SAN BERNARDINO COUNTY, CALIFORNIA
APN 3105-291-01-0000

PROJECT	PROPOSED COMMERCIAL DEVELOPMENT		
CLIENT	MR. CHAD MCKILLOP		
PROJECT NO.	V22095-10A		
DATE	JULY 2022		
SCALE	1:80		
DWG XREFS			
REVISION			
DRAWN BY	JDG	PLATE	1 OF 1

Attachment D - Water Quality Calculation Summary Spreadsheet

SAN BERNARDINO COUNTY STORMWATER PROGRAM
MODEL WATER QUALITY MANAGEMENT PLAN GUIDANCE

Estimating Volume- and Flow-based BMP Design Runoff Quantities

BMP Drainage Area designation	Area, A	Impervious area ratio, i	Region	NOAA Atlas 14 Precipitation Depth (2-yr 1-Hr Rainfall)	Factor of Safety[1]	Volume-based BMP drawdown time[2]	Composite runoff coefficient, C_{BMP}	Intensity regression coefficient, I	Design rainfall intensity, I_{BMP}	Flow-based BMP treatment flowrate, Q	6-hour rainfall regression coefficient	6-hour mean storm rainfall, P_6	Drawdown time regression constant, a	Maximized detention volume, P_0	Target capture volume, V_0	Target capture volume, V_0
	acres		(Valley, Mountain, or Desert)	inches/hour		(24 or 48) hours			inches/hour	cfs		inches		inches	acre-feet	ft^3
DMA A	6.32	0.99	Desert	0.38	2	48	0.87	0.3250	0.25	1.38	1.2371	0.47	1.963	0.81	0.428	18656

Regression Coefficients for Intensity (I) and 6-hour mean storm rainfall (P_6)			
Quantity	Valley	Mountain	Desert
	85% upper confidence limits		
I	0.2787	0.3614	0.3250
P_6	1.4807	1.9090	1.2371

Drawdown Time Regression Constant, a	
Time	a
hours	
24	1.582
48	1.963

Attachment E - CASQA BMP Handbook Materials

Site Design & Landscape Planning SD-10

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.

SD-10 Site Design & Landscape Planning

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.

Roof Runoff Controls SD-11

Rain Garden

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Various roof runoff controls are available to address stormwater that drains off rooftops. The objective is to reduce the total volume and rate of runoff from individual lots, and retain the pollutants on site that may be picked up from roofing materials and atmospheric deposition. Roof runoff controls consist of directing the roof runoff away from paved areas and mitigating flow to the storm drain system through one of several general approaches: cisterns or rain barrels; dry wells or infiltration trenches; pop-up emitters, and foundation planting. The first three approaches require the roof runoff to be contained in a gutter and downspout system. Foundation planting provides a vegetated strip under the drip line of the roof.

Approach

Design of individual lots for single-family homes as well as lots for higher density residential and commercial structures should consider site design provisions for containing and infiltrating roof runoff or directing roof runoff to vegetative swales or buffer areas. Retained water can be reused for watering gardens, lawns, and trees. Benefits to the environment include reduced demand for potable water used for irrigation, improved stormwater quality, increased groundwater recharge, decreased runoff volume and peak flows, and decreased flooding potential.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Designing New Installations

Cisterns or Rain Barrels

One method of addressing roof runoff is to direct roof downspouts to cisterns or rain barrels. A cistern is an above ground storage vessel with either a manually operated valve or a permanently open outlet. Roof runoff is temporarily stored and then released for irrigation or infiltration between storms. The number of rain

barrels needed is a function of the rooftop area. Some low impact developers recommend that every house have at least 2 rain barrels, with a minimum storage capacity of 1000 liters. Roof barrels serve several purposes including mitigating the first flush from the roof which has a high volume, amount of contaminants, and thermal load. Several types of rain barrels are commercially available. Consideration must be given to selecting rain barrels that are vector proof and childproof. In addition, some barrels are designed with a bypass valve that filters out grit and other contaminants and routes overflow to a soak-away pit or rain garden.

If the cistern has an operable valve, the valve can be closed to store stormwater for irrigation or infiltration between storms. This system requires continual monitoring by the resident or grounds crews, but provides greater flexibility in water storage and metering. If a cistern is provided with an operable valve and water is stored inside for long periods, the cistern must be covered to prevent mosquitoes from breeding.

A cistern system with a permanently open outlet can also provide for metering stormwater runoff. If the cistern outlet is significantly smaller than the size of the downspout inlet (say ¼ to ½ inch diameter), runoff will build up inside the cistern during storms, and will empty out slowly after peak intensities subside. This is a feasible way to mitigate the peak flow increases caused by rooftop impervious land coverage, especially for the frequent, small storms.

Dry wells and Infiltration Trenches

Roof downspouts can be directed to dry wells or infiltration trenches. A dry well is constructed by excavating a hole in the ground and filling it with an open graded aggregate, and allowing the water to fill the dry well and infiltrate after the storm event. An underground connection from the downspout conveys water into the dry well, allowing it to be stored in the voids. To minimize sedimentation from lateral soil movement, the sides and top of the stone storage matrix can be wrapped in a permeable filter fabric, though the bottom may remain open. A perforated observation pipe can be inserted vertically into the dry well to allow for inspection and maintenance.

In practice, dry wells receiving runoff from single roof downspouts have been successful over long periods because they contain very little sediment. They must be sized according to the amount of rooftop runoff received, but are typically 4 to 5 feet square, and 2 to 3 feet deep, with a minimum of 1-foot soil cover over the top (maximum depth of 10 feet).

To protect the foundation, dry wells must be set away from the building at least 10 feet. They must be installed in solids that accommodate infiltration. In poorly drained soils, dry wells have very limited feasibility.

Infiltration trenches function in a similar manner and would be particularly effective for larger roof areas. An infiltration trench is a long, narrow, rock-filled trench with no outlet that receives stormwater runoff. These are described under Treatment Controls.

Pop-up Drainage Emitter

Roof downspouts can be directed to an underground pipe that daylights some distance from the building foundation, releasing the roof runoff through a pop-up emitter. Similar to a pop-up irrigation head, the emitter only opens when there is flow from the roof. The emitter remains flush to the ground during dry periods, for ease of lawn or landscape maintenance.

Foundation Planting

Landscape planting can be provided around the base to allow increased opportunities for stormwater infiltration and protect the soil from erosion caused by concentrated sheet flow coming off the roof. Foundation plantings can reduce the physical impact of water on the soil and provide a subsurface matrix of roots that encourage infiltration. These plantings must be sturdy enough to tolerate the heavy runoff sheet flows, and periodic soil saturation.

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.

Supplemental Information

Examples

- City of Ottawa's Water Links Surface –Water Quality Protection Program
- City of Toronto Downspout Disconnection Program
- City of Boston, MA, Rain Barrel Demonstration Program

Other Resources

Hager, Marty Catherine, Stormwater, "Low-Impact Development", January/February 2003. www.stormh2o.com

Low Impact Urban Design Tools, Low Impact Development Design Center, Beltsville, MD. www.lid-stormwater.net

Start at the Source, Bay Area Stormwater Management Agencies Association, 1999 Edition

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.

- 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.

Trash Storage Areas SD-32

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.

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

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.

- 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.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Attachment F – Maintenance Agreement

RECORDING REQUESTED BY:

City of Victorville
Engineering Department

AND WHEN RECORDED MAIL TO:

City of Victorville
Engineering Department
14343 Civic Drive
Victorville, CA 92392

SPACE ABOVE THIS LINE FOR RECORDER'S USE

AGREEMENT

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

Water Quality Management Plan and Stormwater Best Management Practices Transfer, Access and Maintenance Agreement

OWNER NAME: Chad McKillop

PROPERTY ADDRESS: West Gate Plaza LLC

APN: APN 3105-291-01

THIS AGREEMENT is made and entered into in

_____, California, this _____ day of

_____, by and between

_____, hereinafter

referred to as Owner, and the CITY OF VICTORVILLE, a municipal corporation, located in the County of San Bernardino, State of California, hereinafter referred to as CITY;

WHEREAS, the Owner owns real property ("Property") in the City of Victorville, State of California, more specifically described in Exhibit "A" and depicted in Exhibit "B", each of which exhibits is attached hereto and incorporated herein by this reference;

WHEREAS, at the time of initial approval of development project known as

Amethyst Self Storage within the Property described herein, the CITY required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff;

WHEREAS, the Owner has chosen to install and/or implement BMPs as described in the Water Quality Management Plan, on file with the CITY, hereinafter referred to as "WQMP", to minimize pollutants in urban runoff and to minimize other adverse impacts of urban runoff;

WHEREAS, said WQMP has been certified by the Owner and reviewed and approved by the City;

WHEREAS, the Owner is aware that periodic and continuous maintenance, including, but not necessarily limited to, filter material replacement and sediment removal, is required to assure peak performance of all BMPs in the WQMP and that, furthermore, such maintenance activity will require compliance with all Local, State, or Federal laws and regulations, including those pertaining to confined space and waste disposal methods, in effect at the time such maintenance occurs;

NOW THEREFORE, it is mutually stipulated and agreed as follows:

1. All maintenance or replacement of BMPs proposed as part of the WQMP are the sole responsibility of the Owner in accordance with the terms of this Agreement.

2. Owner hereby provides the City of Victorville's designee complete access, of any duration, to the BMPs and their immediate vicinity at any time, upon reasonable notice, or in the event of emergency, as determined by the City's Director of Public Works, no advance notice, for the purpose of inspection, sampling, testing of the Device, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 3 below. The City shall make every effort at all times to minimize or avoid interference with Owner's use of the Property. Denial of access to any premises or facility that contains WQMP features is a violation of the City Stormwater Ordinance. If there is reasonable cause to believe that an illicit discharge or breach of the WQMP operation and maintenance commitments is occurring on the premises then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction in addition to other enforcement actions.

3. Owner shall use its best efforts diligently to maintain all BMPs in a manner assuring peak performance at all times. All reasonable precautions shall be exercised by Owner and Owner's representative or contractor in the removal and extraction of any material(s) from the BMPs and the ultimate disposal of the material(s) in a manner consistent with all relevant laws and regulations in effect at the time. As may be requested from time to time by the City, the Owner shall provide the City with documentation identifying the material(s) removed, the quantity, and disposal destination.

4. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) days of being given written notice by the City , the City is hereby authorized to cause any maintenance necessary to be done and charge the entire cost and expense against the property and/or to the Owner or Owner's successors or assigns, including administrative costs, attorneys fees and interest thereon at the maximum rate authorized by the City Code from the date of the notice of expense until paid in full.

5. The City may require the owner to post security in form and for a time period satisfactory to the City to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the City may, in the case of a cash bond, act for the Owner using the proceeds from it, or in the case of a surety bond, require the sureties to perform the obligations of the Agreement. As an additional remedy, the Director of Public Works may withdraw any previous stormwater-related approval with respect to the property on which BMPs have been installed and/or implemented until such time as Owner repays to City its reasonable costs incurred in accordance with paragraph 3 above.

6. This agreement shall be recorded in the Office of the Recorder of San Bernardino County, California, at the expense of the Owner and shall constitute notice to all successors and assigns of the title to said Property of the obligation herein set forth, and also a lien in such amount as will fully reimburse the City, including interest as herein above set forth, subject to foreclosure in event of default in payment.

7. In event of legal action occasioned by any default or action of the Owner, or its successors or assigns, then the Owner and its successors or assigns agree(s) to hold the City harmless and pay all costs incurred by the City in enforcing the terms of this Agreement, including reasonable attorney's fees and costs, and that the same shall become a part of the lien against said Property.

8. It is the intent of the parties hereto that burdens and benefits herein undertaken shall constitute covenants that run with said Property and constitute a lien there against.

9. The obligations herein undertaken shall be binding upon the heirs, successors, executors, administrators and assigns of the parties hereto. The term "Owner" shall include not only the present Owner, but also its heirs, successors, executors, administrators, and assigns. Owner shall notify any successor to title of all or part of the Property about the existence of this Agreement. Owner shall provide such notice prior to such successor obtaining an interest in all or part of the Property. Owner shall provide a copy of such notice to the City at the same time such notice is provided to the successor.

10. Time is of the essence in the performance of this Agreement.

11. Any notice to a party required or called for in this Agreement shall be served in person, or by deposit in the U.S. Mail, first class postage prepaid, to the address set forth below. Notice(s) shall be deemed effective upon receipt, or seventy-two (72) hours after deposit in the U.S. Mail, whichever is earlier. A party may change a notice address only by providing written notice thereof to the other party.

12. The Owner its successors and assigns, hereby agrees to save and hold harmless the City, any of its departments, agencies, officers or employees, all of whom while working within their respective authority, from all cost, injury and damage incurred by any of the above, and from any other injury or damage to any person or property whatsoever, any of which is caused by an activity, condition or event arising out of the performance, preparation for performance or nonperformance of any provision of this agreement by the Owner, its agents, or any of its independent contractors.

IF TO CITY:
City of Victorville – Engineering Department

14343 Civic Drive,

Victorville, CA 92392

IF TO OWNER:

IN WITNESS THEREOF, the parties hereto have affixed their signatures as of the date first written above.

OWNER:

Signature: _____

Name: _____

Title: _____

OWNER:

Signature: _____

Name: _____

Title: _____

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation (attach appropriate acknowledgement).

ACCEPTED BY:

_____
Brian W. Gengler., City Engineer for City of Victorville

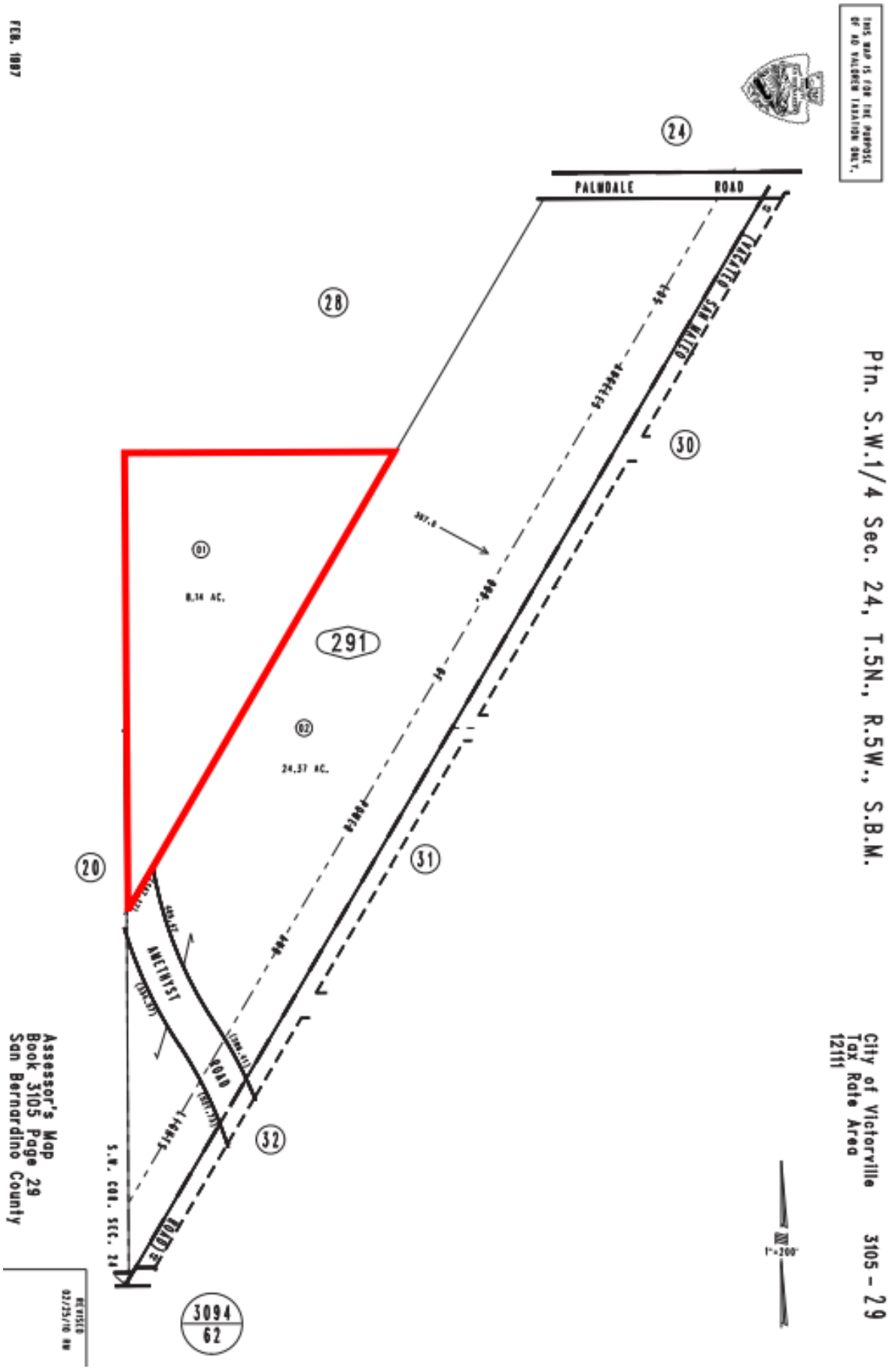
Date: _____

Attachment: Standard Notary Acknowledgement

EXHIBIT A
(Legal Description)

BEING A PORTION OF THE SW 1/4 OF SEC. 24, T5N, R5W

EXHIBIT B
(Map/illustration)



Attachment G – Hydromodification

Hydromodification Summary Table	Runoff Volume (ft3)	TC (min)	Peak (cfs)
Pre Developed	**39317**	**19.21**	**7.0**
Post Developed	59760	9.94	11.66
Difference	20443	9.27	4.66
Difference %	52	48	67
Mitigated W Stormtech Chambers	**22341**	**63.4**	**6.94**

Mitigation indicates reduced flows and increased TC compated to Pre Developed Condition

Mitigated Time of Concentration Summary

Proposed Rat M Q (cfs)	11.66
Total Storage (ft3)	37419
Time to Fill (sec)	3209.2
Time to Fill (min)	53.5
Proposed Rat M TC (min)	9.94
Total TC (min)	63.4

```
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            Ver. 18.0  Release Date: 07/01/2011  License ID 1501

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* APN 3105-291-01                                                      *
* Onsite Existing Condition                                            *
* 10 Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: 3105E.DAT
  TIME/DATE OF STUDY: 12:39 12/10/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6610

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE      0.00 TO NODE      1.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   600.00
  ELEVATION DATA: UPSTREAM(FEET) =   3099.20  DOWNSTREAM(FEET) =   3088.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   15.039
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.741
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  NATURAL DESERT COVER
  "DESERT BRUSH"   (20.0%)   C        1.82      0.24     1.000    88   15.04
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.47
  TOTAL AREA(ACRES) =      1.82   PEAK FLOW RATE(CFS) =      2.47

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3088.00  DOWNSTREAM(FEET) =   3080.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   545.00   CHANNEL SLOPE =  0.0147
  CHANNEL FLOW THRU SUBAREA(CFS) =       2.47
  FLOW VELOCITY(FEET/SEC) =   2.18 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   4.17   Tc(MIN.) =   19.21
  LONGEST FLOWPATH FROM NODE      0.00 TO NODE      2.00 =    1145.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      2.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   19.21
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.467
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL DESERT COVER
  "DESERT BRUSH"   (20.0%)   C        4.50      0.24     1.000    88
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.24
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA AREA(ACRES) =    4.50      SUBAREA RUNOFF(CFS) =    4.99
```

```
  EFFECTIVE AREA(ACRES) =      6.32   AREA-AVERAGED Fm(INCH/HR) =  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.24  AREA-AVERAGED Ap =  1.00
  TOTAL AREA(ACRES) =        6.3       PEAK FLOW RATE(CFS) =       7.00
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.3  TC(MIN.) =     19.21
  EFFECTIVE AREA(ACRES) =      6.32  AREA-AVERAGED Fm(INCH/HR)=  0.24
  AREA-AVERAGED Fp(INCH/HR) =  0.24  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       7.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
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                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* APN 3105-291-01                                                      *
* Onsite Proposed Condition                                            *
* 10 Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: 3105P.DAT
  TIME/DATE OF STUDY: 14:49 12/10/2023
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   6.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL*

  SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.7000
  USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 0.6610

  *ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ====== =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0312 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
  *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     10.00 TO NODE     11.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   615.00
  ELEVATION DATA: UPSTREAM(FEET) =   3098.00  DOWNSTREAM(FEET) =   3089.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.254
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.446
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.86      0.57     0.100    69    9.25
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.85
  TOTAL AREA(ACRES) =      0.86   PEAK FLOW RATE(CFS) =      1.85

****************************************************************************
  FLOW PROCESS FROM NODE     11.00 TO NODE     12.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =   3089.20
  DOWNSTREAM NODE ELEVATION(FEET) =   3084.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   470.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.200
  PAVEMENT LIP(FEET) =  0.010   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.982
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.61      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.38
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.42
  AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =   11.83
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   3.24   Tc(MIN.) =   12.50
  SUBAREA AREA(ACRES) =    0.61       SUBAREA RUNOFF(CFS) =    1.06
  EFFECTIVE AREA(ACRES) =    1.47     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.57  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       2.55

  END OF SUBAREA "V" GUTTER HYDRAULICS:
```

```
  DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =   12.35
  FLOW VELOCITY(FEET/SEC.) =   2.43   DEPTH*VELOCITY(FT*FT/SEC) =   0.74
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1085.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.50
  RAINFALL INTENSITY(INCH/HR) =   1.98
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.47
  TOTAL STREAM AREA(ACRES) =       1.47
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.55

****************************************************************************
  FLOW PROCESS FROM NODE     20.00 TO NODE     21.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   350.00
  ELEVATION DATA: UPSTREAM(FEET) =   3093.50  DOWNSTREAM(FEET) =   3089.10

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    7.597
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.808
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.96      0.57     0.100    69    7.60
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      2.38
  TOTAL AREA(ACRES) =      0.96   PEAK FLOW RATE(CFS) =      2.38

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =   3089.20
  DOWNSTREAM NODE ELEVATION(FEET) =   3086.20
  CHANNEL LENGTH THRU SUBAREA(FEET) =   300.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.100
  PAVEMENT LIP(FEET) =  0.200   MANNING'S N = .0150
```

```
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.499
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        1.61      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      4.15
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.62
  AVERAGE FLOW DEPTH(FEET) =   0.36   FLOOD WIDTH(FEET) =    9.39
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.38   Tc(MIN.) =    8.98
  SUBAREA AREA(ACRES) =    1.61       SUBAREA RUNOFF(CFS) =    3.54
  EFFECTIVE AREA(ACRES) =    2.57     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.57  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        2.6         PEAK FLOW RATE(CFS) =       5.65

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.41   FLOOD WIDTH(FEET) =   13.54
  FLOW VELOCITY(FEET/SEC.) =   3.48   DEPTH*VELOCITY(FT*FT/SEC) =   1.41
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =     650.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     12.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =   3086.20
  DOWNSTREAM NODE ELEVATION(FEET) =   3084.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   175.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.100
  PAVEMENT LIP(FEET) =  0.200   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.327
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.55      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      6.21
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.04
  AVERAGE FLOW DEPTH(FEET) =   0.43   FLOOD WIDTH(FEET) =   16.36
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.96   Tc(MIN.) =    9.94
  SUBAREA AREA(ACRES) =    0.55       SUBAREA RUNOFF(CFS) =    1.12
  EFFECTIVE AREA(ACRES) =    3.12     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.57  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        3.1         PEAK FLOW RATE(CFS) =       6.38
```

```
  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.44   FLOOD WIDTH(FEET) =   16.70
  FLOW VELOCITY(FEET/SEC.) =   3.04   DEPTH*VELOCITY(FT*FT/SEC) =   1.33
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     12.00 =     825.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =    9.94
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.327
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.37      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA AREA(ACRES) =    0.37      SUBAREA RUNOFF(CFS) =    0.76
  EFFECTIVE AREA(ACRES) =      3.49   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        3.5       PEAK FLOW RATE(CFS) =       7.13

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.94
  RAINFALL INTENSITY(INCH/HR) =   2.33
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       3.49
  TOTAL STREAM AREA(ACRES) =       3.49
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       7.13

****************************************************************************
  FLOW PROCESS FROM NODE     30.00 TO NODE     31.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   620.00
  ELEVATION DATA: UPSTREAM(FEET) =   3093.00  DOWNSTREAM(FEET) =   3089.50

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   11.207
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.139
```

```
  SUBAREA Tc AND LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS   Tc
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN  (MIN.)
  COMMERCIAL                 C        0.89      0.57     0.100    69   11.21
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      1.67
  TOTAL AREA(ACRES) =      0.89   PEAK FLOW RATE(CFS) =      1.67

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     12.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =   3089.70
  DOWNSTREAM NODE ELEVATION(FEET) =   3084.80
  CHANNEL LENGTH THRU SUBAREA(FEET) =   410.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.100
  PAVEMENT LIP(FEET) =  0.200   MANNING'S N = .0150
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.02000
  MAXIMUM DEPTH(FEET) =   2.00
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.935
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/      SCS SOIL   AREA      Fp         Ap     SCS
       LAND USE            GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  COMMERCIAL                 C        0.47      0.57     0.100    69
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.57
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.95
  AVERAGE FLOW DEPTH(FEET) =   0.30   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.73   Tc(MIN.) =   12.94
  SUBAREA AREA(ACRES) =    0.47       SUBAREA RUNOFF(CFS) =    0.79
  EFFECTIVE AREA(ACRES) =    1.36     AREA-AVERAGED Fm(INCH/HR) =   0.06
  AREA-AVERAGED Fp(INCH/HR) =   0.57  AREA-AVERAGED Ap =   0.10
  TOTAL AREA(ACRES) =        1.4         PEAK FLOW RATE(CFS) =       2.30

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL
         DEPTH EQUAL TO [GUTTER-HIKE + PAVEMENT LIP]

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.30   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   3.95   DEPTH*VELOCITY(FT*FT/SEC) =   1.18
  LONGEST FLOWPATH FROM NODE     30.00 TO NODE     12.00 =    1030.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     12.00 TO NODE     12.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
```

```
  TOTAL NUMBER OF STREAMS =  3
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  3 ARE:
  TIME OF CONCENTRATION(MIN.) =   12.94
  RAINFALL INTENSITY(INCH/HR) =   1.93
  AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.36
  TOTAL STREAM AREA(ACRES) =       1.36
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       2.30

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        2.55   12.50    1.982  0.57( 0.06) 0.10       1.5      10.00
      2        7.13    9.94    2.327  0.57( 0.06) 0.10       3.5      20.00
      3        2.30   12.94    1.935  0.57( 0.06) 0.10       1.4      30.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
  CONFLUENCE FORMULA USED FOR  3 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       11.66    9.94    2.327  0.57( 0.06) 0.10       5.7      20.00
      2       10.87   12.50    1.982  0.57( 0.06) 0.10       6.3      10.00
      3       10.68   12.94    1.935  0.57( 0.06) 0.10       6.3      30.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.66    Tc(MIN.) =     9.94
  EFFECTIVE AREA(ACRES) =       5.70   AREA-AVERAGED Fm(INCH/HR) =  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap =  0.10
  TOTAL AREA(ACRES) =        6.3
  LONGEST FLOWPATH FROM NODE     10.00 TO NODE     12.00 =    1085.00 FEET.
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.3  TC(MIN.) =      9.94
  EFFECTIVE AREA(ACRES) =      5.70  AREA-AVERAGED Fm(INCH/HR)=  0.06
  AREA-AVERAGED Fp(INCH/HR) =  0.57  AREA-AVERAGED Ap = 0.100
  PEAK FLOW RATE(CFS)   =      11.66

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1       11.66    9.94    2.327  0.57( 0.06) 0.10       5.7      20.00
      2       10.87   12.50    1.982  0.57( 0.06) 0.10       6.3      10.00
      3       10.68   12.94    1.935  0.57( 0.06) 0.10       6.3      30.00
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Existing Condition 10 Year Storm Event

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==========================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
   AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =    2.62 (inches)

   SOIL-COVER    AREA     PERCENT OF   SCS CURVE   LOSS RATE
     TYPE     (Acres)  PERVIOUS AREA    NUMBER   Fp(in./hr.)   YIELD
      1        6.32     100.00           90.      0.200       0.625

   TOTAL AREA (Acres) =     6.32

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.200

                    _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.375
==========================================================================
--------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =    6.32
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.200
   LOW LOSS FRACTION = 0.375
   TIME OF CONCENTRATION(MIN.) = 19.21
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) =  10
     5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.21
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.66
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.01
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.36
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.62

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    0.90
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    0.48

**************************************************************************
 TIME    VOLUME      Q  0.      2.5      5.0      7.5      10.0
(HOURS)   (AF)     (CFS)
--------------------------------------------------------------------------
 0.31     0.0026     0.20  Q       .        .        .        .
 0.63     0.0081     0.21  Q       .        .        .        .
```

0.95	0.0136	0.21	Q	.	.	.	.
1.27	0.0191	0.21	Q	.	.	.	.
1.59	0.0247	0.21	Q	.	.	.	.
1.91	0.0304	0.22	Q	.	.	.	.
2.23	0.0362	0.22	Q	.	.	.	.
2.55	0.0420	0.22	Q	.	.	.	.
2.87	0.0479	0.22	Q	.	.	.	.
3.19	0.0538	0.23	Q	.	.	.	.
3.51	0.0599	0.23	Q	.	.	.	.
3.83	0.0660	0.23	Q	.	.	.	.
4.15	0.0722	0.24	Q	.	.	.	.
4.47	0.0785	0.24	Q	.	.	.	.
4.79	0.0849	0.24	Q	.	.	.	.
5.11	0.0914	0.25	Q	.	.	.	.
5.43	0.0979	0.25	.Q	.	.	.	.
5.75	0.1046	0.25	.Q	.	.	.	.
6.07	0.1114	0.26	.Q	.	.	.	.
6.39	0.1183	0.26	.Q	.	.	.	.
6.72	0.1253	0.27	.Q	.	.	.	.
7.04	0.1325	0.27	.Q	.	.	.	.
7.36	0.1398	0.28	.Q	.	.	.	.
7.68	0.1472	0.28	.Q	.	.	.	.
8.00	0.1547	0.29	.Q	.	.	.	.
8.32	0.1625	0.29	.Q	.	.	.	.
8.64	0.1704	0.30	.Q	.	.	.	.
8.96	0.1784	0.31	.Q	.	.	.	.
9.28	0.1867	0.32	.Q	.	.	.	.
9.60	0.1951	0.32	.Q	.	.	.	.
9.92	0.2038	0.33	.Q	.	.	.	.
10.24	0.2127	0.34	.Q	.	.	.	.
10.56	0.2219	0.35	.Q	.	.	.	.
10.88	0.2313	0.36	.Q	.	.	.	.
11.20	0.2410	0.38	.Q	.	.	.	.
11.52	0.2511	0.38	.Q	.	.	.	.
11.84	0.2615	0.40	.Q	.	.	.	.
12.16	0.2724	0.41	.Q	.	.	.	.
12.48	0.2831	0.40	.Q	.	.	.	.
12.80	0.2939	0.41	.Q	.	.	.	.
13.12	0.3052	0.44	.Q	.	.	.	.
13.44	0.3173	0.46	.Q	.	.	.	.
13.76	0.3301	0.51	. Q	.	.	.	.
14.08	0.3439	0.54	. Q	.	.	.	.
14.40	0.3582	0.55	. Q	.	.	.	.
14.72	0.3732	0.59	. Q	.	.	.	.
15.04	0.3904	0.71	. Q	.	.	.	.
15.36	0.4105	0.81	. Q	.	.	.	.
15.68	0.4353	1.07	. Q	.	.	.	.

16.00	0.4745	1.89	.	Q	.	.	.	.	
16.32	0.5903	7.00	.	.	.	Q	.	.	
16.64	0.6935	0.93	.	Q	.	.	.	.	
16.96	0.7143	0.64	.	Q	.	.	.	.	
17.28	0.7300	0.55	.	Q	.	.	.	.	
17.60	0.7437	0.48	.	Q	.	.	.	.	
17.92	0.7557	0.43	.	Q	.	.	.	.	
18.24	0.7667	0.40	.	Q	.	.	.	.	
18.56	0.7771	0.39	.	Q	.	.	.	.	
18.88	0.7872	0.37	.	Q	.	.	.	.	
19.20	0.7967	0.35	.	Q	.	.	.	.	
19.52	0.8056	0.33	.	Q	.	.	.	.	
19.84	0.8140	0.31	.	Q	.	.	.	.	
20.16	0.8221	0.30	.	Q	.	.	.	.	
20.48	0.8298	0.29	.	Q	.	.	.	.	
20.80	0.8372	0.28	.	Q	.	.	.	.	
21.12	0.8444	0.27	.	Q	.	.	.	.	
21.44	0.8513	0.26	.	Q	.	.	.	.	
21.76	0.8580	0.25	Q	.	.	.	.	.	
22.08	0.8645	0.24	Q	.	.	.	.	.	
22.40	0.8708	0.23	Q	.	.	.	.	.	
22.72	0.8769	0.23	Q	.	.	.	.	.	
23.04	0.8828	0.22	Q	.	.	.	.	.	
23.36	0.8887	0.22	Q	.	.	.	.	.	
23.68	0.8943	0.21	Q	.	.	.	.	.	
24.00	0.8999	0.21	Q	.	.	.	.	.	
24.32	0.9026	0.00	Q	.	.	.	.	.	39317.26

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1440.7
10%	115.3
20%	38.4
30%	19.2
40%	19.2
50%	19.2
60%	19.2
70%	19.2
80%	19.2
90%	19.2

Proposed Condition 10 Year Storm Event

```
==========================================================================
*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
   AND LOW LOSS FRACTION ESTIMATIONS FOR AMC II:

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =    2.62 (inches)

   SOIL-COVER    AREA     PERCENT OF   SCS CURVE   LOSS RATE
     TYPE     (Acres)  PERVIOUS AREA    NUMBER   Fp(in./hr.)   YIELD
      1        6.32       0.00           98.      0.000       0.912

   TOTAL AREA (Acres) =     6.32

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.000

                    _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.088
==========================================================================
--------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =    6.32
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.000
   LOW LOSS FRACTION = 0.088
   TIME OF CONCENTRATION(MIN.) =  9.940
   SMALL AREA PEAK Q COMPUTED USING PEAK FLOW RATE FORMULA
   USER SPECIFIED RAINFALL VALUES ARE USED
   RETURN FREQUENCY(YEARS) =  10
     5-MINUTE POINT RAINFALL VALUE(INCHES) =  0.21
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.52
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.66
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  1.01
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.36
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.62

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    1.37
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    0.01

**************************************************************************
 TIME    VOLUME      Q   0.      5.0     10.0     15.0     20.0
(HOURS)   (AF)     (CFS)
--------------------------------------------------------------------------
 0.02     0.0000     0.00  Q       .       .       .       .
 0.18     0.0021     0.33  Q       .       .       .       .
 0.33     0.0064     0.33  Q       .       .       .       .
```

0.49	0.0106	0.33	Q	.	.	.	.
0.65	0.0149	0.33	Q	.	.	.	.
0.80	0.0192	0.33	Q	.	.	.	.
0.96	0.0236	0.34	Q	.	.	.	.
1.12	0.0279	0.34	Q	.	.	.	.
1.27	0.0323	0.34	Q	.	.	.	.
1.43	0.0367	0.34	Q	.	.	.	.
1.59	0.0411	0.34	Q	.	.	.	.
1.74	0.0456	0.35	Q	.	.	.	.
1.90	0.0501	0.35	Q	.	.	.	.
2.06	0.0546	0.35	Q	.	.	.	.
2.21	0.0591	0.35	Q	.	.	.	.
2.37	0.0637	0.35	Q	.	.	.	.
2.53	0.0683	0.36	Q	.	.	.	.
2.68	0.0729	0.36	Q	.	.	.	.
2.84	0.0775	0.36	Q	.	.	.	.
3.00	0.0822	0.36	Q	.	.	.	.
3.15	0.0869	0.36	Q	.	.	.	.
3.31	0.0916	0.37	Q	.	.	.	.
3.47	0.0964	0.37	Q	.	.	.	.
3.62	0.1012	0.37	Q	.	.	.	.
3.78	0.1060	0.37	Q	.	.	.	.
3.94	0.1109	0.38	Q	.	.	.	.
4.09	0.1158	0.38	Q	.	.	.	.
4.25	0.1207	0.38	Q	.	.	.	.
4.41	0.1257	0.38	Q	.	.	.	.
4.56	0.1306	0.39	Q	.	.	.	.
4.72	0.1357	0.39	Q	.	.	.	.
4.88	0.1407	0.39	Q	.	.	.	.
5.03	0.1459	0.40	Q	.	.	.	.
5.19	0.1510	0.40	Q	.	.	.	.
5.35	0.1562	0.40	Q	.	.	.	.
5.50	0.1614	0.41	Q	.	.	.	.
5.66	0.1667	0.41	Q	.	.	.	.
5.82	0.1720	0.41	Q	.	.	.	.
5.97	0.1773	0.41	Q	.	.	.	.
6.13	0.1827	0.42	Q	.	.	.	.
6.29	0.1881	0.42	Q	.	.	.	.
6.44	0.1936	0.43	Q	.	.	.	.
6.60	0.1991	0.43	Q	.	.	.	.
6.76	0.2047	0.43	Q	.	.	.	.
6.91	0.2103	0.44	Q	.	.	.	.
7.07	0.2160	0.44	Q	.	.	.	.
7.23	0.2218	0.44	Q	.	.	.	.
7.38	0.2275	0.45	Q	.	.	.	.
7.54	0.2334	0.45	Q	.	.	.	.
7.70	0.2393	0.46	Q	.	.	.	.

7.85	0.2452	0.46	Q	.	.	.	.
8.01	0.2512	0.47	Q	.	.	.	.
8.17	0.2573	0.47	Q	.	.	.	.
8.32	0.2634	0.48	Q	.	.	.	.
8.48	0.2696	0.48	Q	.	.	.	.
8.64	0.2759	0.49	Q	.	.	.	.
8.79	0.2822	0.49	Q	.	.	.	.
8.95	0.2886	0.50	Q	.	.	.	.
9.11	0.2951	0.50	.Q	.	.	.	.
9.26	0.3017	0.51	.Q	.	.	.	.
9.42	0.3083	0.51	.Q	.	.	.	.
9.58	0.3150	0.52	.Q	.	.	.	.
9.73	0.3219	0.53	.Q	.	.	.	.
9.89	0.3287	0.54	.Q	.	.	.	.
10.05	0.3357	0.54	.Q	.	.	.	.
10.20	0.3428	0.55	.Q	.	.	.	.
10.36	0.3500	0.56	.Q	.	.	.	.
10.52	0.3573	0.57	.Q	.	.	.	.
10.67	0.3647	0.57	.Q	.	.	.	.
10.83	0.3722	0.59	.Q	.	.	.	.
10.99	0.3798	0.59	.Q	.	.	.	.
11.14	0.3876	0.60	.Q	.	.	.	.
11.30	0.3954	0.61	.Q	.	.	.	.
11.46	0.4034	0.63	.Q	.	.	.	.
11.61	0.4116	0.63	.Q	.	.	.	.
11.77	0.4199	0.65	.Q	.	.	.	.
11.93	0.4284	0.66	.Q	.	.	.	.
12.08	0.4369	0.66	.Q	.	.	.	.
12.24	0.4452	0.62	.Q	.	.	.	.
12.40	0.4533	0.64	.Q	.	.	.	.
12.55	0.4617	0.65	.Q	.	.	.	.
12.71	0.4703	0.68	.Q	.	.	.	.
12.87	0.4792	0.69	.Q	.	.	.	.
13.02	0.4882	0.71	.Q	.	.	.	.
13.18	0.4976	0.73	.Q	.	.	.	.
13.34	0.5072	0.76	.Q	.	.	.	.
13.49	0.5171	0.78	.Q	.	.	.	.
13.65	0.5274	0.81	.Q	.	.	.	.
13.81	0.5380	0.83	.Q	.	.	.	.
13.96	0.5491	0.88	.Q	.	.	.	.
14.12	0.5606	0.89	.Q	.	.	.	.
14.28	0.5720	0.87	.Q	.	.	.	.
14.43	0.5835	0.90	.Q	.	.	.	.
14.59	0.5956	0.98	.Q	.	.	.	.
14.75	0.6086	1.02	. Q	.	.	.	.
14.90	0.6225	1.13	. Q	.	.	.	.
15.06	0.6375	1.19	. Q	.	.	.	.

15.22	0.6540	1.36	.	Q	.	.	.	.
15.37	0.6722	1.46	.	Q	.	.	.	.
15.53	0.6920	1.58	.	Q	.	.	.	.
15.69	0.7139	1.81	.	Q	.	.	.	.
15.84	0.7501	3.77	.		Q	.	.	.
16.00	0.8062	4.90	.		Q.	.	.	.
16.16	0.9134	11.66	.		.	.	Q	.
16.31	1.0040	2.34	.	Q	.	.	.	.
16.47	1.0291	1.53	.	Q	.	.	.	.
16.63	1.0472	1.27	.	Q	.	.	.	.
16.78	1.0623	1.07	.	Q	.	.	.	.
16.94	1.0753	0.94	.Q		.	.	.	.
17.10	1.0868	0.84	.Q		.	.	.	.
17.25	1.0978	0.85	.Q		.	.	.	.
17.41	1.1085	0.79	.Q		.	.	.	.
17.57	1.1184	0.74	.Q		.	.	.	.
17.72	1.1278	0.70	.Q		.	.	.	.
17.88	1.1366	0.66	.Q		.	.	.	.
18.04	1.1450	0.63	.Q		.	.	.	.
18.19	1.1534	0.67	.Q		.	.	.	.
18.35	1.1619	0.64	.Q		.	.	.	.
18.51	1.1700	0.62	.Q		.	.	.	.
18.66	1.1779	0.60	.Q		.	.	.	.
18.82	1.1855	0.58	.Q		.	.	.	.
18.98	1.1929	0.56	.Q		.	.	.	.
19.13	1.2001	0.55	.Q		.	.	.	.
19.29	1.2071	0.53	.Q		.	.	.	.
19.45	1.2139	0.52	.Q		.	.	.	.
19.60	1.2206	0.51	.Q		.	.	.	.
19.76	1.2270	0.49	Q		.	.	.	.
19.92	1.2334	0.48	Q		.	.	.	.
20.07	1.2396	0.47	Q		.	.	.	.
20.23	1.2457	0.46	Q		.	.	.	.
20.39	1.2516	0.46	Q		.	.	.	.
20.54	1.2574	0.45	Q		.	.	.	.
20.70	1.2632	0.44	Q		.	.	.	.
20.86	1.2688	0.43	Q		.	.	.	.
21.01	1.2743	0.42	Q		.	.	.	.
21.17	1.2798	0.42	Q		.	.	.	.
21.33	1.2851	0.41	Q		.	.	.	.
21.48	1.2904	0.40	Q		.	.	.	.
21.64	1.2956	0.40	Q		.	.	.	.
21.80	1.3007	0.39	Q		.	.	.	.
21.95	1.3057	0.39	Q		.	.	.	.
22.11	1.3107	0.38	Q		.	.	.	.
22.27	1.3155	0.38	Q		.	.	.	.
22.42	1.3204	0.37	Q		.	.	.	.

22.58	1.3251	0.37	Q	.	.	.	.	
22.74	1.3298	0.36	Q	.	.	.	.	
22.89	1.3345	0.36	Q	.	.	.	.	
23.05	1.3391	0.35	Q	.	.	.	.	
23.21	1.3436	0.35	Q	.	.	.	.	
23.36	1.3481	0.34	Q	.	.	.	.	
23.52	1.3525	0.34	Q	.	.	.	.	
23.68	1.3569	0.34	Q	.	.	.	.	
23.83	1.3612	0.33	Q	.	.	.	.	
23.99	1.3655	0.33	Q	.	.	.	.	
24.15	1.3698	0.33	Q	.	.	.	.	
24.30	1.3719	0.00	Q	.	.	.	.	59759.96

TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1447.6
10%	103.4
20%	37.6
30%	28.2
40%	18.8
50%	9.4
60%	9.4
70%	9.4
80%	9.4
90%	9.4

Proposed Condition 10 Year Storm Event Routed

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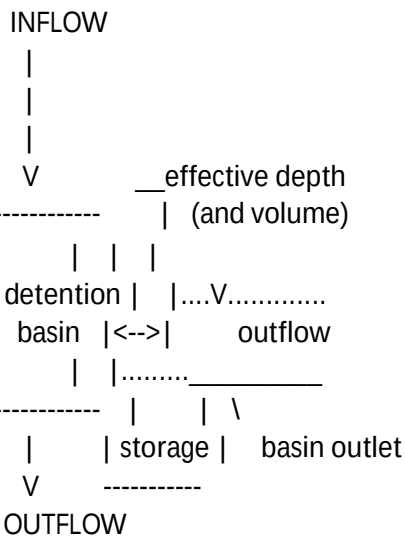
FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
CONSTANT HYDROGRAPH TIME UNIT(MINUTES) = 9.400
DEAD STORAGE(AF) = 0.58
SPECIFIED DEAD STORAGE(AF) FILLED = 0.00
ASSUMED INITIAL DEPTH(FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:
TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 3

*BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	**	BASIN-DEPTH (FEET)	STORAGE (ACRE-FEET)	OUTFLOW (CFS)	*
*	0.000	0.000	0.000**	3.000	0.140	0.100*	
*	6.000	0.280	11.660**				

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	3.00	0.13935	0.14065
3	6.00	0.20452	0.35548

WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

DETENTION BASIN ROUTING RESULTS:
NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.020	0.000	0.00	0.00	0.00	0.000
0.177	0.004	0.33	0.00	0.00	0.000
0.333	0.008	0.33	0.00	0.00	0.000
0.490	0.013	0.33	0.00	0.00	0.000
0.647	0.017	0.33	0.00	0.00	0.000
0.803	0.021	0.33	0.00	0.00	0.000
0.960	0.026	0.34	0.00	0.00	0.000
1.117	0.030	0.34	0.00	0.00	0.000
1.273	0.034	0.34	0.00	0.00	0.000
1.430	0.039	0.34	0.00	0.00	0.000
1.587	0.043	0.34	0.00	0.00	0.000
1.743	0.048	0.35	0.00	0.00	0.000
1.900	0.052	0.35	0.00	0.00	0.000
2.057	0.057	0.35	0.00	0.00	0.000
2.213	0.061	0.35	0.00	0.00	0.000
2.370	0.066	0.35	0.00	0.00	0.000
2.527	0.071	0.36	0.00	0.00	0.000
2.683	0.075	0.36	0.00	0.00	0.000
2.840	0.080	0.36	0.00	0.00	0.000
2.997	0.085	0.36	0.00	0.00	0.000
3.153	0.089	0.36	0.00	0.00	0.000
3.310	0.094	0.37	0.00	0.00	0.000
3.467	0.099	0.37	0.00	0.00	0.000
3.623	0.104	0.37	0.00	0.00	0.000
3.780	0.108	0.37	0.00	0.00	0.000
3.937	0.113	0.38	0.00	0.00	0.000
4.093	0.118	0.38	0.00	0.00	0.000
4.250	0.123	0.38	0.00	0.00	0.000
4.407	0.128	0.38	0.00	0.00	0.000
4.563	0.133	0.39	0.00	0.00	0.000
4.720	0.138	0.39	0.00	0.00	0.000
4.877	0.143	0.39	0.00	0.00	0.000
5.033	0.148	0.40	0.00	0.00	0.000
5.190	0.154	0.40	0.00	0.00	0.000
5.347	0.159	0.40	0.00	0.00	0.000
5.503	0.164	0.41	0.00	0.00	0.000
5.660	0.169	0.41	0.00	0.00	0.000
5.817	0.175	0.41	0.00	0.00	0.000
5.973	0.180	0.41	0.00	0.00	0.000
6.130	0.185	0.42	0.00	0.00	0.000
6.287	0.191	0.42	0.00	0.00	0.000
6.443	0.196	0.43	0.00	0.00	0.000
6.600	0.202	0.43	0.00	0.00	0.000
6.757	0.208	0.43	0.00	0.00	0.000

6.913	0.213	0.44	0.00	0.00	0.000
7.070	0.219	0.44	0.00	0.00	0.000
7.227	0.225	0.44	0.00	0.00	0.000
7.383	0.230	0.45	0.00	0.00	0.000
7.540	0.236	0.45	0.00	0.00	0.000
7.697	0.242	0.46	0.00	0.00	0.000
7.853	0.248	0.46	0.00	0.00	0.000
8.010	0.254	0.47	0.00	0.00	0.000
8.167	0.260	0.47	0.00	0.00	0.000
8.323	0.267	0.48	0.00	0.00	0.000
8.480	0.273	0.48	0.00	0.00	0.000
8.637	0.279	0.49	0.00	0.00	0.000
8.793	0.285	0.49	0.00	0.00	0.000
8.950	0.292	0.50	0.00	0.00	0.000
9.107	0.298	0.50	0.00	0.00	0.000
9.263	0.305	0.51	0.00	0.00	0.000
9.420	0.312	0.51	0.00	0.00	0.000
9.577	0.318	0.52	0.00	0.00	0.000
9.733	0.325	0.53	0.00	0.00	0.000
9.890	0.332	0.54	0.00	0.00	0.000
10.047	0.339	0.54	0.00	0.00	0.000
10.203	0.346	0.55	0.00	0.00	0.000
10.360	0.354	0.56	0.00	0.00	0.000
10.517	0.361	0.57	0.00	0.00	0.000
10.673	0.368	0.57	0.00	0.00	0.000
10.830	0.376	0.59	0.00	0.00	0.000
10.987	0.384	0.59	0.00	0.00	0.000
11.143	0.391	0.60	0.00	0.00	0.000
11.300	0.399	0.61	0.00	0.00	0.000
11.457	0.407	0.63	0.00	0.00	0.000
11.613	0.416	0.63	0.00	0.00	0.000
11.770	0.424	0.65	0.00	0.00	0.000
11.927	0.433	0.66	0.00	0.00	0.000
12.083	0.441	0.66	0.00	0.00	0.000
12.240	0.449	0.62	0.00	0.00	0.000
12.397	0.458	0.64	0.00	0.00	0.000
12.553	0.466	0.65	0.00	0.00	0.000
12.710	0.475	0.68	0.00	0.00	0.000
12.867	0.484	0.69	0.00	0.00	0.000
13.023	0.493	0.71	0.00	0.00	0.000
13.180	0.502	0.73	0.00	0.00	0.000
13.337	0.512	0.76	0.00	0.00	0.000
13.493	0.522	0.78	0.00	0.00	0.000
13.650	0.533	0.81	0.00	0.00	0.000
13.807	0.543	0.83	0.00	0.00	0.000
13.963	0.555	0.88	0.00	0.00	0.000
14.120	0.566	0.89	0.00	0.00	0.000

14.277	0.578	0.87	0.00	0.00	0.000
14.433	0.580	0.72	0.20	0.00	0.009
14.590	0.580	0.98	0.47	0.01	0.022
14.747	0.580	1.02	0.74	0.02	0.035
14.903	0.580	1.13	1.05	0.03	0.049
15.060	0.580	1.19	1.37	0.04	0.064
15.217	0.580	1.36	1.73	0.05	0.081
15.373	0.580	1.46	2.12	0.06	0.099
15.530	0.580	1.58	2.54	0.08	0.118
15.687	0.580	1.81	3.01	0.11	0.140
15.843	0.580	3.77	3.67	1.40	0.171
16.000	0.580	4.90	4.07	3.44	0.190
16.157	0.580	11.66	5.41	6.81	0.253
16.313	0.580	2.34	4.14	6.94	0.193
16.470	0.580	1.53	3.60	3.45	0.168
16.627	0.580	1.27	3.39	2.02	0.158
16.783	0.580	1.07	3.29	1.43	0.154
16.940	0.580	0.94	3.24	1.13	0.151
17.097	0.580	0.84	3.21	0.96	0.150
17.253	0.580	0.85	3.20	0.88	0.149
17.410	0.580	0.79	3.19	0.84	0.149
17.567	0.580	0.74	3.17	0.79	0.148
17.723	0.580	0.70	3.16	0.74	0.148
17.880	0.580	0.66	3.15	0.70	0.147
18.037	0.580	0.63	3.14	0.66	0.147
18.193	0.580	0.67	3.15	0.65	0.147
18.350	0.580	0.64	3.14	0.65	0.147
18.507	0.580	0.62	3.14	0.64	0.146
18.663	0.580	0.60	3.13	0.62	0.146
18.820	0.580	0.58	3.13	0.60	0.146
18.977	0.580	0.56	3.12	0.58	0.146
19.133	0.580	0.55	3.12	0.56	0.145
19.290	0.580	0.53	3.11	0.55	0.145
19.447	0.580	0.52	3.11	0.53	0.145
19.603	0.580	0.51	3.11	0.52	0.145
19.760	0.580	0.49	3.10	0.51	0.145
19.917	0.580	0.48	3.10	0.49	0.145
20.073	0.580	0.47	3.10	0.48	0.145
20.230	0.580	0.46	3.10	0.47	0.144
20.387	0.580	0.46	3.09	0.46	0.144
20.543	0.580	0.45	3.09	0.45	0.144
20.700	0.580	0.44	3.09	0.45	0.144
20.857	0.580	0.43	3.09	0.44	0.144
21.013	0.580	0.42	3.08	0.43	0.144
21.170	0.580	0.42	3.08	0.42	0.144
21.327	0.580	0.41	3.08	0.42	0.144
21.483	0.580	0.40	3.08	0.41	0.144

21.640	0.580	0.40	3.08	0.40	0.144
21.797	0.580	0.39	3.08	0.40	0.144
21.953	0.580	0.39	3.07	0.39	0.143
22.110	0.580	0.38	3.07	0.39	0.143
22.267	0.580	0.38	3.07	0.38	0.143
22.423	0.580	0.37	3.07	0.38	0.143
22.580	0.580	0.37	3.07	0.37	0.143
22.737	0.580	0.36	3.07	0.37	0.143
22.893	0.580	0.36	3.07	0.36	0.143
23.050	0.580	0.35	3.07	0.36	0.143
23.207	0.580	0.35	3.06	0.35	0.143
23.363	0.580	0.34	3.06	0.35	0.143
23.520	0.580	0.34	3.06	0.34	0.143
23.677	0.580	0.34	3.06	0.34	0.143
23.833	0.580	0.33	3.06	0.34	0.143
23.990	0.580	0.33	3.06	0.33	0.143
24.147	0.580	0.33	3.06	0.33	0.143
24.303	0.580	0.00	3.00	0.21	0.140

PATEL & ASSOCIATES, INC.

August 2, 2022

Project No. V22095-12A

Mr. Chad McKillop

Subject: **Infiltration Testing for Water Quality Treatment Areas, Assessor Parcel Number 3105-291-01-0000, Located on Amethyst Road, Victorville Area, San Bernardino County, California**

INTRODUCTION

Patel & Associates is pleased to present this infiltration feasibility report for the proposed residential tract homes, located on Amethyst Road, Assessor Parcel Number 3105-291-01-0000, in the Victorville Area, San Bernardino County, California. The purpose of our study was to determine the infiltration rates and physical characteristics of the subsurface earth materials at the approximate depth of the proposed WQMP area within the proposed development. This feasibility report provides the infiltration rates to be used for the design and the development of the water quality management plan, where applicable.

PROPERTY DESCRIPTION

The subject property is located on Amethyst Road in the Victorville Area, San Bernardino County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The subject property is comprised of approximately 8.14-acres of undeveloped land. The site has not been graded. Topographic relief at the subject property is relatively low with the terrain being generally flat. Elevations at the site range from approximately 3,076 to 3,094 feet above mean sea level (msl), for a difference of about 18± feet across the entire site. Drainage within the subject property generally flows to the northeast.

The site is currently bordered by vacant property to the north, east, south and Amethyst Road to the west. Most of the vegetation on the site consists of moderate to dense amounts of annual weeds/grasses.

PROPOSED CONSTRUCTION

Based on the provided plans, the proposed development will consist of a commercial development complete with interior streets, utilities, driveway, parking and an onsite water quality treatment area.

SUBSURFACE EXPLORATION

Subsurface Exploration

Subsurface exploration within the subject site was performed on February 10, 2022 for the exploratory excavations. A truck mounted hollow-stem-auger drill rig was utilized to drill five (5) borings throughout the site to a maximum depth of 40 feet. The exploratory holes were excavated for geotechnical evaluation purposes with respect to the proposed developments and to interpret whether groundwater or impermeable soil layers were present. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration. The approximate locations of the exploratory excavations are shown on the attached Infiltration Location Map, Plate 1 and descriptive logs are presented in Appendix A.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions may have been reconciled to reflect laboratory test results with regard to ASTM D 2487.

Earth Materials

A general description of the earth materials observed on site is provided below.

- Quaternary Alluvium (map symbol Qal): Quaternary alluvium was encountered to the maximum depth explored. These alluvial deposits consist predominately of interlayered light brown, clayey sand, and occasional sandy silt. These deposits were generally noted to be in a slightly moist and dense state.

INFILTRATION TESTING

The double ring infiltrometer test method was utilized to perform a total of two (2) infiltration tests on February 23, 2022 to evaluate near surface infiltration rates in order to estimate the amount of storm water runoff that can infiltrate into the onsite water quality treatment plan areas. The infiltration tests were performed in general accordance with the requirements of double ring infiltration testing, ASTM D3385 and San Bernardino County Technical Guidance Document for Water Quality Management plans requirements.

The infiltration tests were performed using double ring infiltrometer and Mariotte tubes at a depth of 4 feet below existing grades. The locations of the infiltration tests are indicated on the attached infiltration Location Map, Plate 1. The double ring infiltrometer tests were located by property boundary measurement on the site plan and by using geographic features. Infiltration test data recorded in the field are summarized in the following table and is included within Appendix B including the graph of Infiltration Rate versus Elapsed Time.

Infiltration Test Summary

TEST NUMBER	INFILTRATION HOLE DEPTH (ft.)	INFILTRATION RATE (in/hr)	DESCRIPTION
DR-1	2.5	0.11	Clayey SAND
DR-2	3.4	0.76	Clayey SAND

The infiltration test rates ranged from 0.11 to 0.76 inches per hour (in/hr). A factor of safety of 2 should be applied to the measured test rates.

CONCLUSIONS AND RECOMMENDATIONS

General

From geotechnical and engineering geologic points of view, the proposed WQMP areas, where tested, is considered suitable for infiltration for the proposed development, provided the following conclusions and recommendations are incorporated into the plans and are implemented during construction.

Groundwater

Groundwater was not observed during our subsurface exploration to a total depth of 40 feet. Local well data from the California Department of Water Resources indicates local groundwater at depths greater than 100 feet below existing surface, which meets the minimum separation of 10 feet from the bottom of infiltration facility to the groundwater mark. Potential groundwater impact is considered low.

Geologic/ Geotechnical Screening

In order to reduce the risk of groundwater mounding below utility trenches and building foundations, the proposed WQMP areas (see Plate 1) should utilize the proper setbacks and installed at a lower elevation than the proposed structures in competent native earth materials.

Preliminary laboratory test results indicate onsite earth materials exhibit an expansion potential of **VERY LOW** as classified in accordance with 2019 CBC Section 1803.5.3 and ASTM D4829. The proposed structures will be supported by compacted fill and competent earth materials, with no shallow groundwater.

Therefore, infiltration within the proposed WQMP areas will not encroach on any proposed structures and will not increase the risk of geologic hazards.

Design Rate/Recommended Factor of Safety

The recommended factor of safety for the infiltration design is 2. Based on the data presented in this report and the recommendations set forth herein, it is the opinion of Patel & Associates, Inc. that the WQMP area can be designed for an infiltration rate of 0.44 inches per hour in the vicinity of DR-1 and DR-2.

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **Mr. Chad McKillop** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Patel & Associates, Inc. should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Patel & Associates, Inc. not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

Patel & Associates, Inc. should be retained to provide observations during construction to validate this report. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Patel & Associates, Inc. should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property.

The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Patel & Associates, Inc. during construction. This report is considered valid for a period of one year from the time the report was issued.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

Respectfully submitted,

PATEL & ASSOCIATES, INC.

Stephen M. Poole, PE 40219
President
Principal Engineer

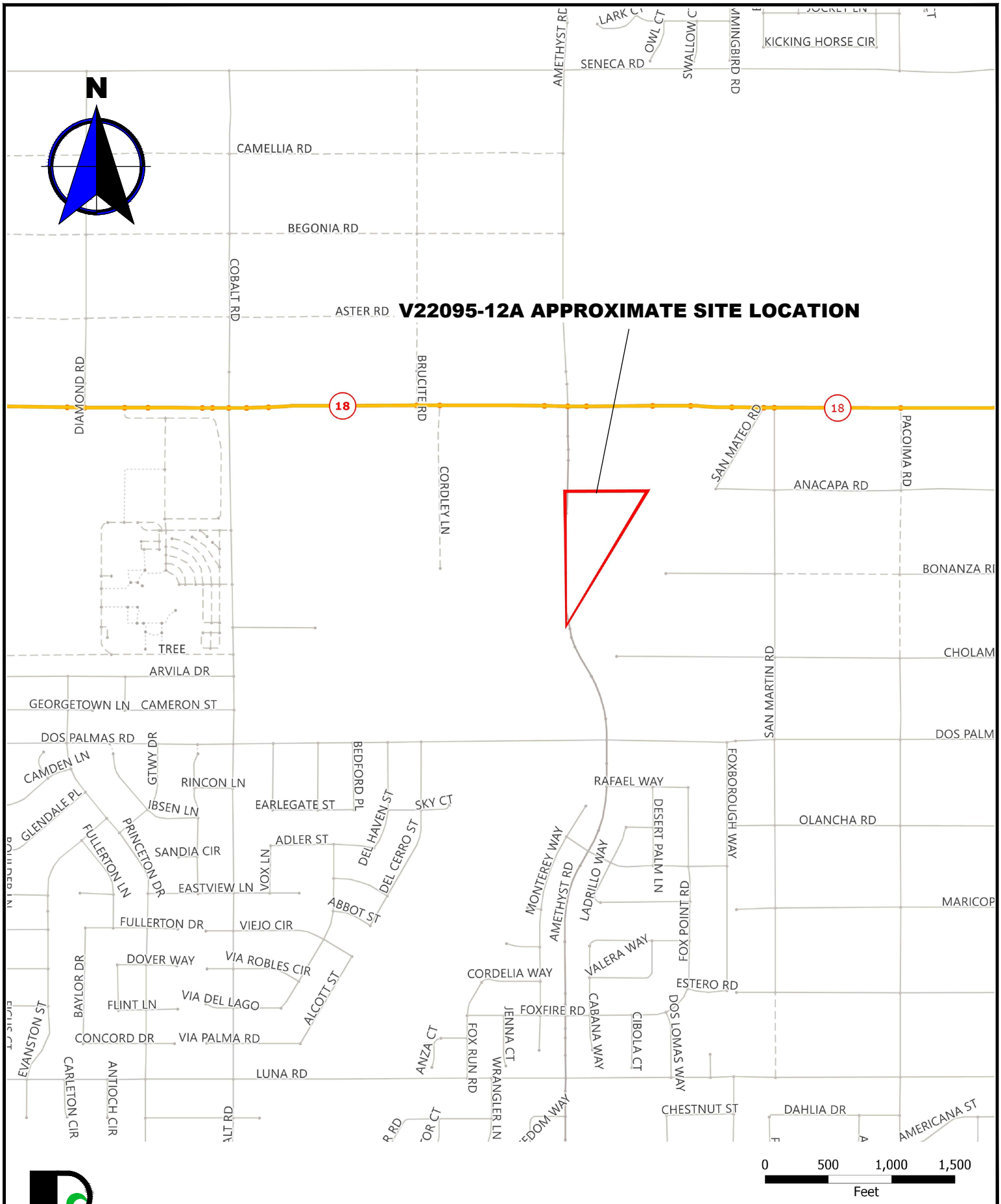
SMP/vh

Distribution: (1) Addressee

Attachments: Figure 1 – Vicinity Map *(Rear of Text)*
Appendix A – Exploratory Logs *(Rear of Text)*
Appendix B – Infiltration Test Sheets *(Rear of Text)*
Plate 1 – Infiltration Location Map *(Rear of Text)*

FIGURE 1

VICINITY MAP



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PROPOSED COMMERCIAL DEVELOPMENT		V22095-12A
VICINITY MAP	SEE BAR SCALE	
	JULY 2022	FIGURE 1

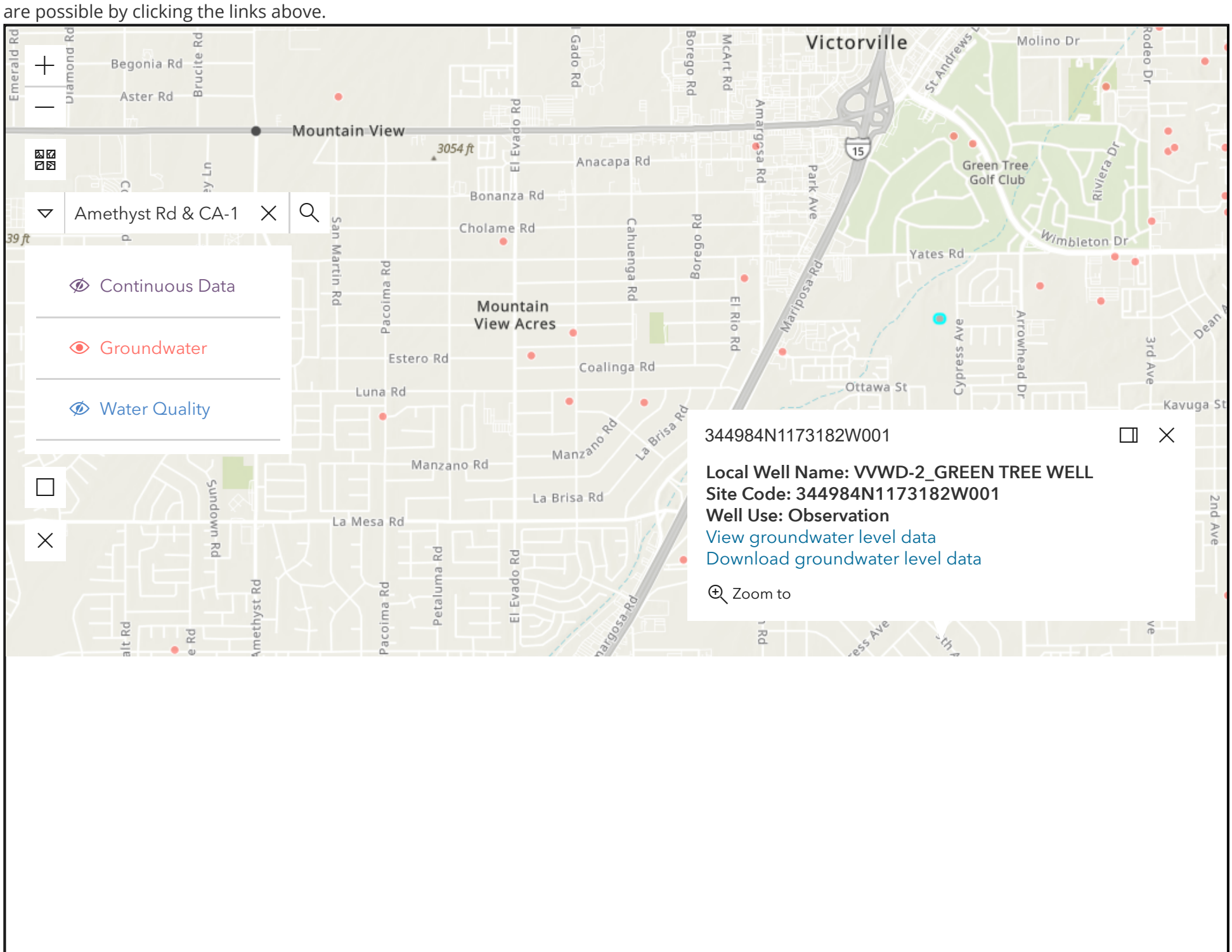
Contact WDL

CALIFORNIA DEPARTMENT OF WATER RESOURCES

WDL Station Map | Water Quality | Groundwater | Continuous Data | About | Login

Water Data Library (WDL) Station Map

Use the map below to locate monitoring stations. You can find an area of interest if you zoom and pan the map. Use the search box below to find features on the map such as the name of a city, park, landmark, lake, water feature, or zip code within California. Additional searches by data type are possible by clicking the links above.

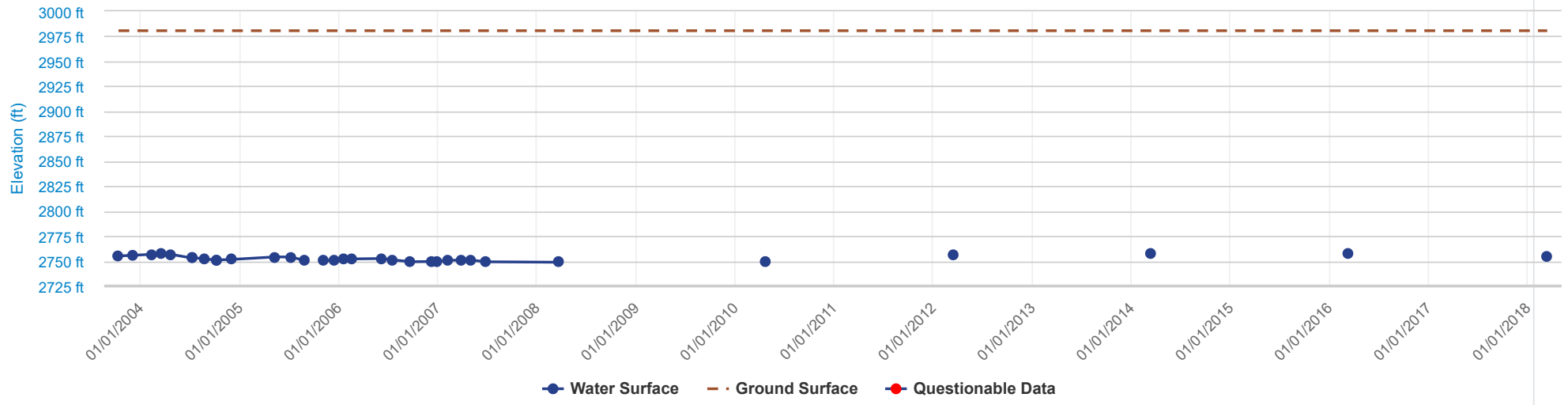


Groundwater Level Report

Station 344984N1173182W001

Station Data | **Groundwater Level Data**

Groundwater Levels for Well 344984N1173182W001



Download Data

Measurement Date (PST)	Reference Point Elevation	Ground Surface Elevation	Distance from RP to WS	Groundwater Elevation	Ground Surface to Water Surface	Measurement Issue	Submitting Organization	Collecting Organization	Water Level Measurement Comments
10/10/2003 00:00:00	2980.585	2980.585	225.54	2755.045	225.54		Mojave Water Agency...	Mojave Water Agency	
12/02/2003 00:00:00	2980.585	2980.585	224.91	2755.675	224.91		Mojave Water Agency...	Mojave Water Agency	
02/11/2004 00:00:00	2980.585	2980.585	223.87	2756.715	223.87		Mojave Water Agency...	Mojave Water Agency	
03/18/2004 00:00:00	2980.585	2980.585	223.38	2757.205	223.38		Mojave Water Agency...	Mojave Water Agency	
04/22/2004 00:00:00	2980.585	2980.585	224.01	2756.575	224.01		Mojave Water Agency...	Mojave Water Agency	
07/08/2004 00:00:00	2980.585	2980.585	227.7	2752.885	227.7		Mojave Water Agency...	Mojave Water Agency	
07/08/2004 00:00:00	2980.585	2980.585	227.07	2753.515	227.07		Mojave Water Agency...	Mojave Water Agency	
08/26/2004 00:00:00	2980.585	2980.585	228.67	2751.915	228.67		Mojave Water Agency...	Mojave Water Agency	
10/06/2004 00:00:00	2980.585	2980.585	229.61	2750.975	229.61		Mojave Water Agency...	Mojave Water Agency	
10/07/2004 00:00:00	2980.585	2980.585	229.61	2750.975	229.61		Mojave Water Agency...	Mojave Water Agency	
11/30/2004 00:00:00	2980.585	2980.585	229.02	2751.565	229.02		Mojave Water Agency...	Mojave Water Agency	
05/12/2005 00:00:00	2980.585	2980.585	226.47	2754.115	226.47		Mojave Water Agency...	Mojave Water Agency	
07/07/2005 00:00:00	2980.585	2980.585	226.64	2753.945	226.64		Mojave Water Agency...	Mojave Water Agency	
08/26/2005 00:00:00	2980.585	2980.585	230	2750.585	230		Mojave Water Agency...	Mojave Water Agency	
09/15/2005 00:00:00	2980.585	2980.585				NM:Dry well	Mojave Water Agency...	Mojave Water Agency	

11/03/2005 00:00:00	2980.585	2980.585	230.3	2750.285	230.3		Mojave Water Agency...	Mojave Water Agency
12/14/2005 00:00:00	2980.585	2980.585	230.09	2750.495	230.09		Mojave Water Agency...	Mojave Water Agency
01/17/2006 00:00:00	2980.585	2980.585	229.02	2751.565	229.02		Mojave Water Agency...	Mojave Water Agency
02/16/2006 00:00:00	2980.585	2980.585	228.51	2752.075	228.51		Mojave Water Agency...	Mojave Water Agency
06/07/2006 00:00:00	2980.585	2980.585	228.14	2752.445	228.14		Mojave Water Agency...	Mojave Water Agency
07/18/2006 00:00:00	2980.585	2980.585	229.42	2751.165	229.42		Mojave Water Agency...	Mojave Water Agency
09/20/2006 00:00:00	2980.585	2980.585	231.34	2749.245	231.34		Mojave Water Agency...	Mojave Water Agency
12/08/2006 11:00:00	2980.585	2980.585	231.11	2749.475	231.11		Mojave Water Agency...	Mojave Water Agency
12/30/2006 00:00:00	2980.585	2980.585	231.11	2749.475	231.11		Mojave Water Agency...	Mojave Water Agency
02/09/2007 00:00:00	2980.585	2980.585	229.81	2750.775	229.81		Mojave Water Agency...	Mojave Water Agency

1 to 25 of 34 records

< 1 2 >

text

APPENDIX A

EXPLORATORY LOGS

Geotechnical Boring Log B-1

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	39	2.5'	108.8	2.0	SC	Clayey SAND; light brown, slightly moist, dense
					SM	Silty SAND; light tan, slightly moist, dense
5	48	5'	113.5	5.4		
	33	7.5'	107.1	0.5		
					SP-SM	Poorly-Graded SAND with Silt; light tan, slightly moist, dense
10	52	10'	115.4	0.4		
					SM	Silty SAND; brown, slightly moist, dense
15	36	15'	118.9	0.7		
20	49	20'	128.7	0.5		
25						
30						

Geotechnical Boring Log B-1

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-2

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	47	2.5'	119.4	0.6	SC	Clayey SAND; light brown, slightly moist, dense
5	35	5'	-	-		No Recovery
	34	7.5'	107.5	1.7	SM	Silty SAND; orange, slightly moist, dense
					SM	Silty SAND; light tan, slightly moist, dense
10	33	10'	119.8	0.5		
15	37	15'	122.2	2.8		
20						
25						
30						

Geotechnical Boring Log B-2

Date: February 10, 2022	**Project Name: Amethyst** **Page: 2 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
30						
35						
40						End of Boring: 40 feet
						No Groundwater
45						
50						
55						
60						

Geotechnical Boring Log B-3

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
					SM	Silty SAND; brown, slightly moist, medium dense
	61	2.5'	116.3	1.8		
					SM	Silty SAND; brown, slightly moist, medium dense
5	30	5'	108.4	0.6		
	41	7.5'	114.3	0.6		
10	47	10'	104.9	0.6		
					SM	Silty SAND; tan, slightly moist, dense
15	48	15'	115.9	0.5		
20						
25						
30						

12284 Industrial Blvd Suite 2-A, Victorville CA 92395

PATEL & ASSOCIATES, INC.

Geotechnical Boring Log B-4

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
	76	2.5'	117.4	2.2	SC	Clayey SAND; brown, slightly moist, dense, silt
5	70	5'	95.8	1.4	SM	Silty SAND; brown, slightly moist, dense
	56	7.5'	118.0	0.8		
10	52	10'	114.1	0.8		
					SM	Silty SAND; tan, slightly moist, dense
15	55	15'	106.1	1.2		
20						
25						
30						

Geotechnical Boring Log B-5

Date: February 10, 2022	**Project Name: Amethyst** **Page: 1 of 2**
Project Number: V22095-10A	**Logged By: MWG**
Drilling Company: GP	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Alluvium (Qal):**
					SM	Silty SAND; brown, slightly moist, dense
	52	2.5'	-	-		
5	51	5'	114.7	1.7		
	73/11"	7.5'	118.1	1.5		
					SM	Silty SAND; brown, slightly moist, very dense, gravel
10	60	10'	104.2	1.6		
					SM	Silty SAND; tan, slightly moist, dense
15	63	15'	111.7	1.4		
20						
25						
30						

APPENDIX B

INFILTRATION TEST SHEETS

Test No.	DR-1	Location	See Map	Turf-Tec International - Record Chart for IN10-W - (12 & 24 Inch Infiltration Rings)

Project Identification:						Constants	Area cm2	Depth of Liquid (cm)	Liquid Container Number		Marriotte Tube Volume
Test Location:	DR-1					Inner Ring	729	10.0	1		3000
Liquid Used:	TAP WATE	pH:	8.0			Annular Ring	2189	10.0	2		10000
Tested By:	MWG		Date	2/23/2022		Liquid level maintained	(X) Flow Valve	( ) Float Valve	( ) Mariotte Tubes		
Depth to water table:			Depth of Test	2.5'		Penetration Depth of Outer Ring:	9 cm		Other		

Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Time Increment /(Total)	Elapsed Time (Min)	Flow Readings				Liquid Temp ºF	Infiltration Rates				Ground Temperature		Remarks
						Inner Ring Reading cm	Inner Maroitte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate In/h	Annular Infiltration Rate cm/h	Annular Infiltration Rate In/h	Ground Temp Depth (cm)	Temp at Depth (c)	Weather conditions Etc...
1	Start Test	2/23/2022	10:05	0:30	30												
	End Test	2/23/2022	10:35	0:30		6.00	400	6.00	4200		1.10	**0.43**	3.84	**1.51**			
2	Start Test	2/23/2022	10:35	0:30	60												
	End Test	2/23/2022	11:05	1:00		6.00	100	6.00	1800		0.27	**0.11**	1.64	**0.65**			
3	Start Test	2/23/2022	11:05	0:30	90												
	End Test	2/23/2022	11:35	1:30		6.00	0	6.00	1600		0.00	**0.00**	1.46	**0.58**			
4	Start Test	2/23/2022	11:35	0:30	120												
	End Test	2/23/2022	12:05	2:00		6.00	0	6.00	1000		0.00	**0.00**	0.91	**0.36**			
5	Start Test	2/23/2022	12:05	0:30	150												
	End Test	2/23/2022	12:35	2:30		6.00	300	6.00	900		0.82	**0.32**	0.82	**0.32**			
6	Start Test	2/23/2022	12:35	0:30	180												
	End Test	2/23/2022	13:05	3:00		6.00	100	6.00	1300		0.27	**0.11**	1.19	**0.47**			
7	Start Test	2/23/2022	13:05	0:30	210												
	End Test	2/23/2022	13:35	3:30		6.00	0	6.00	300		0.00	**0.00**	0.27	**0.11**			
8	Start Test	2/23/2022	13:35	0:30	240												
	End Test	2/23/2022	14:05	4:00		6.00	100	6.00	1000		0.27	**0.11**	0.91	**0.36**			
9	Start Test	2/23/2022	14:05	0:30	270												
	End Test	2/23/2022	14:35	4:30		6.00	100	6.00	1200		0.27	**0.11**	1.10	**0.43**			
10	Start Test	2/23/2022	14:35	0:30	300												
	End Test	2/23/2022	15:05	5:00		6.00	100	6.00	1000		0.27	**0.11**	0.91	**0.36**			
11	Start Test	2/23/2022	15:05	0:30	330												
	End Test	2/23/2022	15:35	5:30		6.00	100	6.00	400		0.27	**0.11**	0.37	**0.14**			
12	Start Test	2/23/2022	15:35	0:30	360												
	End Test	2/23/2022	16:05	6:00		6.00	100	6.00	500		0.27	**0.11**	0.46	**0.18**			

Project Identification:			0
Test Location:	DR-1		
Liquid Used:	TAP WATE	**pH:**	8.0
Tested By:	MWG		
Depth to water table:			0

Earth Strata Geotechnical Services, Inc.
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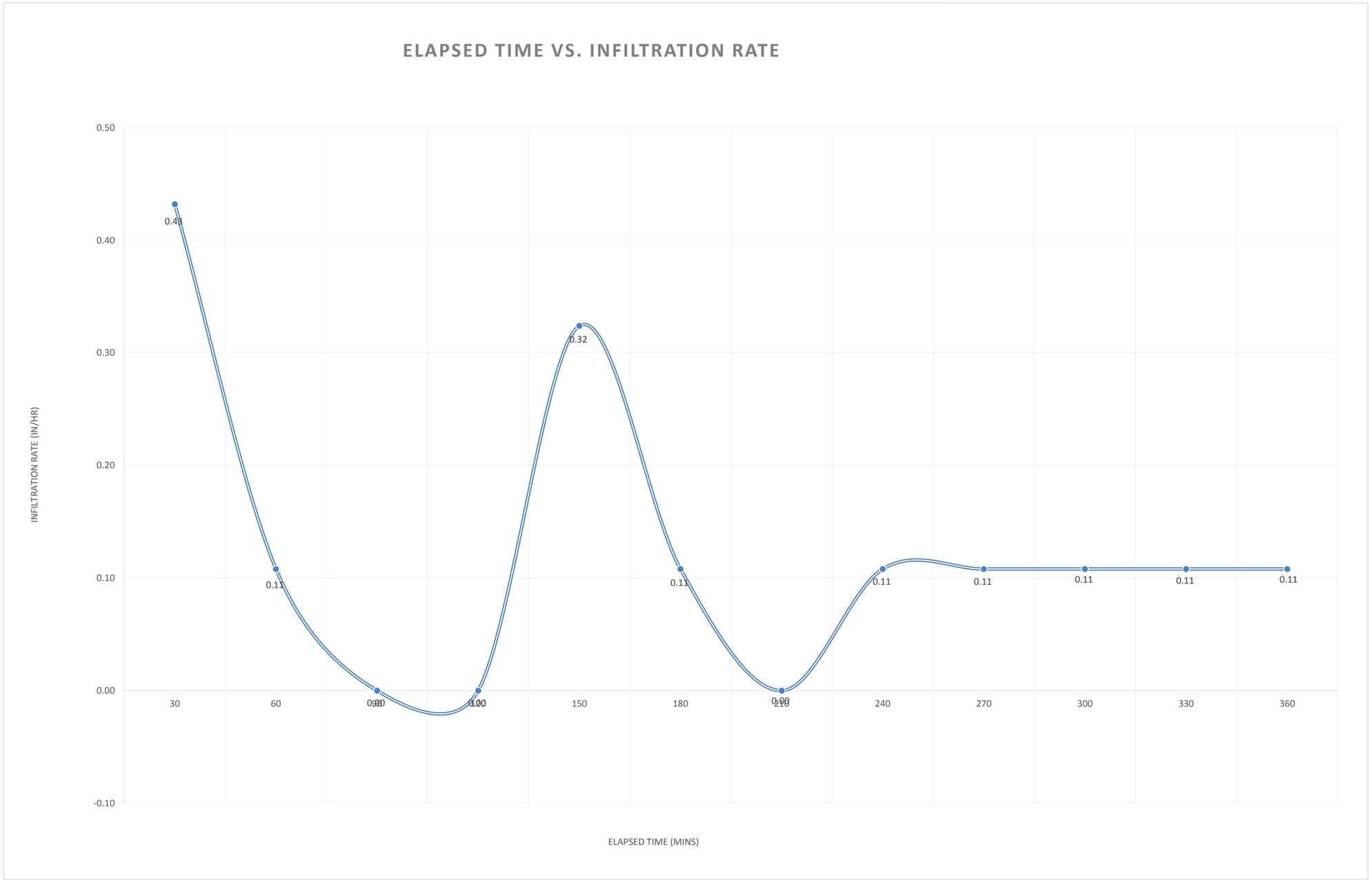


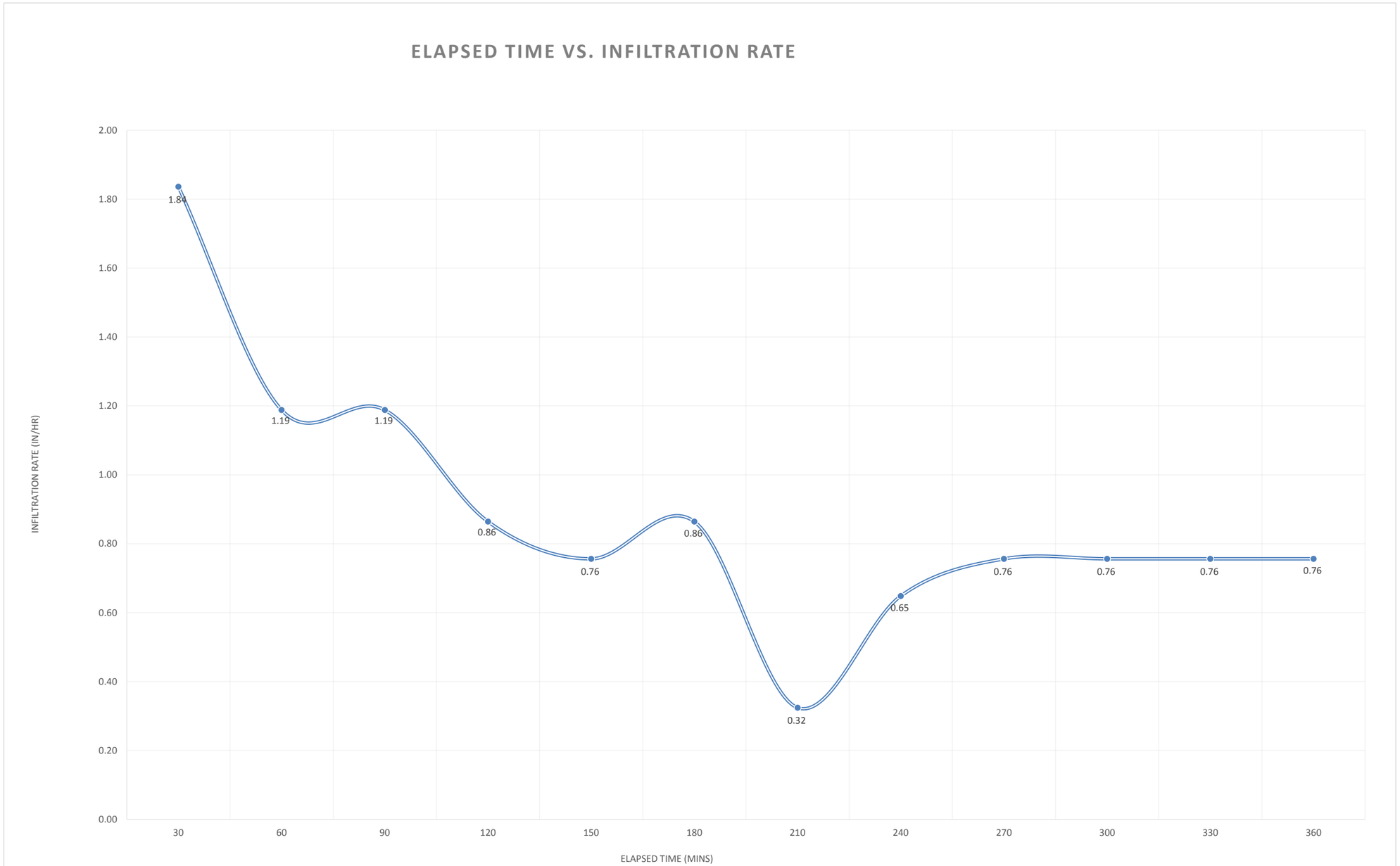
Test No.	DR-2	Location	See Map	Turf-Tec International - Record Chart for IN10-W - (12 & 24 Inch Infiltration Rings)

Project Identification:						Constants	Area cm2	Depth of Liquid (cm)	Liquid Container Number		Marriotte Tube Volume
Test Location:	DR-2					Inner Ring	729	10.0	1		3000
Liquid Used:	TAP WATE	pH:	8.0			Annular Ring	2189	10.0	2		10000
Tested By:	MWG		Date	2/23/2022		Liquid level maintained	(X) Flow Valve	( ) Float Valve	( ) Mariotte Tubes		
Depth to water table:			Depth of Test	3.4'		Penetration Depth of Outer Ring:	9 cm		Other		

Trial #	Start / End	Date MM/DD/YY	Time HR:MIN	Time Increment /(Total)	Elapsed Time (Min)	Flow Readings				Liquid Temp ºF	Infiltration Rates				Ground Temperature		Remarks
						Inner Ring Reading cm	Inner Maroitte Tube Flow (ml)	Annular Space Reading cm	Annular Space Marriotte Tube Flow (ml)		Inner Infiltration Rate cm/h	Inner Infiltration Rate In/h	Annular Infiltration Rate cm/h	Annular Infiltration Rate In/h	Ground Temp Depth (cm)	Temp at Depth (c)	Weather conditions Etc...
1	Start Test	2/23/2022	10:09	0:30	30	5.00		5.00									
	End Test	2/23/2022	10:39	0:30		5.00	1700	5.00	5100		4.66	**1.84**	4.66	**1.83**			
2	Start Test	2/23/2022	10:39	0:30	60	5.00		5.00									
	End Test	2/23/2022	11:09	1:00		6.00	1100	5.00	2800		3.02	**1.19**	2.56	**1.01**			
3	Start Test	2/23/2022	11:09	0:30	90	5.00		5.00									
	End Test	2/23/2022	11:39	1:30		5.00	1100	5.00	2500		3.02	**1.19**	2.28	**0.90**			
4	Start Test	2/23/2022	11:39	0:30	120	5.00		5.00									
	End Test	2/23/2022	12:09	2:00		5.00	800	5.00	2700		2.19	**0.86**	2.47	**0.97**			
5	Start Test	2/23/2022	12:09	0:30	150	5.00		5.00									
	End Test	2/23/2022	12:39	2:30		5.00	700	5.00	2100		1.92	**0.76**	1.92	**0.76**			
6	Start Test	2/23/2022	12:39	0:30	180	5.00		5.00									
	End Test	2/23/2022	13:09	3:00		5.00	800	5.00	2300		2.19	**0.86**	2.10	**0.83**			
7	Start Test	2/23/2022	13:09	0:30	210	5.00		5.00									
	End Test	2/23/2022	13:39	3:30		5.00	300	5.00	2500		0.82	**0.32**	2.28	**0.90**			
8	Start Test	2/23/2022	13:39	0:30	240	5.00		5.00									
	End Test	2/23/2022	14:09	4:00		5.00	600	5.00	2800		1.65	**0.65**	2.56	**1.01**			
9	Start Test	2/23/2022	14:09	0:30	270	5.00		5.00									
	End Test	2/23/2022	14:39	4:30		5.00	700	5.00	1700		1.92	**0.76**	1.55	**0.61**			
10	Start Test	2/23/2022	14:39	0:30	300	5.00		5.00									
	End Test	2/23/2022	15:09	5:00		5.00	700	5.00	1900		1.92	**0.76**	1.74	**0.68**			
11	Start Test	2/23/2022	15:09	0:30	330	5.00		5.00									
	End Test	2/23/2022	15:39	5:30		5.00	700	5.00	2000		1.92	**0.76**	1.83	**0.72**			
12	Start Test	2/23/2022	15:39	0:30	360	5.00		5.00									
	End Test	2/23/2022	16:09	6:00		5.00	700	5.00	1800		1.92	**0.76**	1.64	**0.65**			

Project Identification:			0
Test Location:	DR-2		
Liquid Used:	TAP WATE	**pH:**	8.0
Tested By:	MWG		
Depth to water table:			0

Earth Strata Geotechnical Services, Inc.
Geotechnical, Environmental and Materials Testing Consultants
www.ESGSINC.com (951) 397-8315



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 x v
A	Suitability Assessment	Soil assessment methods	0.25	1	
		Predominant soil texture	0.25	1	
		Site soil variability	0.25	1	
		Depth to groundwater / impervious layer	0.25	1	
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1
B	Design	Tributary area size	0.25		
		Level of pretreatment/ expected sediment loads	0.25		
		Redundancy	0.25		
		Compaction during construction	0.25		
		Design Safety Factor, $S_B = \Sigma p$			
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					.11 - .76
Design Infiltration Rate, in/hr, $K_{DESIGN} = S_{TOT} \times K_M$					0.44

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

see infiltration report

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

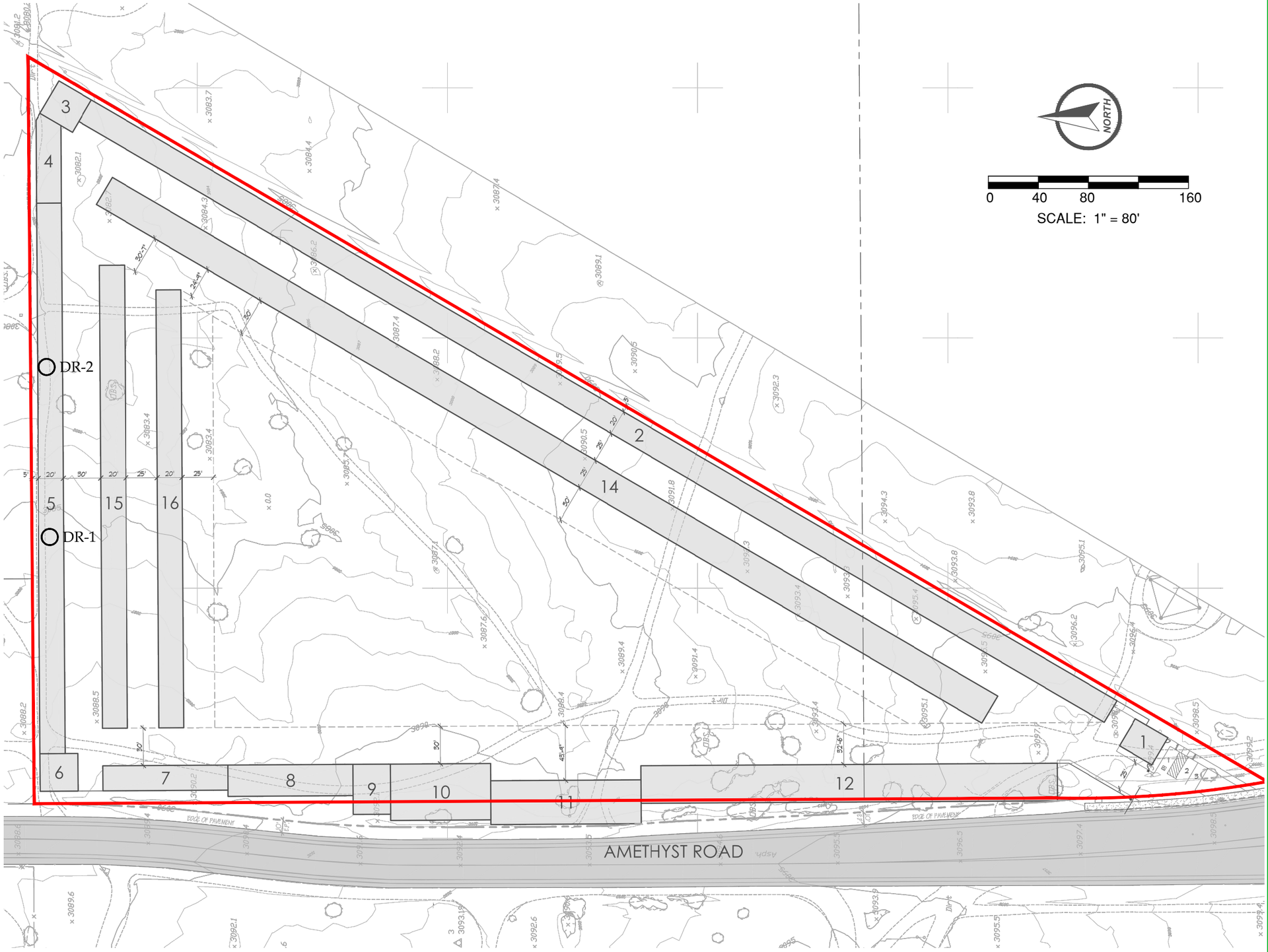
LEGEND

Locations are Approximate

Symbols

- Limits of Report

DR-2 - Double Ring Location



Commitment of Excellence
through Engineered Solution

INFILTRATION MAP

LOCATED ON AMETHYST ROAD
VICTORVILLE AREA, SAN BERNARDINO COUNTY, CALIFORNIA
APN 3105-291-01-0000

PROJECT	*PROPOSED COMMERCIAL DEVELOPMENT*		
CLIENT	*MR. CHAD MCKILLOP*		
PROJECT NO.	*V22095-12A*		
DATE	*JULY 2022*		
SCALE	*1:80*		
DWG XREFS			
REVISION			
DRAWN BY	*JDG*	*PLATE*	*1 OF 1*