Appendix F-1

Town of Apple Valley
Water Quality Management Plan For A.P.N. : 0463-441-07

Allard Engineering

March 5, 2026

Town of Apple Valley

Water Quality Management Plan

For:

A.P.N. : 0463-441-07

Prepared for:

Joshua Grading and Excavating, Inc.

P.O. Box 292329

Phelan, CA 92329

Phone# (760) 559-5845

Prepared by:

Allard Engineering

16866 Seville Avenue

Fontana, CA 92335

909-356-1815

Submittal Date: March 5, 2026

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 Conco Construction by Allard Engineering. The WQMP is intended to comply with the requirements of the Town of Apple Valley 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):	0463-441-07	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			

Owner's Signature			
Owner Name: David Dhillon			
Title	Janie and Thomas Craft		
Company	Joshua Grading and Excavating, Inc.		
Address	P.O. Box 292329, Phelan, CA 92329		
Email	janie@joshuagrading.com		
Telephone #	760-559-5845		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):		Grading Permit Number(s):	
Tract/Parcel Map Number(s):	0463-441-07	Building Permit Number(s):	
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			Lot# , Tract #

"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: Robert K. Allard, PE		PE Stamp Below
Title	Principal	
Company	Allard Engineering	
Address	16866 Seville Avenue, Fontana, CA 92335	
Email	rallard@allardeng.com	
Telephone #	909-356-1815	
Signature	*Robert K. Allard*	
Date	3/5/2026	



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Section I – Introduction

This WQMP 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).

Section 1 Discretionary Permit(s)

Form 1-1 Project Information

Project Name	APN: 0463-441-07				
Project Owner Contact Name:	Janie and Thomas Craft				
Mailing Address:	P.O. Box 292329 Phelan, CA 92329	E-mail Address:	janie@joshuagrading.com	Telephone:	760-559-5845
Permit/Application Number(s):		Tract/Parcel Map Number(s):	APN: 0463-441-07		
Additional Information/ Comments: Site Coordinates	Latitude: 34.61481 N, Longitude: -117.19930 W				
Description of Project:	The 10.37 acres project site (including the street improvements) is located along Tecaya Road, approximately 0.4 mile east of Dale Evans Parkway, adjacent to the south side of Quarry Road (APN 0463-441-07). Project site area is currently vacant and contains natural vegetation entirely. The proposed site will consist of 3 commercial building (Office/Auto Shop/Repair/Storage facilities) and paved parking lot/drive aisles. Also include the following road construction: Dirt Tecaya Road (The frontal street to the south) which includes north half width, plus 4' of pavement south of the centerline (Half width plus 4'), including the curb and gutter on the north side of Tecaya Road adjacent to the proposed site. Approximately 0.68 ac of street improvement in Tecaya Road included in DA-2. Dirt Dachshund Road (The side street to the east) which includes west half width, plus 4' of pavement east of the centerline (Half width plus 4'), including the curb & gutter and cul-de-sac on the north up to 545' adjacent to the proposed site. Approximately 0.68 ac of street improvement in Dachshund Ave. included in DA-3. We also proposing 26' of pavement west of the site along Tecaya Road extended over to Dale Evans Pkwy (22' of pavement to the north of the centerline, and 4' to the south of the centerline. The site area (10.37 acres) consists of 3.38 acres of open brush area (will not be developed) from northwest which continue to drain west to the existing drainage course un-mitigated along the westerly property line and finally drain into Tecaya Road. The remaining 6.99 acres are divided into three sub-areas (DA-1,2,3). DA-1 (2.55 acres): Consist of 90% of impervious area (Buildings/paved area and parking lot) whereas 10% of pervious area (Landscaping, planters). This sub-area drain to Retention/Infiltration Basin-1,2 (connected basin) for a portion of water quality volume mitigation and riser outflow into the Contech retention/infiltration chamber system for WQ volume.				

	Runoff from this area conveys to the Ret/Inf Basin-1,2 via the onsite storm drain conveyance system and riser outflow into the ret/inf chamber system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Basin-1,2, Inf/Ret Chamber System. For high flows upto 100-yr storm event, the flows will overflow in chamber system and drain out to street gutter in Tecaya Road via stormdrain/parkway drain. DA-2 (2.45 acres): Consist of 90% of impervious area (Buildings/paved &parking area and street improvement in Tecaya Road) where as 10% of pervious area (Landscaping, planters). The street improvement area (0.68 ac) in Tecaya Road also included in this sub-area. This sub-area drain to Retention/Infiltration Chamber System for water quality volume mitigation and outflow into the Tecaya Road curb&gutter in a mitigated flow rate via the stormdrain/parkway drain after retaining the water volume form larger storm. Runoff from this area conveys to the Ret/Inf Chamber System via the onsite storm drain conveyance system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Inf/Ret Chamber System. For high flows upto 100-yr storm event, the flows will be overflow the chamber and outlet via the storm drain/parkway drain into the street gutter in Tecaya Road. DA-3 (1.99 acres): Consist of 30% of impervious area (Buildings/paved area and street improvement in Dachshund Avenue) where as 70% of pervious area (Open brush, Landscaping, planters). The street improvement area (0.48 ac) in Dachshund Ave also included in this sub-area. This sub-area drain to Ret/Inf Basin-3 for water quality volume mitigation and riser outflow into the Contech retention/infiltration chamber system for high flow retention. Runoff from this area conveys to the Ret/Inf Basin-3 via the onsite storm drain conveyance system and riser outflow into the ret/inf chamber system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Basin-3. For high flows upto 100-yr storm event, the flows will overflow in chamber system and drain out to street gutter in Tecaya Road via stormdrain/parkway drain. Also the proposed Contech Chamber system at the southcenter (in DA-2) of the site to retain high flows from the drainage subareas and route the high flows through it and releases the flow in less than existing flow rates to mitigate HCOC condition from high flows upto 100-yr storm event.

Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	Not Applicable

Section 2 Project Description

2.1 Project Information

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):	304 484 SF	**3** Number of Dwelling Units:	n/a	**4** SIC Code:	5541

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:

Joshua Grading and Excavating, Inc. will be responsible to build the site and the maintenance of the post-developed BMPs.

Address:

P.O. Box 292329

Phelan, CA 92329

Phone Number: (706) 559-5845

2.3 Potential Stormwater Pollutants

Form 2.3-1 Pollutants of Concern			
Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Bacteria and viruses are a potential pollutant for the commercial used site. Due to the nature of the development the site will be treated using site and source and treatment control BMPs. Bacteria and virus can also be detected in pavement runoff, therefore, the site has incorporated treatment control throughout. All paved and hardened surfaces will flow through the proposed grate inlet pre-treatment units prior to discharge into the proposed inf/ret basin as part of Low Impact Design (LID).
Nutrients - Phosphorous	E ☒	N ☐	This commercial site includes landscaping area which will be the potential generation of this type of pollutants.
Nutrients - Nitrogen	E ☒	N ☐	This commercial site includes landscaping area which will be the potential generation of this type of pollutants.
Noxious Aquatic Plants	E ☒	N ☐	This commercial site includes landscaping area which will be the potential generation of this type of pollutants.
Sediment	E ☒	N ☐	This commercial site which will be the potential generation of this type of pollutants.
Metals	E ☒	N ☐	Generates from parking lots
Oil and Grease	E ☒	N ☐	Generates from oil & grease from parked vehicle of the commercial site
Trash/Debris	E ☒	N ☐	Debris/trash is a potential pollutant from the commercial site. Trash/debris from paved surfaces will be intercepted in the proposed grate inlets with filtration devices as part of the source and treatment control BMPs.
Pesticides / Herbicides	E ☒	N ☐	This commercial site will use pesticides/herbicides for pest control purposes and will be the potential generation of this type of pollutants.
Organic Compounds	E ☒	N ☐	This commercial site includes the usage of solvents which will be the potential generation of this type of pollutants.

Section 3 Site and Watershed Description

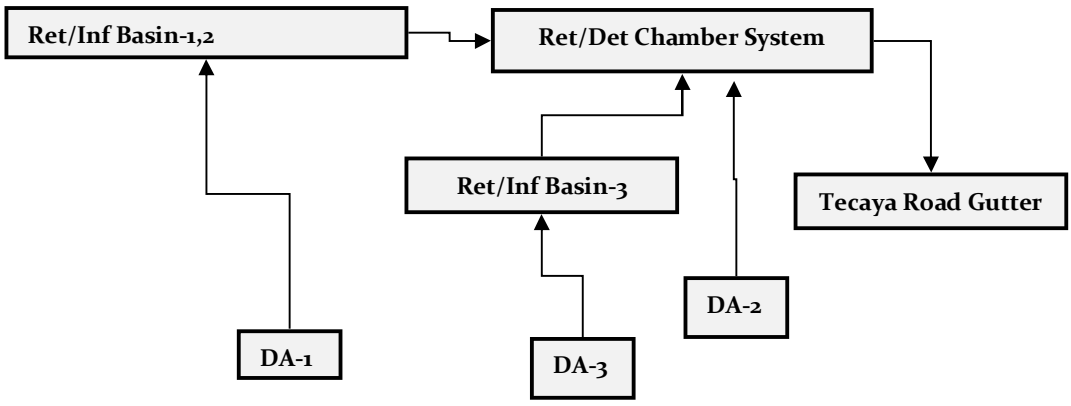
Describe the project site conditions that will facilitate the selection of BMPs through an analysis of the physical conditions and limitations of the site and its receiving waters. Identify distinct drainage areas (DA) that collect flow from a portion of the site and describe how runoff from each DA (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 34.6148	Longitude -117.1993	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*

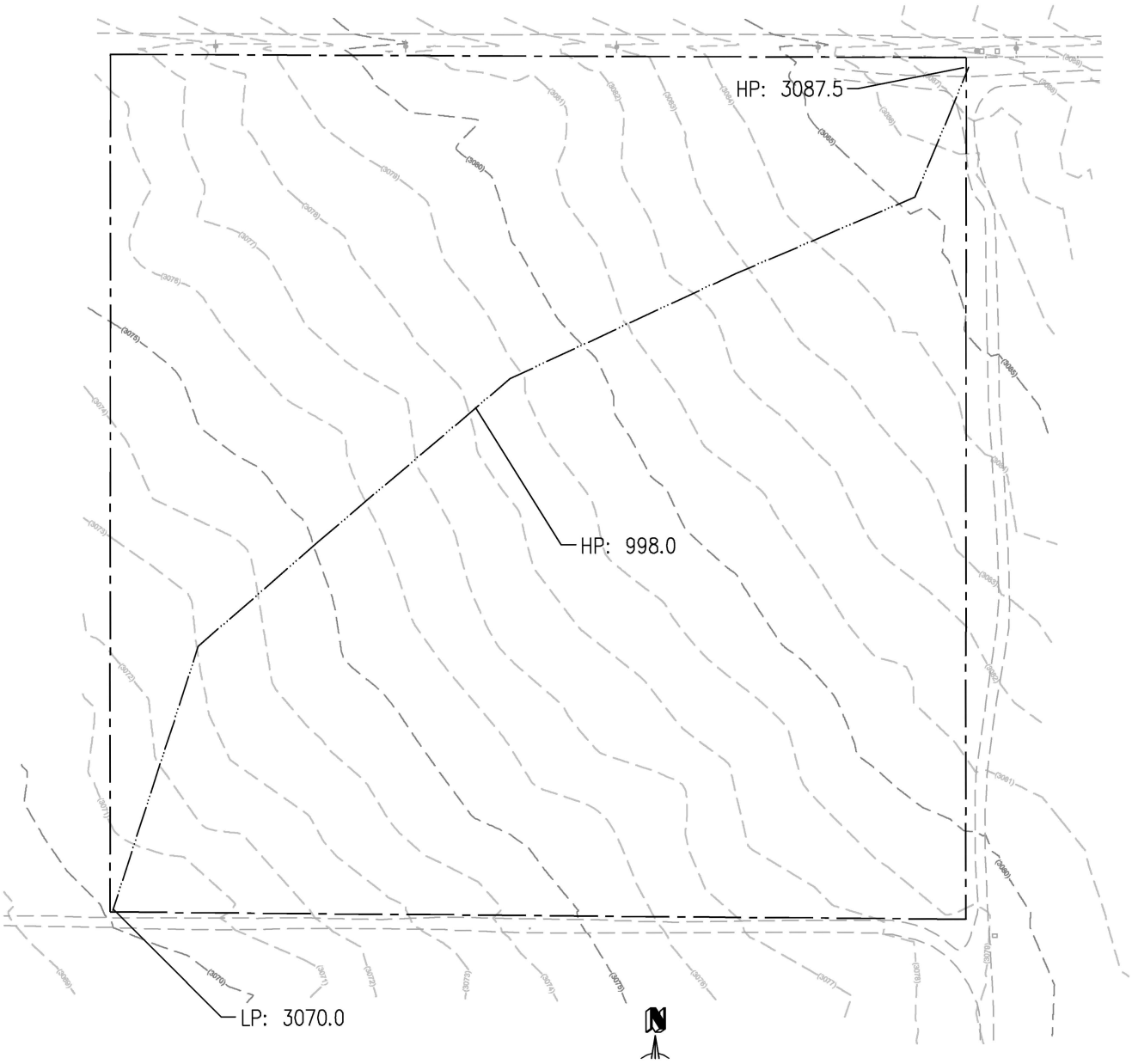


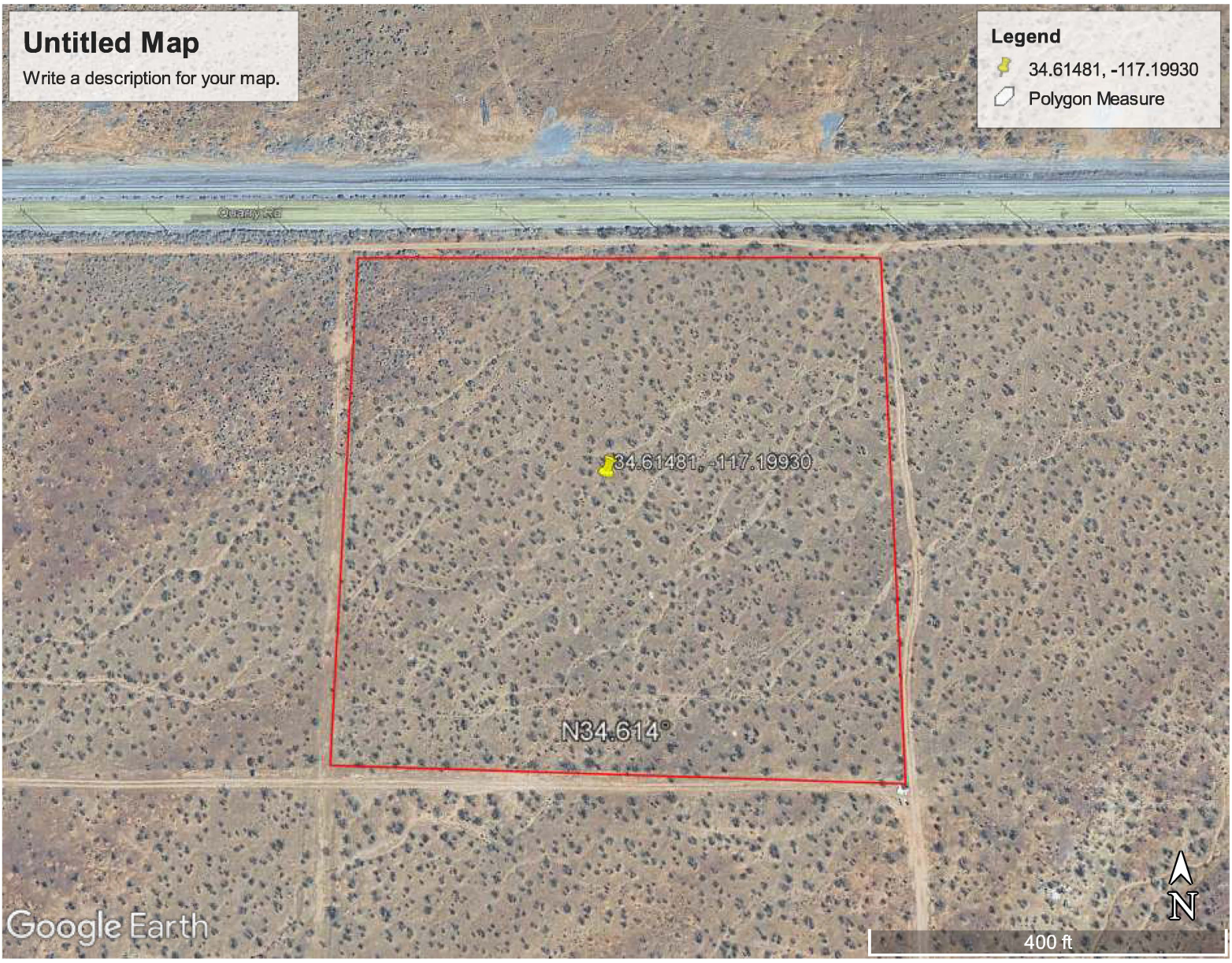
Conveyance	
DA1, DA2, DA3 to Outlet 1	The site area (10.37 acres) consists of 3.38 acres of open brush area (will not be developed) from northwest which continue to drain west to the existing drainage course un-mitigated along the westerly property line and finally drain into Tecaya Road. The remaining 6.99 acres are divided into three sub-areas (DA-1,2,3). DA-1 (2.55 acres): Consist of 90% of impervious area (Buildings/paved area and parking lot) whereas 10% of pervious area (Landscaping, planters). This sub-area drain to Retention/Infiltration Basin-1,2 (connected basin) for a portion of water quality volume mitigation and riser outflow into the Contech retention/infiltration chamber system for WQ volume. Runoff from this area conveys to the Ret/Inf Basin-1,2 via the onsite storm drain conveyance system

	and riser outflow into the ret/inf chamber system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Basin-1,2, Inf/Ret Chamber System. For high flows upto 100-yr storm event, the flows will overflow in chamber system and drain out to street gutter in Tecaya Road via stormdrain/parkway drain. DA-2 (2.45 acres): Consist of 90% of impervious area (Buildings/paved &parking area and street improvement in Tecaya Road) where as 10% of pervious area (Landscaping, planters). The street improvement area (0.68 ac) in Tecaya Road also included in this sub-area. This sub-area drain to Retention/Infiltration Chamber System for water quality volume mitigation and outflow into the Tecaya Road curb&gutter in a mitigated flow rate via the stormdrain/parkway drain after retaining the water volume form larger storm. Runoff from this area conveys to the Ret/Inf Chamber System via the onsite storm drain conveyance system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Inf/Ret Chamber System. For high flows upto 100-yr storm event, the flows will be overflow the chamber and outlet via the storm drain/parkway drain into the street gutter in Tecaya Road. DA-3 (1.99 acres): Consist of 30% of impervious area (Buildings/paved area and street improvement in Dachshund Avenue) where as 70% of pervious area (Open brush, Landscaping, planters). The street improvement area (0.48 ac) in Dachshund Ave also included in this sub-area. This sub-area drain to Ret/Inf Basin-3 for water quality volume mitigation and riser outflow into the Contech retention/infiltration chamber system for high flow retention. Runoff from this area conveys to the Ret/Inf Basin-3 via the onsite storm drain conveyance system and riser outflow into the ret/inf chamber system. Runoff will be pre-treated in grated inlets using the filter inserts prior to drain to the Basin-3. For high flows upto 100-yr storm event, the flows will overflow in chamber system and drain out to street gutter in Tecaya Road via stormdrain/parkway drain. Also the proposed Contech Chamber system at the southcenter (in DA-2) of the site to retain high flows from the drainage subareas and route the high flows through it and releases the flow in less than existing flow rates to mitigate HCOC condition from high flows upto 100-yr storm event.

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DA1, DA2, DA3	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	304,484			
2 Existing site impervious area (ft^2)	0			
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	III			
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	A			
5 Longest flowpath length (ft)	998			
6 Longest flowpath slope (ft/ft)	1.75			
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Natural Cover Open 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			


HP: 3087.5
HP: 998.0
LP: 3070.0


Untitled Map
Write a description for your map.
Legend
34.61481, -117.19930
Polygon Measure
34.61481, -117.19930
N34.614°
Google Earth
400 ft
N

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*	Mojave River – Mojave Forks Reserv Outlet to Upper Narrows Ammonia, Chloride, Sulphate Tetrachloroethylene/PCE, Tetrachloroethylene/TCE
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Mojave River – Mojave Forks Reserv Outlet to Upper Narrows Fluoride
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	Desert Tortoise Habitat CAT-3.
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	☒	☐	Practical education materials will be provided to property owner and Workshop and Maintenance staffs covering various water quality issues that will need to be addressed on their specific site. These materials will include general practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements. The developer will request these materials in writing at least 30 days prior to intended distribution and will then be responsible for publication and distribution.
N2	Activity Restrictions	☒	☐	Restrictions may be developed by property owner or other mechanisms. Pesticide applications will be performed by an applicator certified by the California Department of Pesticide Regulation. Vehicle washing will be prohibited.
N3	Landscape Management BMPs	☒	☐	According to the California Stormwater Quality Associations Stormwater Best Management Practice Handbook, landscape planning is implemented to reduce groundwater and storm water contamination. This will be accomplished through an debris basins, infiltration basins, and landscape areas.
N4	BMP Maintenance	☒	☐	See section 5, Table 5.1 for details on BMP maintenance
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	No hazardous waster onsite
N7	Spill Contingency Plan	☒	☐	If Hazmats are stored on site in reportable quantities, the owner and the Occupant of the property shall comply with the required Spill Contingency Plan by stockpiling dry cleanup materials, notifying of responsible agencies when a spill occures and proper disposal of cleanup materials, documentation, etc.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tank on the site.
N9	Hazardous Materials Disclosure Compliance	☒	☐	If hazardous materials are stored on site in reportable quantities, the owner and occupant shall comply with all Hazmat Disclosure requirements.

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	☒	☐	Will comply with Town of Apple Valley mandated uniform fire code.
N11	Litter/Debris Control Program	☒	☐	Litter control onsite will include the use of litter patrols, violation reporting and clean up during landscaping maintenance activities and as needed to ensure good housekeeping of the project's common areas.
N12	Employee Training	☒	☐	Owner, Employees and/or the Tenants will have training regarding the location and maintenance of the BMP. Owner will be responsible for training.
N13	Housekeeping of Loading Docks	☐	☒	Not applicable
N14	Catch Basin Inspection Program	☒	☐	As required by the TGD, at least 80% of the project's private drainage facilities shall be inspected, cleaned/maintained annually, with 100% of facilities inspected and maintained within a two-year period. Drainage facilities include catch basins (storm drain inlets), detention basins, retention basins, open drainage channel.
N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	Parking lot and onsite pavement shall be swept, at minimum, prior to the start of the traditional rainy season and as needed.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	No other non-structural measures required.
N17	Comply with all other applicable NPDES permits	☒	☐	Prior to and during the entire construction phases, the owner shall apply for coverage under the statewide Construction General Permitby filing an NOI and SWPPP with the CA State Water Board.

Form 4.1-2 Structural Source Control BMPs

Identifier	Name	Check One		Describe BMP Implementation OR, If not applicable, state reason
		Included	Not Applicable	
S1	Provide storm drain system stencilling and signage (CASQA New Development BMP Handbook SD-13)	☒	☐	Storm drain stencils or signage prohibiting dumping and discharge of materials ("No Dumping – Drains to Ocean") shall be provided adjacent to each of the project's proposed inlets. The stencils shall be inspected and re-stenciled as needed to maintain legibility.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☒	☐	Outdoor material storage area will be designed as an enclosed paved area with berm & roof to minimize direct precipitation & exposure according to the design requirements of CASQA source control BMP SD-34 (Outdoor material storage).
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☐	☒	Where and how trash, debris and refuge containers are stored is dictated by municipal code
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (State wide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	In conjunction with routine landscaping maintenance activities, inspect irrigation for signs of leaks, overspray and repair or adjust accordingly. Adjust system cycle to accommodate seasonal fluctuations in water demand and temperatures. Ensure use of native or drought tolerant/non-invasive plant species to minimize water consumption.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	New landscaped areas will be constructed at a minimum of 1 inch below existing paved areas
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Not applicable
S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Not applicable
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	Not applicable

S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Not applicable.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	Not applicable
S11	Equipment wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	Not applicable
S12	Fueling areas (CASQA New Development BMP Handbook SD-30)	☐	☒	Not applicable
S13	Hillside landscaping (CASQA New Development BMP Handbook SD-10)	☐	☒	Not applicable
S14	Wash water control for food preparation areas	☐	☒	Not applicable
S15	Community car wash racks (CASQA New Development BMP Handbook SD-33)	☐	☒	Not applicable

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.

Proposed site design practices and their implementation at this site is provided in Form 4.1-3 (Site Design Practices Check List). Please refer to Form 4.1-3.

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: The site has landscaped area, multiple planter areas in addition to an infiltration/retention basin

Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐
Explanation: Runoff from impervious surfaces will be conveyed through landscaped areas so that infiltration is maximized. Runoff will also be intercepted by an infiltration/retention basin-1,2,3.

Preserve existing drainage patterns and time of concentration: Yes ☐ No ☒
Explanation: Existing drainage patterns is sheet flow towards the south.

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 areas will drain into Retention/Infiltration basin-1,2,3.

Use of Porous Pavement.: Yes ☐ No ☒
Explanation: The site drains to infiltration/retention basin-1,2,3 for infiltration

Protect existing vegetation and sensitive areas: Yes ☐ No ☒
Explanation: There are no environmentally sensitive portions onsite and existing vegetation.

Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐
Explanation: Part of the disturbed areas will be revegetated.

Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐
Explanation: No compaction will be performed within the area where the infiltration basin is proposed.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒
Explanation: Runoff will be intercepted by the Infiltration/Retention basin-1,2,3 and multiple landscaped areas/planters.

Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☐ No ☒
Explanation: No compaction will be performed within the area where landscape areas are proposed.

Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒
Explanation: The site will utilize the proposed Infiltration/Retention basin-1,2,3 for water collection.

Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒
Explanation: No adjacent Steams to this site.

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

<table>
<tr><th colspan="3">Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume
(DA 1)</th></tr>
<tr><td>[1] Project area DA 1 (ft^2):
111,078</td><td>[2] Imperviousness after applying preventative site design practices (Imp%): 90%</td><td>[3] Runoff Coefficient (Rc): 0.70
$R_c = 0.858(Imp\%)^{\wedge 3}-0.78(Imp\%)^{\wedge 2}+0.774(Imp\%)+0.04$</td></tr>
<tr><td colspan="3">[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.354 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html</td></tr>
<tr><td colspan="3">[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.5198
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)</td></tr>
<tr><td colspan="2">[6] Drawdown Rate
Use 48 hours as the default condition. Selection and use of the 24 hour drawdown time condition is subject to approval by the local jurisdiction. The necessary BMP footprint is a function of drawdown time. While shorter drawdown times reduce the performance criteria for LID BMP design capture volume, the depth of water that can be stored is also reduced.</td><td>24-hrs ☐
48-hrs ☒</td></tr>
<tr><td colspan="3">[7] Compute design capture volume, DCV (ft^3): 6,898
DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)
Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2</td></tr>
</table>

Target Captured Volume
Watershed DA-1

1) Calculate the "Watershed Imperviousness Ratio", I which is equal to the percent of impervious area in the BMP Drainage Area divided by 100

Imperviousness(i)= **0.9**

Total Acreage(A) = **2.55** 111078 SF

2) Calculate the composite Runoff Coefficient C_{bmp} for the drainage area

$C_{bmp} = 0.858i^3-0.78i^2+0.774i+0.04$

C_{bmp} = 0.73

3) Determine which Regression Coefficient to use by region the project is located in

Valley	1.481
Mountain	1.909
Desert	1.237

Regression coefficient for this project is: 1.481

4) Determine the area averaged "6 hour Mean Storm Rainfall" , P_6

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= 0.354 inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.5198 inches

5) Determine Regression Constant (a) for 48 hour drawdown

a for 24 hour = 1.582
a for 48 hour = 1.963

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

P_0 = C x a x P6

Po(inches) = 0.7452

7) Calculate the Target Capture Volume, V_0, in acre feet

$V_0 = (P_0 * A)/12$

V_0 = 0.16 acre-feet
V_0 = 6,898 CF

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 2)		
[1] Project area DA 2 (ft^2): 106,722	[2] Imperviousness after applying preventative site design practices (Imp%): 90%	[3] Runoff Coefficient (Rc): 0.73 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.354 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.5198 *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): 6,627 *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 3)		
[1] Project area DA 2 (ft^2): 86,684	[2] Imperviousness after applying preventative site design practices (Imp%): 30%	[3] Runoff Coefficient (Rc): 0.23 *$R_c = 0.858(Imp\%)^{\wedge 3} - 0.78(Imp\%)^{\wedge 2} + 0.774(Imp\%) + 0.04$*
[4] Determine 1-hour rainfall depth for a 2-year return period $P_{2yr\text{-}1hr}$ (in): 0.354 http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.5198 *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): 1,660 *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*		

Target Captured Volume
Watershed DA-2

1) Calculate the "Watershed Imperviousness Ratio", I which is equal to the percent of impervious area in the BMP Drainage Area divided by 100

Imperviousness(i)= **0.9**

Total Acreage(A) = **2.45** 106722 SF

2) Calculate the composite Runoff Coefficient C_{bmp} for the drainage area

$C_{bmp} = 0.858i^3-0.78i^2+0.774i+0.04$

C_{bmp} = 0.73

3) Determine which Regression Coefficient to use by region the project is located in

Valley	1.481
Mountain	1.909
Desert	1.237

Regression coefficient for this project is: 1.481

4) Determine the area averaged "6 hour Mean Storm Rainfall" , P_6

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= 0.354 inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.5198 inches

5) Determine Regression Constant (a) for 48 hour drawdown

a for 24 hour = 1.582
a for 48 hour = 1.963

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

P_0 = C x a x P6

Po(inches) = 0.7452

7) Calculate the Target Capture Volume, V_0, in acre feet

$V_0 = (P_0 * A)/12$

V_0 = 0.15 acre-feet
V_0 = 6,627 CF

Target Captured Volume
Watershed DA-3

1) Calculate the "Watershed Imperviousness Ratio", I which is equal to the percent of impervious area in the BMP Drainage Area divided by 100

Imperviousness(i)= **0.3**

Total Acreage(A) = **1.99** 86684 SF

2) Calculate the composite Runoff Coefficient C_{bmp} for the drainage area

$C_{bmp} = 0.858i^3-0.78i^2+0.774i+0.04$

C_{bmp} = 0.23

3) Determine which Regression Coefficient to use by region the project is located in

Valley	1.481
Mountain	1.909
Desert	1.237

Regression coefficient for this project is: 1.481

4) Determine the area averaged "6 hour Mean Storm Rainfall" , P_6

2 yr 1 Hr Rainfall Depth per NOAA Atlas 14= 0.354 inches

P_6 = 2 yr 1 hr Rainfall x Regression coefficient

P_6 = 0.5198 inches

5) Determine Regression Constant (a) for 48 hour drawdown

a for 24 hour = 1.582
a for 48 hour = 1.963

a = 1.963

6) Calculate the Maximized Detention Volume, P_0

P_0 = C x a x P6

Po(inches) = 0.2298

7) Calculate the Target Capture Volume, V_0, in acre feet

$V_0 = (P_0 * A)/12$

V_0 = 0.04 acre-feet
V_0 = 1,660 CF

VICINITY EXHIBIT



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

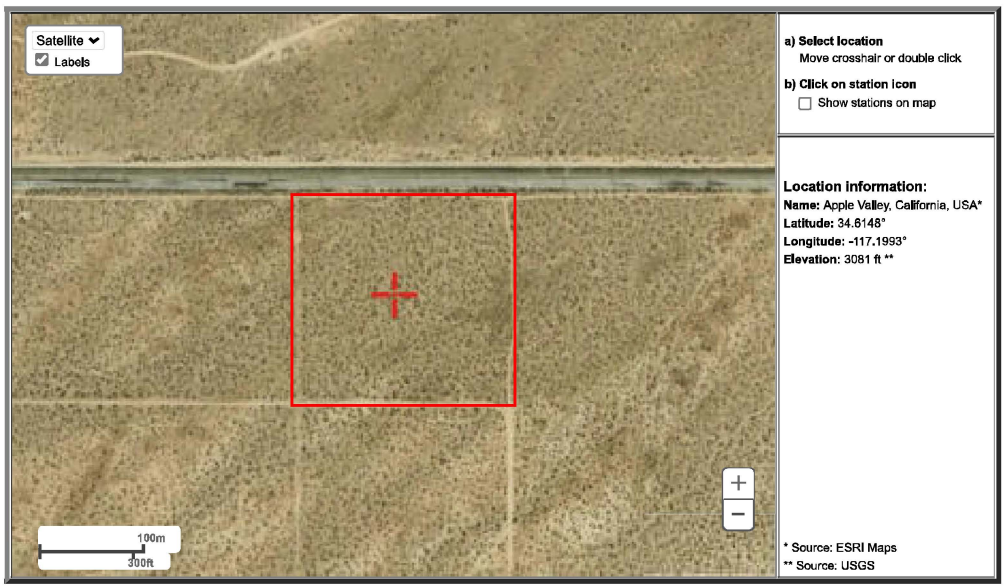
1) Manually:

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:



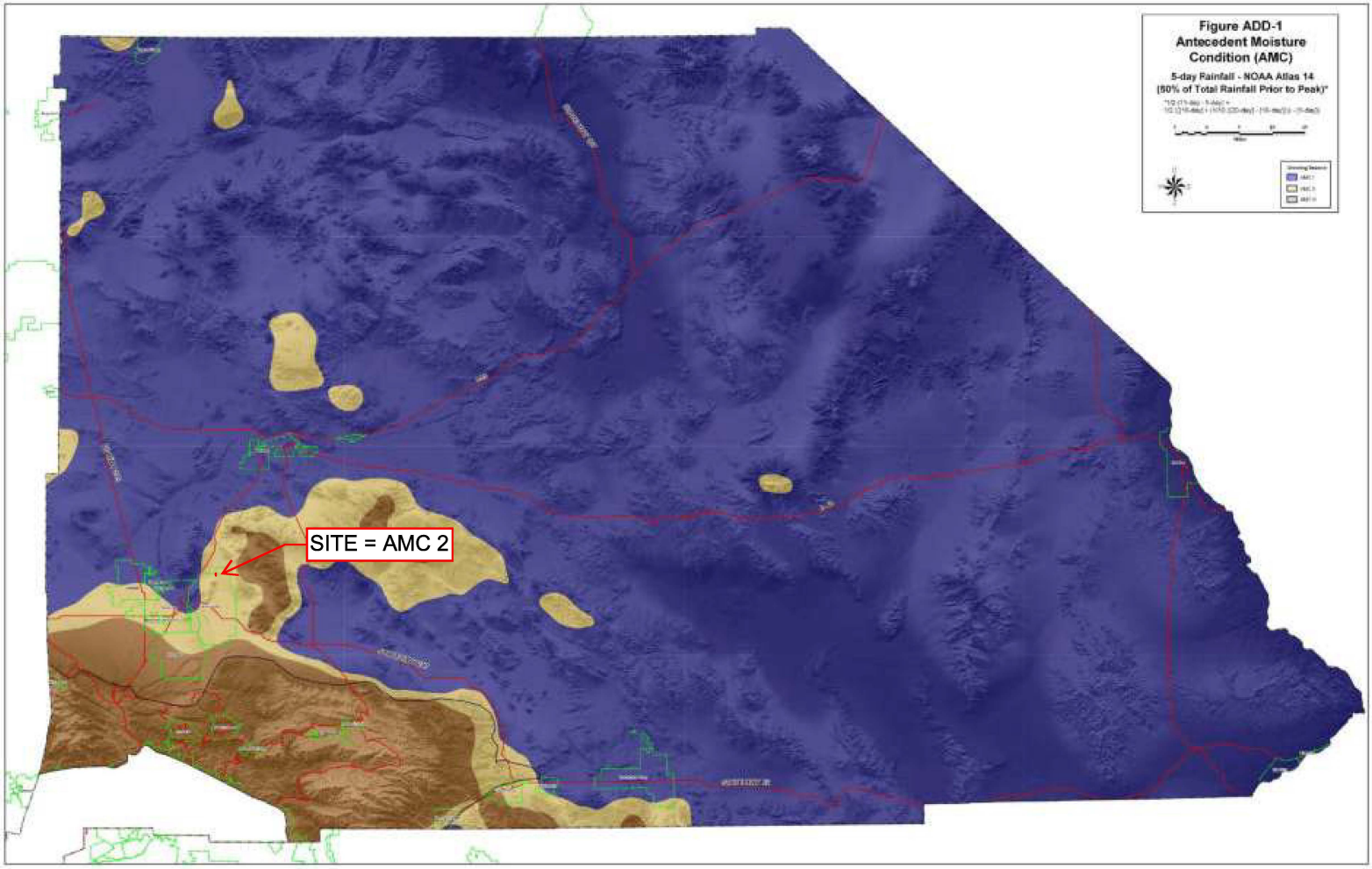
POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

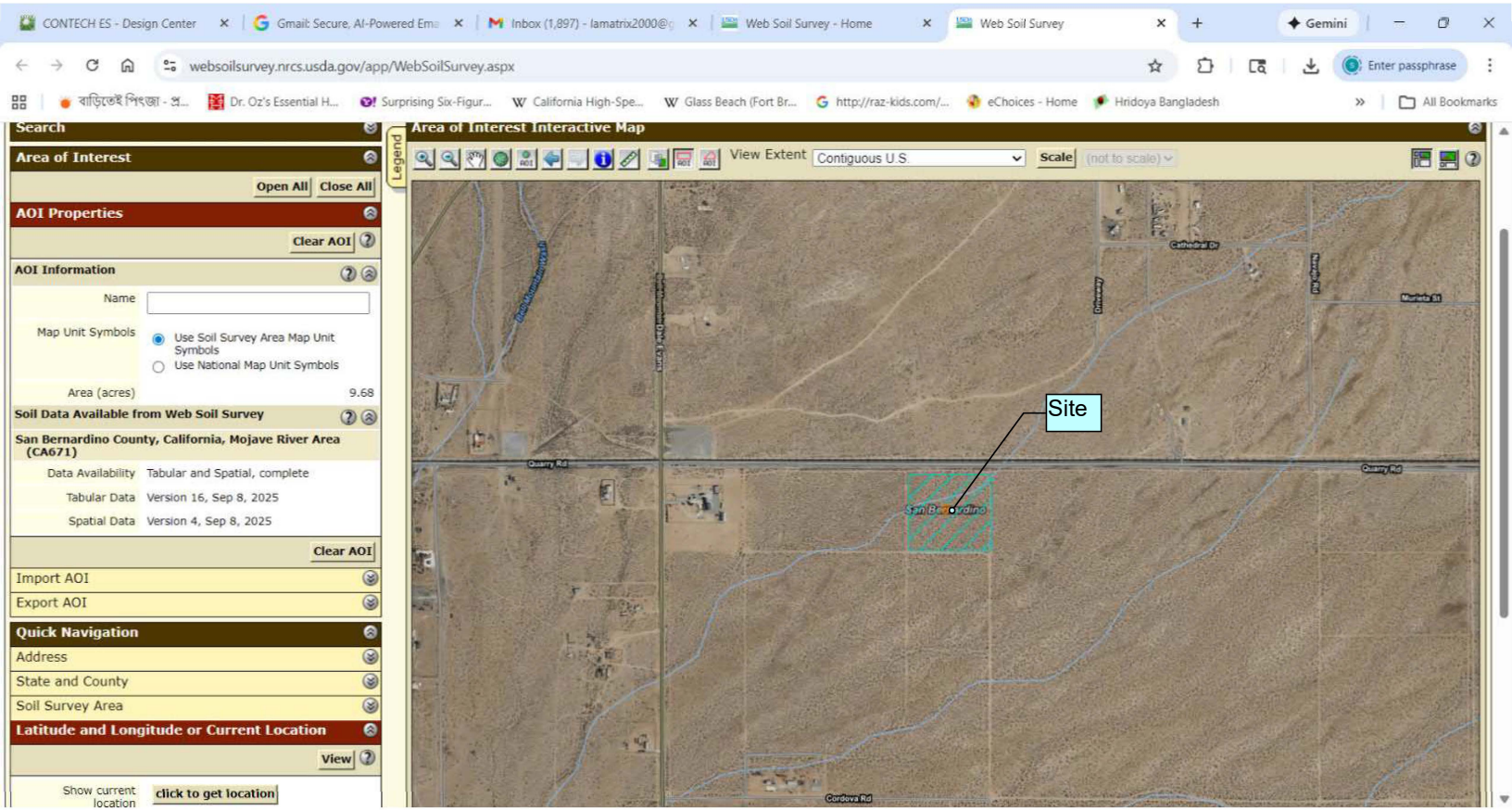
WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular | PF graphical | Supplementary information | Print page

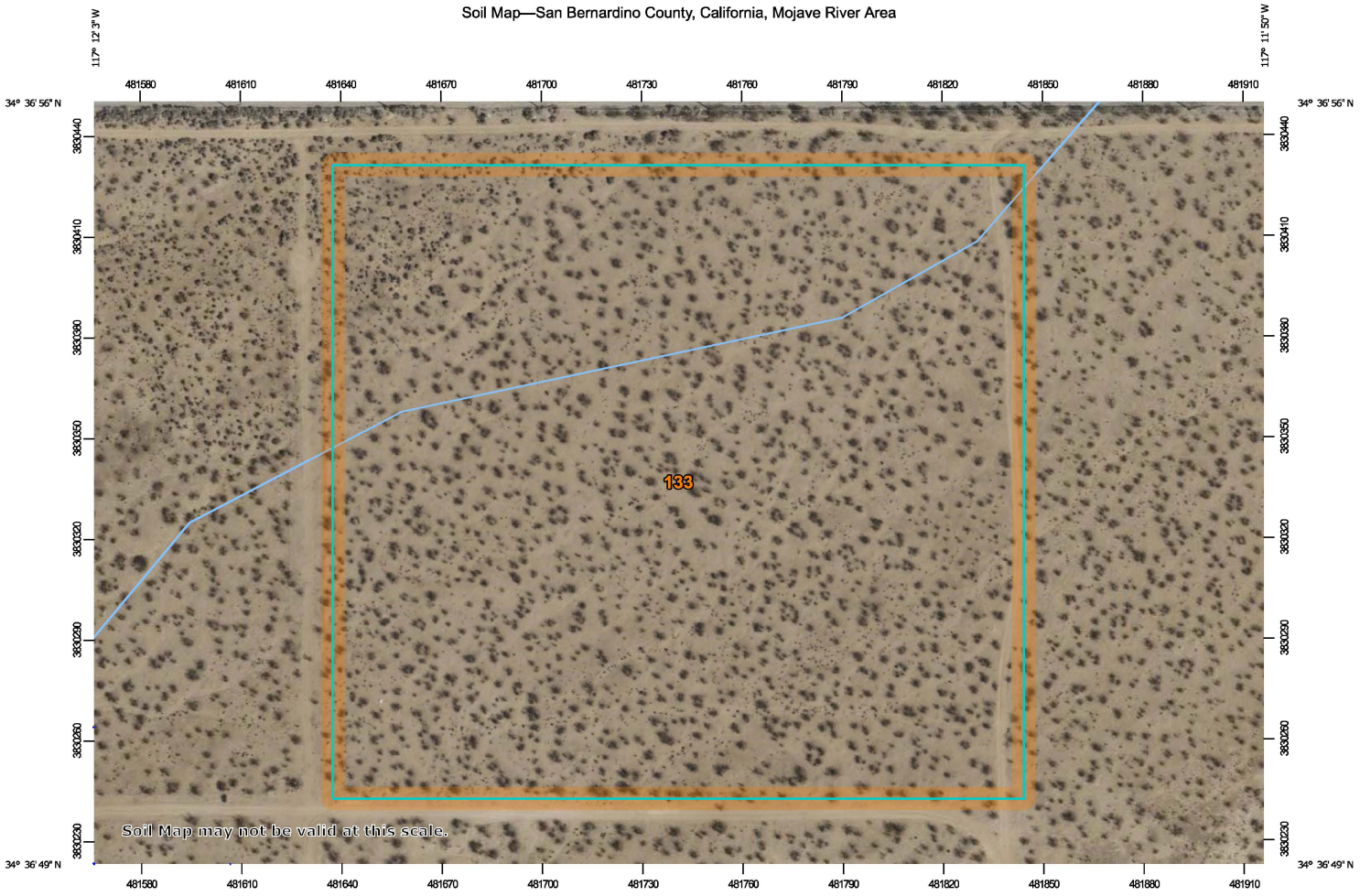
PDS-based precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.083 (0.069-0.102)	0.117 (0.096-0.143)	0.163 (0.134-0.201)	0.204 (0.166-0.253)	0.262 (0.206-0.336)	0.310 (0.239-0.405)	0.361 (0.272-0.483)	0.416 (0.305-0.573)	0.496 (0.349-0.712)	0.562 (0.382-0.835)
10-min	0.119 (0.098-0.147)	0.167 (0.138-0.206)	0.234 (0.192-0.289)	0.292 (0.238-0.362)	0.375 (0.296-0.481)	0.444 (0.342-0.581)	0.517 (0.389-0.693)	0.596 (0.437-0.822)	0.711 (0.500-1.02)	0.806 (0.548-1.20)
15-min	0.144 (0.119-0.177)	0.202 (0.167-0.249)	0.283 (0.232-0.349)	0.353 (0.287-0.438)	0.454 (0.358-0.582)	0.537 (0.414-0.702)	0.625 (0.471-0.838)	0.721 (0.529-0.994)	0.860 (0.605-1.23)	0.974 (0.663-1.45)
30-min	0.198 (0.163-0.243)	0.278 (0.228-0.341)	0.388 (0.319-0.478)	0.484 (0.394-0.601)	0.622 (0.490-0.798)	0.735 (0.568-0.963)	0.857 (0.645-1.15)	0.988 (0.725-1.36)	1.18 (0.830-1.69)	1.34 (0.909-1.98)
60-min	0.250 (0.206-0.307)	0.351 (0.288-0.431)	0.491 (0.402-0.604)	0.611 (0.498-0.759)	0.786 (0.619-1.01)	0.929 (0.717-1.22)	1.08 (0.815-1.45)	1.25 (0.915-1.72)	1.49 (1.05-2.14)	1.69 (1.15-2.50)
2-hr	0.354 (0.291-0.434)	0.478 (0.393-0.587)	0.650 (0.533-0.800)	0.797 (0.648-0.989)	1.01 (0.793-1.29)	1.18 (0.909-1.54)	1.36 (1.02-1.82)	1.55 (1.14-2.14)	1.83 (1.29-2.63)	2.06 (1.40-3.05)
3-hr	0.429 (0.353-0.526)	0.572 (0.471-0.703)	0.769 (0.631-0.947)	0.937 (0.763-1.16)	1.18 (0.927-1.51)	1.37 (1.08-1.79)	1.57 (1.18-2.11)	1.79 (1.31-2.47)	2.10 (1.48-3.01)	2.35 (1.60-3.49)
6-hr	0.582 (0.479-0.714)	0.769 (0.633-0.945)	1.02 (0.840-1.26)	1.24 (1.01-1.54)	1.54 (1.21-1.98)	1.78 (1.38-2.33)	2.04 (1.54-2.73)	2.31 (1.69-3.18)	2.68 (1.89-3.85)	2.99 (2.03-4.43)
12-hr	0.745 (0.613-0.913)	0.990 (0.814-1.22)	1.32 (1.08-1.63)	1.60 (1.30-1.98)	1.98 (1.56-2.54)	2.28 (1.76-2.99)	2.60 (1.96-3.48)	2.93 (2.15-4.04)	3.39 (2.39-4.86)	3.76 (2.56-5.58)
24-hr	0.977 (0.866-1.12)	1.32 (1.17-1.52)	1.77 (1.56-2.04)	2.14 (1.88-2.50)	2.66 (2.26-3.20)	3.07 (2.54-3.77)	3.48 (2.82-4.39)	3.92 (3.09-5.07)	4.52 (3.42-6.10)	4.99 (3.64-6.97)
2-day	1.15 (1.02-1.32)	1.58 (1.40-1.82)	2.14 (1.89-2.46)	2.61 (2.28-3.04)	3.25 (2.75-3.91)	3.74 (3.11-4.60)	4.25 (3.45-5.36)	4.78 (3.77-6.20)	5.51 (4.17-7.44)	6.08 (4.44-8.50)
3-day	1.25 (1.11-1.44)	1.73 (1.53-1.99)	2.36 (2.09-2.73)	2.89 (2.53-3.36)	3.60 (3.05-4.33)	4.15 (3.45-5.11)	4.72 (3.83-5.95)	5.32 (4.19-6.88)	6.13 (4.63-8.27)	6.77 (4.94-9.46)
4-day	1.33 (1.18-1.52)	1.84 (1.63-2.12)	2.52 (2.23-2.91)	3.08 (2.70-3.58)	3.84 (3.26-4.62)	4.43 (3.68-5.45)	5.04 (4.08-6.35)	5.67 (4.47-7.34)	6.54 (4.94-8.82)	7.22 (5.27-10.1)
7-day	1.44 (1.28-1.66)	1.99 (1.76-2.29)	2.71 (2.40-3.14)	3.31 (2.90-3.86)	4.13 (3.50-4.97)	4.77 (3.98-5.86)	5.42 (4.39-6.83)	6.10 (4.81-7.90)	7.04 (5.32-9.50)	7.77 (5.68-10.9)
10-day	1.53 (1.36-1.76)	2.10 (1.86-2.41)	2.85 (2.52-3.30)	3.48 (3.05-4.05)	4.34 (3.68-5.23)	5.02 (4.16-6.17)	5.71 (4.62-7.19)	6.43 (5.07-8.33)	7.43 (5.62-10.0)	8.21 (6.00-11.5)
20-day	1.75 (1.56-2.02)	2.42 (2.14-2.78)	3.31 (2.92-3.82)	4.05 (3.55-4.71)	5.08 (4.31-6.12)	5.89 (4.89-7.24)	6.73 (5.46-8.48)	7.62 (6.00-9.86)	8.84 (6.68-11.9)	9.80 (7.16-13.7)
30-day	1.98 (1.76-2.28)	2.74 (2.43-3.16)	3.77 (3.33-4.36)	4.64 (4.06-5.40)	5.85 (4.96-7.04)	6.82 (5.66-8.38)	7.82 (6.33-9.84)	8.87 (6.99-11.5)	10.3 (7.82-14.0)	11.5 (8.40-16.1)
45-day	2.33 (2.06-2.68)	3.23 (2.86-3.72)	4.46 (3.94-5.16)	5.52 (4.83-6.42)	7.01 (5.94-8.44)	8.21 (6.82-10.1)	9.47 (7.67-11.9)	10.8 (8.51-14.0)	12.7 (9.58-17.1)	14.2 (10.3-19.8)
60-day	2.55 (2.26-2.94)	3.53 (3.13-4.07)	4.90 (4.32-5.65)	6.06 (5.31-7.06)	7.74 (6.56-9.31)	9.10 (7.55-11.2)	10.5 (8.54-13.3)	12.1 (9.51-15.6)	14.3 (10.8-19.2)	16.0 (11.7-22.4)


Figure ADD-1
Antecedent Moisture Condition (AMC)
5-day Rainfall - NOAA Atlas 14
(50% of Total Rainfall Prior to Peak)*
SITE = AMC 2


Search
Area of Interest
Open All
Close All
AOI Properties
Clear AOI
AOI Information
Name
Map Unit Symbols
Use Soil Survey Area Map Unit Symbols
Use National Map Unit Symbols
Area (acres)
9.68
Soil Data Available from Web Soil Survey
San Bernardino County, California, Mojave River Area (CA671)
Data Availability
Tabular and Spatial, complete
Tabular Data
Version 16, Sep 8, 2025
Spatial Data
Version 4, Sep 8, 2025
Clear AOI
Import AOI
Export AOI
Quick Navigation
Address
State and County
Soil Survey Area
Latitude and Longitude or Current Location
View
Show current location
click to get location
Area of Interest Interactive Map
Legend
View Extent
Contiguous U.S.
Scale
(not to scale)
Site
Quarry Rd
Cathedral Dr
Muriels St
Cordova Rd

Soil Map—San Bernardino County, California, Mojave River Area



Map Scale: 1:1,600 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 17, Sep 8, 2025

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

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

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
133	HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*	9.7	100.0%
Totals for Area of Interest		**9.7**	**100.0%**

San Bernardino County, California, Mojave River Area

133—HELENDALE-BRYMAN LOAMY SANDS, 2 TO 5 PERCENT SLOPES*

Map Unit Setting

National map unit symbol: hks6
Elevation: 2,500 to 4,000 feet
Mean annual precipitation: 3 to 6 inches
Mean annual air temperature: 59 to 63 degrees F
Frost-free period: 180 to 280 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Helendale and similar soils: 50 percent
Bryman and similar soils: 35 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Helendale

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 6 inches: loamy sand
H2 - 6 to 30 inches: sandy loam
H3 - 30 to 66 inches: sandy loam
H4 - 66 to 99 inches: loamy sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Description of Bryman

Setting

Landform: Fan remnants
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite sources

Typical profile

H1 - 0 to 8 inches: loamy sand
H2 - 8 to 12 inches: sandy loam
H3 - 12 to 44 inches: sandy clay loam
H4 - 44 to 60 inches: loamy sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R030XF012CA - Sandy
Hydric soil rating: No

Minor Components

Cajon

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

Mohave variant

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

Unnamed soils

Percent of map unit: 5 percent

Hydric soil rating: No

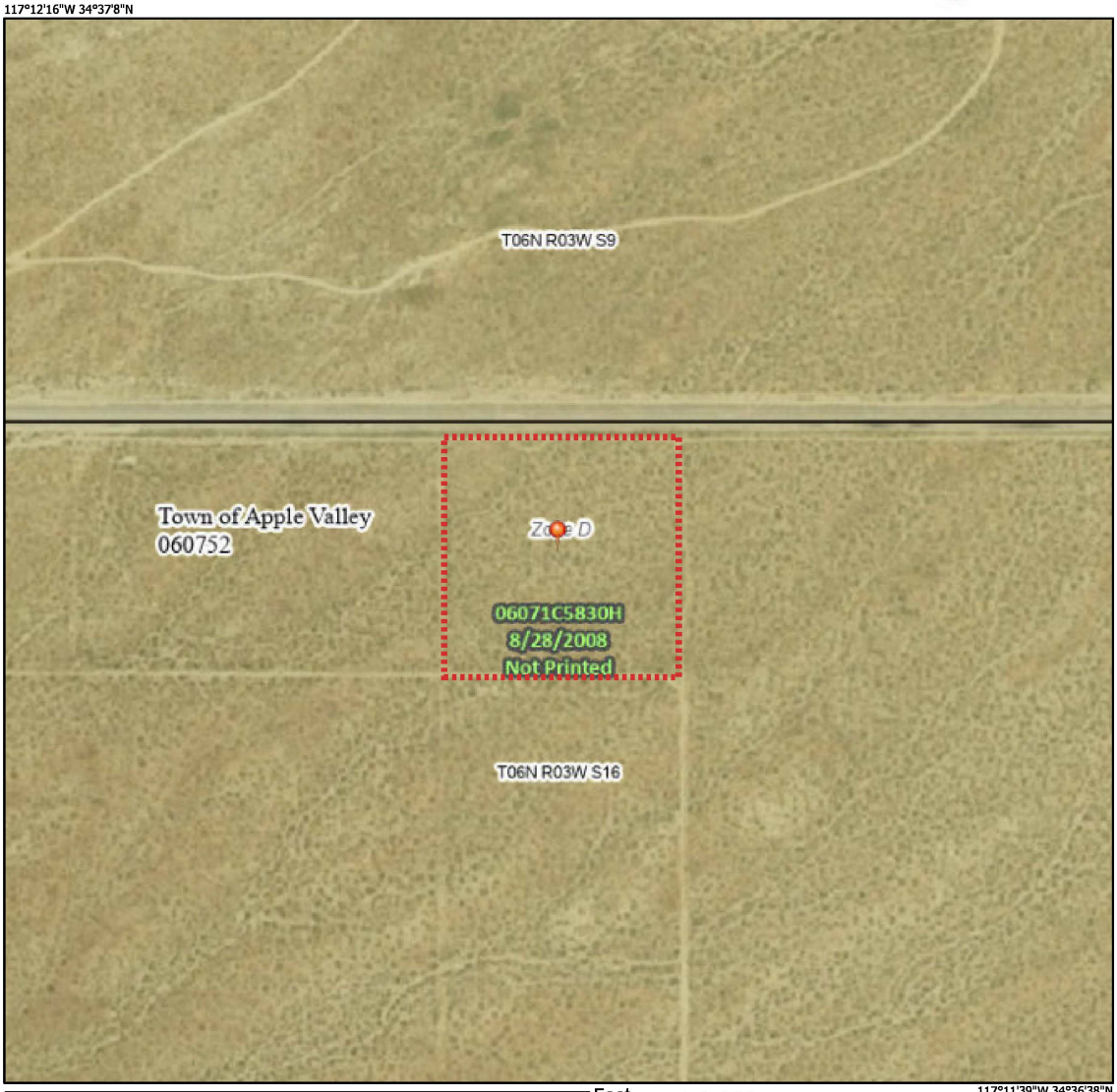
Data Source Information

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 17, Sep 8, 2025

National Flood Hazard Layer FIRMette

FEMA

117°12'16"W 34°37'8"N



117°11'39"W 34°36'38"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee, See Notes, *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/10/2025 at 8:36 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Form 4.2-2 Summary of Hydromodification Assessment

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** 8019.4 *Form 4.2-3 Item 12*	**2** 16.99 *Form 4.2-4 Item 13*	**3** 4.62 *Form 4.2-5 Item 10*
Post-developed	**4** 34368.8 *Form 4.2-3 Item 13*	**5** 8.63 *Form 4.2-4 Item 14*	**6** 9.92 *Form 4.2-5 Item 14*
Difference	**7** *26349.4* *Item 4 – Item 1*	**8** *8.36* *Item 2 – Item 5*	**9** *5.3* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *328.6%* *Item 7 / Item 1*	**11** *49.2%* *Item 8 / Item 2*	**12** *114.7%* *Item 9 / Item 3*

HCOC Mitigation:

In developed condition the site will drain to the proposed Infiltration/Retention Basin-1,2,3 and the Contech Inf/Det Chamber System for mitigation of WQMP volume (DCV)(15,185 CF) as well as mitigation of HCOC runoff volume generated from a 10-yr, 24-hr storm event by retention per the City requirement.

Full retention and infiltration of the increased runoff volume (26,349.4 CF) in developed condition for the 10-yr, 24-hr storm event will be satisfied by the proposed Infiltration/Retention Basin-1,2,3 and the proposed Contech Chamber System within 48-hr drawdown time (Combined capacity of the Chamber System and the Basin-1,2,3: 31,114 CF).

The increase runoff rate in developed condition will be reduced to less than the existing condition by implementing the surface retention/infiltration basin-1,2,3. In addition of of the inf/ret basin, the site also proposing a below surface detention CMP chamber system for detain 100-yr storm volume and route the flow out from the site below existing runoff flow rate.

See below the relevant calculations (10-yr Rational Method Hydrology & Unit Hydrograph analysis.

When the Infiltation/Retention Basin-1,2,3 reach its capacity, it will drain to the below surface detention system to detain and route peak flows from storm event upto 100-yr. Onsite flow will then drain to Tecaya Road street gutter in a mitigated flow rate and finally drain to Mojave River via the natural drainage courses.

10-year Hydrology Analysis

Form 4.2-2

Condition	Volume(ft3)	TC (Min)	Peak (cfs)
Pre	8019.4	16.99	4.62
Post	34368.8	8.63	9.92
Difference	26349.4	8.36	5.3
%	328.6	49.2	114.7

Mitigated	8019.2	56.2	2.55

Basin	Volumes (ft3)
1	1828
2	1805
3	9230
Chambers	18,251
Total	31,114

TC Summary

Rat M TC (min)	8.63
Rat M Peak (TC)	7.61
*Storage for DA1 (ft3)	21741.00
Time to Fill (sec)	2856.90
Time to Fill (min)	47.61
Total TC (min)	56.24

***Note: DA2 is excluded from TC summary because entire 10 year storm is retained in basin 3**

Mitigated values indicate, Volume is preserved, TC is extended, Peak is reduced

For Calculations see following :

Existing Condtion Rational Method

Proposed Condition Rational Method

Existing Condition Hydrograph

DA1 Proposed Condition Hydrograph

DA2 Proposed Condition Hydrograph

Hydrology Exhibits

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

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* APN 0463-411-07                                                      *
* Onsite Existing Condition                                            *
* 10 Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: 04631E.DAT
  TIME/DATE OF STUDY: 10:16 01/11/2026
==========================================================================
  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) = 0.6110

  *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) =   700.00
  ELEVATION DATA: UPSTREAM(FEET) =   3087.00  DOWNSTREAM(FEET) =   3074.53

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.145
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.531
  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 POOR COVER
  "GRASS"                    A        3.38      0.60     1.000    67   16.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.84
  TOTAL AREA(ACRES) =      3.38   PEAK FLOW RATE(CFS) =      2.84

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   792.00
  ELEVATION DATA: UPSTREAM(FEET) =   3084.70  DOWNSTREAM(FEET) =   3070.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.989
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.478
  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 POOR COVER
  "GRASS"                    A        5.83      0.60     1.000    67   16.99
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      4.62
  TOTAL AREA(ACRES) =      5.83   PEAK FLOW RATE(CFS) =      4.62
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        5.8  TC(MIN.) =     16.99
  EFFECTIVE AREA(ACRES) =      5.83  AREA-AVERAGED Fm(INCH/HR)=  0.60
  AREA-AVERAGED Fp(INCH/HR) =  0.60  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =       4.62
============================================================================
```

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

                          Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* APN 0463-411-07                                                      *
* ONSITE DEVELOPED CONDITION                                           *
* 10 Year Storm Event                                                  *
 ************************************************************************

  FILE NAME: 04631.DAT
  TIME/DATE OF STUDY: 11:14 01/11/2026
==========================================================================
  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) = 0.6110

  *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) =   700.00
  ELEVATION DATA: UPSTREAM(FEET) =   3087.00  DOWNSTREAM(FEET) =   3074.53

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   16.145
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.531
  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 POOR COVER
  "GRASS"                    A        3.38      0.60     1.000    67   16.15
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.60
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
  SUBAREA RUNOFF(CFS) =      2.84
  TOTAL AREA(ACRES) =      3.38   PEAK FLOW RATE(CFS) =      2.84

****************************************************************************
  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) =   560.00
  ELEVATION DATA: UPSTREAM(FEET) =   3081.00  DOWNSTREAM(FEET) =   3072.78

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.888
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.326
  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                 A        1.89      0.98     0.100    32    8.89
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.79
  TOTAL AREA(ACRES) =      1.89   PEAK FLOW RATE(CFS) =      3.79

****************************************************************************
  FLOW PROCESS FROM NODE     21.00 TO NODE     22.00 IS CODE =  52
----------------------------------------------------------------------------
  >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   3072.78  DOWNSTREAM(FEET) =   3070.40
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   250.00   CHANNEL SLOPE =  0.0095
  CHANNEL FLOW THRU SUBAREA(CFS) =       3.79
  FLOW VELOCITY(FEET/SEC) =   1.93 (PER LACFCD/RCFC&WCD HYDROLOGY MANUAL)
  TRAVEL TIME(MIN.) =   2.16   Tc(MIN.) =   11.05
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     22.00 =     810.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     22.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
  MAINLINE Tc(MIN.) =   11.05
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  1.998
  SUBAREA LOSS RATE DATA(AMC  II):
   DEVELOPMENT TYPE/       SCS SOIL   AREA      Fp         Ap      SCS
       LAND USE             GROUP   (ACRES)  (INCH/HR)  (DECIMAL)  CN
  NATURAL FAIR COVER
  "GRASS"                     A        0.13      0.82     1.000    50
  COMMERCIAL                  A        0.53      0.98     0.100    32
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.86
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.277
  SUBAREA AREA(ACRES) =    0.66      SUBAREA RUNOFF(CFS) =    1.04
  EFFECTIVE AREA(ACRES) =      2.55   AREA-AVERAGED Fm(INCH/HR) =  0.13
  AREA-AVERAGED Fp(INCH/HR) =  0.92  AREA-AVERAGED Ap =  0.15
  TOTAL AREA(ACRES) =        2.5       PEAK FLOW RATE(CFS) =       4.28

****************************************************************************
  FLOW PROCESS FROM NODE     22.00 TO NODE     31.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  3066.00  DOWNSTREAM(FEET) =  3065.50
  FLOW LENGTH(FEET) =    90.00   MANNING'S N =  0.013
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.23
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       4.28
  PIPE TRAVEL TIME(MIN.) =   0.35    Tc(MIN.) =   11.40
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     31.00 =     900.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.40
  RAINFALL INTENSITY(INCH/HR) =   1.95
  AREA-AVERAGED Fm(INCH/HR) =  0.13
```

```
  AREA-AVERAGED Fp(INCH/HR) =  0.92
  AREA-AVERAGED Ap =  0.15
  EFFECTIVE STREAM AREA(ACRES) =       2.55
  TOTAL STREAM AREA(ACRES) =       2.55
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       4.28

****************************************************************************
  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) =   510.00
  ELEVATION DATA: UPSTREAM(FEET) =   3078.90  DOWNSTREAM(FEET) =   3071.70

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    8.629
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.375
  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                 A        1.77      0.98     0.100    32    8.63
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.98
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.100
  SUBAREA RUNOFF(CFS) =      3.63
  TOTAL AREA(ACRES) =      1.77   PEAK FLOW RATE(CFS) =      3.63

****************************************************************************
  FLOW PROCESS FROM NODE     31.00 TO NODE     31.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    8.63
  RAINFALL INTENSITY(INCH/HR) =   2.37
  AREA-AVERAGED Fm(INCH/HR) =  0.10
  AREA-AVERAGED Fp(INCH/HR) =  0.98
  AREA-AVERAGED Ap =  0.10
  EFFECTIVE STREAM AREA(ACRES) =       1.77
  TOTAL STREAM AREA(ACRES) =       1.77
  PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.63

  ** CONFLUENCE DATA **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap     Ae     HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)         (ACRES)    NODE
      1        4.28   11.40    1.954  0.92( 0.13) 0.15       2.5      20.00
      2        3.63    8.63    2.375  0.98( 0.10) 0.10       1.8      30.00

  RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
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  CONFLUENCE FORMULA USED FOR  2 STREAMS.

  ** PEAK FLOW RATE TABLE **
   STREAM       Q      Tc   Intensity   Fp(Fm)     Ap      Ae      HEADWATER
   NUMBER     (CFS)  (MIN.) (INCH/HR) (INCH/HR)          (ACRES)     NODE
      1        7.61    8.63    2.375  0.94( 0.12) 0.12       3.7       30.00
      2        7.23   11.40    1.954  0.94( 0.12) 0.13       4.3       20.00

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.61   Tc(MIN.) =     8.63
  EFFECTIVE AREA(ACRES) =       3.70   AREA-AVERAGED Fm(INCH/HR) =  0.12
  AREA-AVERAGED Fp(INCH/HR) =  0.94  AREA-AVERAGED Ap =  0.12
  TOTAL AREA(ACRES) =        4.3
  LONGEST FLOWPATH FROM NODE     20.00 TO NODE     31.00 =     900.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     40.00 TO NODE     41.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
============================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   635.00
  ELEVATION DATA: UPSTREAM(FEET) =   3084.70  DOWNSTREAM(FEET) =   3077.90

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =    9.955
  *  10 YEAR RAINFALL INTENSITY(INCH/HR) =  2.148
  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                 A        0.45      0.98      0.100    32    9.95
  NATURAL POOR COVER
  "GRASS"                    A        1.06      0.60      1.000    67   17.19
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.61
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.732
  SUBAREA RUNOFF(CFS) =      2.31
  TOTAL AREA(ACRES) =      1.51   PEAK FLOW RATE(CFS) =      2.31
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        1.5  TC(MIN.) =      9.95
  EFFECTIVE AREA(ACRES) =      1.51  AREA-AVERAGED Fm(INCH/HR)=  0.45
  AREA-AVERAGED Fp(INCH/HR) =  0.61  AREA-AVERAGED Ap = 0.732
  PEAK FLOW RATE(CFS)   =       2.31
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

7.61 + 2.31 = 9.92 cfs

10 Year Existing Condition Analysis

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

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =    2.14 (inches)

   SOIL-COVER    AREA     PERCENT OF   SCS CURVE   LOSS RATE
     TYPE     (Acres)  PERVIOUS AREA    NUMBER   Fp(in./hr.)   YIELD
      1        5.83     100.00          67.      0.598      0.103

   TOTAL AREA (Acres) =     5.83

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.598

                      _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.897
==============================================================================
------------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =    5.83
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.598
   LOW LOSS FRACTION = 0.897
   TIME OF CONCENTRATION(MIN.) = 16.99
   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) =  0.20
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.48
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.24
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.14

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    0.18
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    0.86

******************************************************************************
 TIME    VOLUME      Q  0.      2.5      5.0      7.5      10.0
(HOURS)   (AF)     (CFS)
------------------------------------------------------------------------------
 0.11     0.0000     0.00 Q       .        .        .        .
```

0.36	0.0002	0.02	Q	.	.	.	.
0.60	0.0007	0.02	Q	.	.	.	.
0.85	0.0011	0.02	Q	.	.	.	.
1.10	0.0015	0.02	Q	.	.	.	.
1.35	0.0020	0.02	Q	.	.	.	.
1.60	0.0024	0.02	Q	.	.	.	.
1.85	0.0029	0.02	Q	.	.	.	.
2.09	0.0034	0.02	Q	.	.	.	.
2.34	0.0038	0.02	Q	.	.	.	.
2.59	0.0043	0.02	Q	.	.	.	.
2.84	0.0048	0.02	Q	.	.	.	.
3.09	0.0053	0.02	Q	.	.	.	.
3.34	0.0058	0.02	Q	.	.	.	.
3.58	0.0063	0.02	Q	.	.	.	.
3.83	0.0068	0.02	Q	.	.	.	.
4.08	0.0073	0.02	Q	.	.	.	.
4.33	0.0078	0.03	Q	.	.	.	.
4.58	0.0083	0.03	Q	.	.	.	.
4.83	0.0088	0.03	Q	.	.	.	.
5.07	0.0094	0.03	Q	.	.	.	.
5.32	0.0099	0.03	Q	.	.	.	.
5.57	0.0105	0.03	Q	.	.	.	.
5.82	0.0110	0.03	Q	.	.	.	.
6.07	0.0116	0.03	Q	.	.	.	.
6.32	0.0122	0.03	Q	.	.	.	.
6.56	0.0128	0.03	Q	.	.	.	.
6.81	0.0133	0.03	Q	.	.	.	.
7.06	0.0139	0.03	Q	.	.	.	.
7.31	0.0146	0.03	Q	.	.	.	.
7.56	0.0152	0.03	Q	.	.	.	.
7.81	0.0158	0.03	Q	.	.	.	.
8.05	0.0165	0.03	Q	.	.	.	.
8.30	0.0171	0.03	Q	.	.	.	.
8.55	0.0178	0.03	Q	.	.	.	.
8.80	0.0185	0.03	Q	.	.	.	.
9.05	0.0192	0.03	Q	.	.	.	.
9.30	0.0199	0.04	Q	.	.	.	.
9.54	0.0206	0.04	Q	.	.	.	.
9.79	0.0214	0.04	Q	.	.	.	.
10.04	0.0221	0.04	Q	.	.	.	.
10.29	0.0229	0.04	Q	.	.	.	.
10.54	0.0237	0.04	Q	.	.	.	.
10.79	0.0245	0.04	Q	.	.	.	.
11.03	0.0254	0.04	Q	.	.	.	.
11.28	0.0262	0.04	Q	.	.	.	.

11.53	0.0271	0.04	Q	.	.	.	.
11.78	0.0281	0.05	Q	.	.	.	.
12.03	0.0290	0.05	Q	.	.	.	.
12.27	0.0300	0.05	Q	.	.	.	.
12.52	0.0311	0.05	Q	.	.	.	.
12.77	0.0322	0.06	Q	.	.	.	.
13.02	0.0334	0.06	Q	.	.	.	.
13.27	0.0346	0.06	Q	.	.	.	.
13.52	0.0358	0.06	Q	.	.	.	.
13.77	0.0372	0.07	Q	.	.	.	.
14.01	0.0386	0.07	Q	.	.	.	.
14.26	0.0401	0.07	Q	.	.	.	.
14.51	0.0417	0.08	Q	.	.	.	.
14.76	0.0435	0.09	Q	.	.	.	.
15.01	0.0454	0.10	Q	.	.	.	.
15.26	0.0476	0.12	Q	.	.	.	.
15.50	0.0502	0.13	Q	.	.	.	.
15.75	0.0533	0.17	Q	.	.	.	.
16.00	0.0584	0.33	.Q	.	.	.	.
16.25	0.1093	4.62	.	.	Q	.	.
16.50	0.1581	0.14	Q	.	.	.	.
16.75	0.1606	0.11	Q	.	.	.	.
16.99	0.1625	0.08	Q	.	.	.	.
17.24	0.1642	0.07	Q	.	.	.	.
17.49	0.1656	0.07	Q	.	.	.	.
17.74	0.1669	0.06	Q	.	.	.	.
17.99	0.1680	0.05	Q	.	.	.	.
18.23	0.1691	0.05	Q	.	.	.	.
18.48	0.1701	0.05	Q	.	.	.	.
18.73	0.1710	0.04	Q	.	.	.	.
18.98	0.1718	0.04	Q	.	.	.	.
19.23	0.1726	0.04	Q	.	.	.	.
19.48	0.1734	0.04	Q	.	.	.	.
19.73	0.1741	0.03	Q	.	.	.	.
19.97	0.1748	0.03	Q	.	.	.	.
20.22	0.1755	0.03	Q	.	.	.	.
20.47	0.1761	0.03	Q	.	.	.	.
20.72	0.1767	0.03	Q	.	.	.	.
20.97	0.1773	0.03	Q	.	.	.	.
21.22	0.1779	0.03	Q	.	.	.	.
21.46	0.1785	0.03	Q	.	.	.	.
21.71	0.1790	0.03	Q	.	.	.	.
21.96	0.1796	0.03	Q	.	.	.	.
22.21	0.1801	0.03	Q	.	.	.	.
22.46	0.1806	0.02	Q	.	.	.	.

22.70	0.1811	0.02	Q	.	.	.	.	
22.95	0.1816	0.02	Q	.	.	.	.	
23.20	0.1821	0.02	Q	.	.	.	.	
23.45	0.1825	0.02	Q	.	.	.	.	
23.70	0.1830	0.02	Q	.	.	.	.	
23.95	0.1834	0.02	Q	.	.	.	.	
24.19	0.1839	0.02	Q	.	.	.	.	
24.44	0.1841	0.00	Q	.	.	.	.	8019.396

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%	1445.3
10%	14.9
20%	14.9
30%	14.9
40%	14.9
50%	14.9
60%	14.9
70%	14.9
80%	14.9
90%	14.9

10 Year DA-1 Proposed Condition

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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 =    2.14 (inches)

   SOIL-COVER    AREA     PERCENT OF   SCS CURVE   LOSS RATE
     TYPE     (Acres)  PERVIOUS AREA    NUMBER   Fp(in./hr.)   YIELD
      1       0.13     100.00          50.      0.820      0.001
      2       4.19      10.00          98.      0.000      0.894



   TOTAL AREA (Acres) =     4.32

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.025

                    _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.133
==========================================================================
--------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =   4.32
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.025
   LOW LOSS FRACTION = 0.133
   TIME OF CONCENTRATION(MIN.) =  8.63
   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) =  0.20
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.48
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.24
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.14

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    0.68
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    0.09

**************************************************************************
 TIME    VOLUME     Q   0.     2.5     5.0     7.5     10.0
```

(HOURS)	(AF)	(CFS)					
0.09	0.0000	0.00	Q	.	.	.	.
0.24	0.0008	0.13	Q	.	.	.	.
0.39	0.0025	0.13	Q	.	.	.	.
0.55	0.0042	0.13	Q	.	.	.	.
0.70	0.0059	0.13	Q	.	.	.	.
0.85	0.0076	0.14	Q	.	.	.	.
1.01	0.0093	0.14	Q	.	.	.	.
1.16	0.0110	0.14	Q	.	.	.	.
1.31	0.0128	0.14	Q	.	.	.	.
1.46	0.0145	0.14	Q	.	.	.	.
1.62	0.0163	0.14	Q	.	.	.	.
1.77	0.0180	0.14	Q	.	.	.	.
1.92	0.0198	0.14	Q	.	.	.	.
2.08	0.0216	0.14	Q	.	.	.	.
2.23	0.0234	0.14	Q	.	.	.	.
2.38	0.0252	0.14	Q	.	.	.	.
2.54	0.0271	0.14	Q	.	.	.	.
2.69	0.0289	0.15	Q	.	.	.	.
2.84	0.0308	0.15	Q	.	.	.	.
2.99	0.0326	0.15	Q	.	.	.	.
3.15	0.0345	0.15	Q	.	.	.	.
3.30	0.0364	0.15	Q	.	.	.	.
3.45	0.0383	0.15	Q	.	.	.	.
3.61	0.0402	0.15	Q	.	.	.	.
3.76	0.0422	0.15	Q	.	.	.	.
3.91	0.0441	0.16	Q	.	.	.	.
4.07	0.0461	0.16	Q	.	.	.	.
4.22	0.0481	0.16	Q	.	.	.	.
4.37	0.0501	0.16	Q	.	.	.	.
4.52	0.0521	0.16	Q	.	.	.	.
4.68	0.0541	0.16	Q	.	.	.	.
4.83	0.0561	0.16	Q	.	.	.	.
4.98	0.0582	0.16	Q	.	.	.	.
5.14	0.0603	0.17	Q	.	.	.	.
5.29	0.0624	0.17	Q	.	.	.	.
5.44	0.0645	0.17	Q	.	.	.	.
5.60	0.0666	0.17	Q	.	.	.	.
5.75	0.0688	0.17	Q	.	.	.	.
5.90	0.0710	0.17	Q	.	.	.	.
6.05	0.0731	0.17	Q	.	.	.	.
6.21	0.0754	0.18	Q	.	.	.	.
6.36	0.0776	0.18	Q	.	.	.	.
6.51	0.0798	0.18	Q	.	.	.	.

6.67	0.0821	0.18	Q	.	.	.	.
6.82	0.0844	0.18	Q	.	.	.	.
6.97	0.0867	0.18	Q	.	.	.	.
7.13	0.0891	0.19	Q	.	.	.	.
7.28	0.0914	0.19	Q	.	.	.	.
7.43	0.0938	0.19	Q	.	.	.	.
7.58	0.0963	0.19	Q	.	.	.	.
7.74	0.0987	0.19	Q	.	.	.	.
7.89	0.1012	0.20	Q	.	.	.	.
8.04	0.1037	0.20	Q	.	.	.	.
8.20	0.1062	0.20	Q	.	.	.	.
8.35	0.1088	0.20	Q	.	.	.	.
8.50	0.1114	0.21	Q	.	.	.	.
8.66	0.1140	0.21	Q	.	.	.	.
8.81	0.1166	0.21	Q	.	.	.	.
8.96	0.1193	0.21	Q	.	.	.	.
9.11	0.1220	0.22	Q	.	.	.	.
9.27	0.1248	0.22	Q	.	.	.	.
9.42	0.1276	0.22	Q	.	.	.	.
9.57	0.1304	0.23	Q	.	.	.	.
9.73	0.1333	0.23	Q	.	.	.	.
9.88	0.1362	0.23	Q	.	.	.	.
10.03	0.1392	0.24	Q	.	.	.	.
10.19	0.1422	0.24	Q	.	.	.	.
10.34	0.1453	0.24	Q	.	.	.	.
10.49	0.1484	0.25	Q	.	.	.	.
10.65	0.1515	0.25	.Q	.	.	.	.
10.80	0.1547	0.26	.Q	.	.	.	.
10.95	0.1580	0.26	.Q	.	.	.	.
11.10	0.1613	0.26	.Q	.	.	.	.
11.26	0.1647	0.27	.Q	.	.	.	.
11.41	0.1682	0.27	.Q	.	.	.	.
11.56	0.1717	0.28	.Q	.	.	.	.
11.72	0.1753	0.29	.Q	.	.	.	.
11.87	0.1789	0.29	.Q	.	.	.	.
12.02	0.1827	0.30	.Q	.	.	.	.
12.18	0.1866	0.32	.Q	.	.	.	.
12.33	0.1906	0.32	.Q	.	.	.	.
12.48	0.1947	0.33	.Q	.	.	.	.
12.63	0.1990	0.34	.Q	.	.	.	.
12.79	0.2033	0.35	.Q	.	.	.	.
12.94	0.2078	0.36	.Q	.	.	.	.
13.09	0.2124	0.37	.Q	.	.	.	.
13.25	0.2171	0.38	.Q	.	.	.	.
13.40	0.2220	0.40	.Q	.	.	.	.

13.55	0.2271	0.40	.Q	.	.	.	.
13.70	0.2323	0.42	.Q	.	.	.	.
13.86	0.2378	0.44	.Q	.	.	.	.
14.01	0.2434	0.46	.Q	.	.	.	.
14.16	0.2493	0.46	.Q	.	.	.	.
14.32	0.2553	0.49	.Q	.	.	.	.
14.47	0.2616	0.51	. Q	.	.	.	.
14.62	0.2682	0.55	. Q	.	.	.	.
14.78	0.2753	0.57	. Q	.	.	.	.
14.93	0.2829	0.63	. Q	.	.	.	.
15.08	0.2911	0.67	. Q	.	.	.	.
15.23	0.3002	0.77	. Q	.	.	.	.
15.39	0.3103	0.84	. Q	.	.	.	.
15.54	0.3212	0.89	. Q	.	.	.	.
15.69	0.3334	1.03	. Q	.	.	.	.
15.85	0.3539	2.22	. Q	.	.	.	.
16.00	0.3867	2.96	. .Q	.	.	.	.
16.15	0.4535	7.61	.	.	.	Q	.
16.31	0.5105	1.41	. Q	.	.	.	.
16.46	0.5248	0.85	. Q	.	.	.	.
16.61	0.5346	0.71	. Q	.	.	.	.
16.77	0.5429	0.60	. Q	.	.	.	.
16.92	0.5500	0.53	. Q	.	.	.	.
17.07	0.5563	0.47	.Q	.	.	.	.
17.22	0.5621	0.45	.Q	.	.	.	.
17.38	0.5676	0.41	.Q	.	.	.	.
17.53	0.5726	0.39	.Q	.	.	.	.
17.68	0.5774	0.36	.Q	.	.	.	.
17.84	0.5818	0.34	.Q	.	.	.	.
17.99	0.5861	0.33	.Q	.	.	.	.
18.14	0.5901	0.31	.Q	.	.	.	.
18.30	0.5938	0.29	.Q	.	.	.	.
18.45	0.5974	0.28	.Q	.	.	.	.
18.60	0.6009	0.27	.Q	.	.	.	.
18.75	0.6042	0.26	.Q	.	.	.	.
18.91	0.6074	0.25	Q	.	.	.	.
19.06	0.6105	0.24	Q	.	.	.	.
19.21	0.6135	0.23	Q	.	.	.	.
19.37	0.6165	0.23	Q	.	.	.	.
19.52	0.6193	0.22	Q	.	.	.	.
19.67	0.6221	0.22	Q	.	.	.	.
19.83	0.6247	0.21	Q	.	.	.	.
19.98	0.6274	0.20	Q	.	.	.	.
20.13	0.6299	0.20	Q	.	.	.	.
20.28	0.6324	0.20	Q	.	.	.	.

7.61 +2.31 (DA2) TC
Summary= 9.92 cfs

ac/ft	peak (cfs)
0.4535	7.61
0.50	2.55
0.5105	1.41

at 0.50 storage is full, Q = 2.55 cfs

20.44	0.6349	0.19	Q	.	.	.	.	
20.59	0.6373	0.19	Q	.	.	.	.	
20.74	0.6396	0.18	Q	.	.	.	.	
20.90	0.6419	0.18	Q	.	.	.	.	
21.05	0.6442	0.18	Q	.	.	.	.	
21.20	0.6464	0.17	Q	.	.	.	.	
21.36	0.6485	0.17	Q	.	.	.	.	
21.51	0.6507	0.17	Q	.	.	.	.	
21.66	0.6528	0.16	Q	.	.	.	.	
21.81	0.6548	0.16	Q	.	.	.	.	
21.97	0.6569	0.16	Q	.	.	.	.	
22.12	0.6589	0.16	Q	.	.	.	.	
22.27	0.6608	0.15	Q	.	.	.	.	
22.43	0.6628	0.15	Q	.	.	.	.	
22.58	0.6647	0.15	Q	.	.	.	.	
22.73	0.6665	0.15	Q	.	.	.	.	
22.89	0.6684	0.15	Q	.	.	.	.	
23.04	0.6702	0.14	Q	.	.	.	.	
23.19	0.6720	0.14	Q	.	.	.	.	
23.34	0.6738	0.14	Q	.	.	.	.	
23.50	0.6756	0.14	Q	.	.	.	.	
23.65	0.6773	0.14	Q	.	.	.	.	
23.80	0.6790	0.13	Q	.	.	.	.	
23.96	0.6807	0.13	Q	.	.	.	.	
24.11	0.6824	0.13	Q	.	.	.	.	
24.26	0.6832	0.00	Q	.	.	.	.	29760.19

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%	1441.3
10%	82.6
20%	27.5
30%	18.4
40%	9.2
50%	9.2
60%	9.2
70%	9.2
80%	9.2
90%	9.2

10 Year DA-2 Proposed Condition

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

   TOTAL 24-HOUR DURATION RAINFALL DEPTH =    2.14 (inches)

   SOIL-COVER    AREA     PERCENT OF   SCS CURVE   LOSS RATE
     TYPE     (Acres)  PERVIOUS AREA    NUMBER   Fp(in./hr.)   YIELD
      1       0.45      10.00          98.      0.000      0.894
      2       1.06     100.00          67.      0.598      0.103



   TOTAL AREA (Acres) =     1.51

                 _
   AREA-AVERAGED LOSS RATE, Fm (in./hr.) =  0.420

                    _
   AREA-AVERAGED LOW LOSS FRACTION, Y = 0.662
================================================================================
--------------------------------------------------------------------------------


   RATIONAL METHOD CALIBRATION COEFFICIENT = 1.00
   TOTAL CATCHMENT AREA(ACRES) =   1.51
   SOIL-LOSS RATE, Fm,(INCH/HR) =  0.420
   LOW LOSS FRACTION = 0.662
   TIME OF CONCENTRATION(MIN.) =  9.95
   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) =  0.20
    30-MINUTE POINT RAINFALL VALUE(INCHES) =  0.48
     1-HOUR   POINT RAINFALL VALUE(INCHES) =  0.61
     3-HOUR   POINT RAINFALL VALUE(INCHES) =  0.94
     6-HOUR   POINT RAINFALL VALUE(INCHES) =  1.24
    24-HOUR   POINT RAINFALL VALUE(INCHES) =  2.14

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

   TOTAL CATCHMENT   RUNOFF  VOLUME(ACRE-FEET) =    0.11
   TOTAL CATCHMENT SOIL-LOSS VOLUME(ACRE-FEET) =    0.16

********************************************************************************
 TIME    VOLUME     Q   0.     2.5     5.0     7.5     10.0
```

(HOURS)	(AF)	(CFS)					
0.11	0.0001	0.02	Q	.	.	.	.
0.24	0.0003	0.02	Q	.	.	.	.
0.37	0.0005	0.02	Q	.	.	.	.
0.50	0.0007	0.02	Q	.	.	.	.
0.63	0.0009	0.02	Q	.	.	.	.
0.76	0.0011	0.02	Q	.	.	.	.
0.89	0.0012	0.02	Q	.	.	.	.
1.02	0.0014	0.02	Q	.	.	.	.
1.15	0.0016	0.02	Q	.	.	.	.
1.27	0.0018	0.02	Q	.	.	.	.
1.40	0.0020	0.02	Q	.	.	.	.
1.53	0.0022	0.02	Q	.	.	.	.
1.66	0.0024	0.02	Q	.	.	.	.
1.79	0.0027	0.02	Q	.	.	.	.
1.92	0.0029	0.02	Q	.	.	.	.
2.05	0.0031	0.02	Q	.	.	.	.
2.18	0.0033	0.02	Q	.	.	.	.
2.31	0.0035	0.02	Q	.	.	.	.
2.44	0.0037	0.02	Q	.	.	.	.
2.57	0.0039	0.02	Q	.	.	.	.
2.70	0.0041	0.02	Q	.	.	.	.
2.83	0.0043	0.02	Q	.	.	.	.
2.95	0.0045	0.02	Q	.	.	.	.
3.08	0.0048	0.02	Q	.	.	.	.
3.21	0.0050	0.02	Q	.	.	.	.
3.34	0.0052	0.02	Q	.	.	.	.
3.47	0.0054	0.02	Q	.	.	.	.
3.60	0.0056	0.02	Q	.	.	.	.
3.73	0.0059	0.02	Q	.	.	.	.
3.86	0.0061	0.02	Q	.	.	.	.
3.99	0.0063	0.02	Q	.	.	.	.
4.12	0.0065	0.02	Q	.	.	.	.
4.25	0.0068	0.02	Q	.	.	.	.
4.38	0.0070	0.02	Q	.	.	.	.
4.50	0.0072	0.02	Q	.	.	.	.
4.63	0.0075	0.02	Q	.	.	.	.
4.76	0.0077	0.02	Q	.	.	.	.
4.89	0.0079	0.02	Q	.	.	.	.
5.02	0.0082	0.02	Q	.	.	.	.
5.15	0.0084	0.02	Q	.	.	.	.
5.28	0.0086	0.02	Q	.	.	.	.
5.41	0.0089	0.02	Q	.	.	.	.
5.54	0.0091	0.02	Q	.	.	.	.

5.67	0.0094	0.02	Q	.	.	.	.
5.80	0.0096	0.02	Q	.	.	.	.
5.93	0.0099	0.02	Q	.	.	.	.
6.05	0.0101	0.02	Q	.	.	.	.
6.18	0.0104	0.02	Q	.	.	.	.
6.31	0.0106	0.02	Q	.	.	.	.
6.44	0.0109	0.02	Q	.	.	.	.
6.57	0.0112	0.02	Q	.	.	.	.
6.70	0.0114	0.02	Q	.	.	.	.
6.83	0.0117	0.02	Q	.	.	.	.
6.96	0.0120	0.03	Q	.	.	.	.
7.09	0.0122	0.03	Q	.	.	.	.
7.22	0.0125	0.03	Q	.	.	.	.
7.35	0.0128	0.03	Q	.	.	.	.
7.47	0.0131	0.03	Q	.	.	.	.
7.60	0.0133	0.03	Q	.	.	.	.
7.73	0.0136	0.03	Q	.	.	.	.
7.86	0.0139	0.03	Q	.	.	.	.
7.99	0.0142	0.03	Q	.	.	.	.
8.12	0.0145	0.03	Q	.	.	.	.
8.25	0.0148	0.03	Q	.	.	.	.
8.38	0.0151	0.03	Q	.	.	.	.
8.51	0.0154	0.03	Q	.	.	.	.
8.64	0.0157	0.03	Q	.	.	.	.
8.77	0.0160	0.03	Q	.	.	.	.
8.90	0.0163	0.03	Q	.	.	.	.
9.02	0.0166	0.03	Q	.	.	.	.
9.15	0.0169	0.03	Q	.	.	.	.
9.28	0.0172	0.03	Q	.	.	.	.
9.41	0.0175	0.03	Q	.	.	.	.
9.54	0.0179	0.03	Q	.	.	.	.
9.67	0.0182	0.03	Q	.	.	.	.
9.80	0.0185	0.03	Q	.	.	.	.
9.93	0.0189	0.03	Q	.	.	.	.
10.06	0.0192	0.03	Q	.	.	.	.
10.19	0.0196	0.03	Q	.	.	.	.
10.32	0.0199	0.03	Q	.	.	.	.
10.45	0.0203	0.03	Q	.	.	.	.
10.57	0.0206	0.03	Q	.	.	.	.
10.70	0.0210	0.03	Q	.	.	.	.
10.83	0.0214	0.04	Q	.	.	.	.
10.96	0.0218	0.04	Q	.	.	.	.
11.09	0.0221	0.04	Q	.	.	.	.
11.22	0.0225	0.04	Q	.	.	.	.
11.35	0.0229	0.04	Q	.	.	.	.

11.48	0.0233	0.04	Q	.	.	.	.
11.61	0.0237	0.04	Q	.	.	.	.
11.74	0.0241	0.04	Q	.	.	.	.
11.87	0.0246	0.04	Q	.	.	.	.
12.00	0.0250	0.04	Q	.	.	.	.
12.12	0.0254	0.04	Q	.	.	.	.
12.25	0.0259	0.04	Q	.	.	.	.
12.38	0.0264	0.04	Q	.	.	.	.
12.51	0.0269	0.05	Q	.	.	.	.
12.64	0.0273	0.05	Q	.	.	.	.
12.77	0.0278	0.05	Q	.	.	.	.
12.90	0.0284	0.05	Q	.	.	.	.
13.03	0.0289	0.05	Q	.	.	.	.
13.16	0.0294	0.05	Q	.	.	.	.
13.29	0.0300	0.05	Q	.	.	.	.
13.42	0.0305	0.05	Q	.	.	.	.
13.55	0.0311	0.06	Q	.	.	.	.
13.68	0.0317	0.06	Q	.	.	.	.
13.80	0.0324	0.06	Q	.	.	.	.
13.93	0.0330	0.06	Q	.	.	.	.
14.06	0.0337	0.06	Q	.	.	.	.
14.19	0.0343	0.06	Q	.	.	.	.
14.32	0.0350	0.07	Q	.	.	.	.
14.45	0.0358	0.07	Q	.	.	.	.
14.58	0.0365	0.07	Q	.	.	.	.
14.71	0.0373	0.08	Q	.	.	.	.
14.84	0.0382	0.08	Q	.	.	.	.
14.97	0.0391	0.09	Q	.	.	.	.
15.10	0.0400	0.10	Q	.	.	.	.
15.23	0.0411	0.10	Q	.	.	.	.
15.35	0.0422	0.11	Q	.	.	.	.
15.48	0.0435	0.11	Q	.	.	.	.
15.61	0.0447	0.13	Q	.	.	.	.
15.74	0.0463	0.15	Q	.	.	.	.
15.87	0.0487	0.30	.Q	.	.	.	.
16.00	0.0531	0.53	. Q	.	.	.	.
16.13	0.0683	2.31	.	Q.	.	.	.
16.26	0.0819	0.24	Q	.	.	.	.
16.39	0.0839	0.12	Q	.	.	.	.
16.52	0.0851	0.11	Q	.	.	.	.
16.65	0.0861	0.09	Q	.	.	.	.
16.77	0.0870	0.08	Q	.	.	.	.
16.90	0.0878	0.07	Q	.	.	.	.
17.03	0.0886	0.07	Q	.	.	.	.
17.16	0.0892	0.06	Q	.	.	.	.

17.29	0.0899	0.06	Q	.	.	.	.
17.42	0.0905	0.05	Q	.	.	.	.
17.55	0.0911	0.05	Q	.	.	.	.
17.68	0.0916	0.05	Q	.	.	.	.
17.81	0.0921	0.05	Q	.	.	.	.
17.94	0.0926	0.04	Q	.	.	.	.
18.07	0.0931	0.04	Q	.	.	.	.
18.20	0.0935	0.04	Q	.	.	.	.
18.33	0.0939	0.04	Q	.	.	.	.
18.45	0.0944	0.04	Q	.	.	.	.
18.58	0.0948	0.04	Q	.	.	.	.
18.71	0.0951	0.04	Q	.	.	.	.
18.84	0.0955	0.03	Q	.	.	.	.
18.97	0.0959	0.03	Q	.	.	.	.
19.10	0.0962	0.03	Q	.	.	.	.
19.23	0.0966	0.03	Q	.	.	.	.
19.36	0.0969	0.03	Q	.	.	.	.
19.49	0.0972	0.03	Q	.	.	.	.
19.62	0.0975	0.03	Q	.	.	.	.
19.75	0.0979	0.03	Q	.	.	.	.
19.88	0.0982	0.03	Q	.	.	.	.
20.00	0.0985	0.03	Q	.	.	.	.
20.13	0.0988	0.03	Q	.	.	.	.
20.26	0.0990	0.03	Q	.	.	.	.
20.39	0.0993	0.03	Q	.	.	.	.
20.52	0.0996	0.03	Q	.	.	.	.
20.65	0.0999	0.03	Q	.	.	.	.
20.78	0.1001	0.02	Q	.	.	.	.
20.91	0.1004	0.02	Q	.	.	.	.
21.04	0.1007	0.02	Q	.	.	.	.
21.17	0.1009	0.02	Q	.	.	.	.
21.30	0.1012	0.02	Q	.	.	.	.
21.42	0.1014	0.02	Q	.	.	.	.
21.55	0.1017	0.02	Q	.	.	.	.
21.68	0.1019	0.02	Q	.	.	.	.
21.81	0.1021	0.02	Q	.	.	.	.
21.94	0.1024	0.02	Q	.	.	.	.
22.07	0.1026	0.02	Q	.	.	.	.
22.20	0.1028	0.02	Q	.	.	.	.
22.33	0.1030	0.02	Q	.	.	.	.
22.46	0.1033	0.02	Q	.	.	.	.
22.59	0.1035	0.02	Q	.	.	.	.
22.72	0.1037	0.02	Q	.	.	.	.
22.85	0.1039	0.02	Q	.	.	.	.
22.98	0.1041	0.02	Q	.	.	.	.

23.10	0.1043	0.02	Q	.	.	.	.	
23.23	0.1045	0.02	Q	.	.	.	.	
23.36	0.1047	0.02	Q	.	.	.	.	
23.49	0.1049	0.02	Q	.	.	.	.	
23.62	0.1051	0.02	Q	.	.	.	.	
23.75	0.1053	0.02	Q	.	.	.	.	
23.88	0.1055	0.02	Q	.	.	.	.	
24.01	0.1057	0.02	Q	.	.	.	.	
24.14	0.1058	0.00	Q	.	.	.	.	4608.648

4608.6 ft3 completely retained in Basin 3 (9203 ft3)

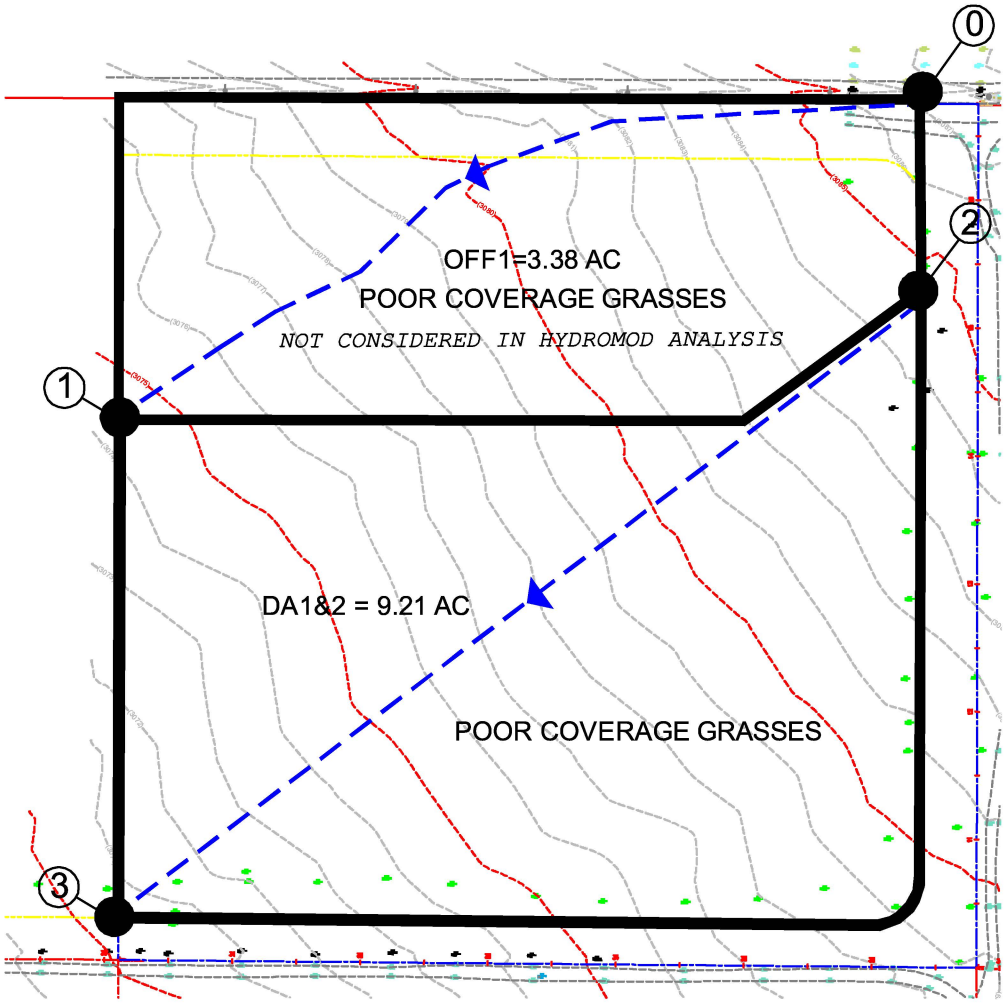
TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
(Note: 100% of Peak Flow Rate estimate assumed to have
an instantaneous time duration)

Percentile of Estimated Peak Flow Rate	Duration (minutes)
0%	1441.5
10%	31.0
20%	15.5
30%	7.8
40%	7.8
50%	7.8
60%	7.8
70%	7.8
80%	7.8
90%	7.8

ONSITE EXISTING HYDROLOGY

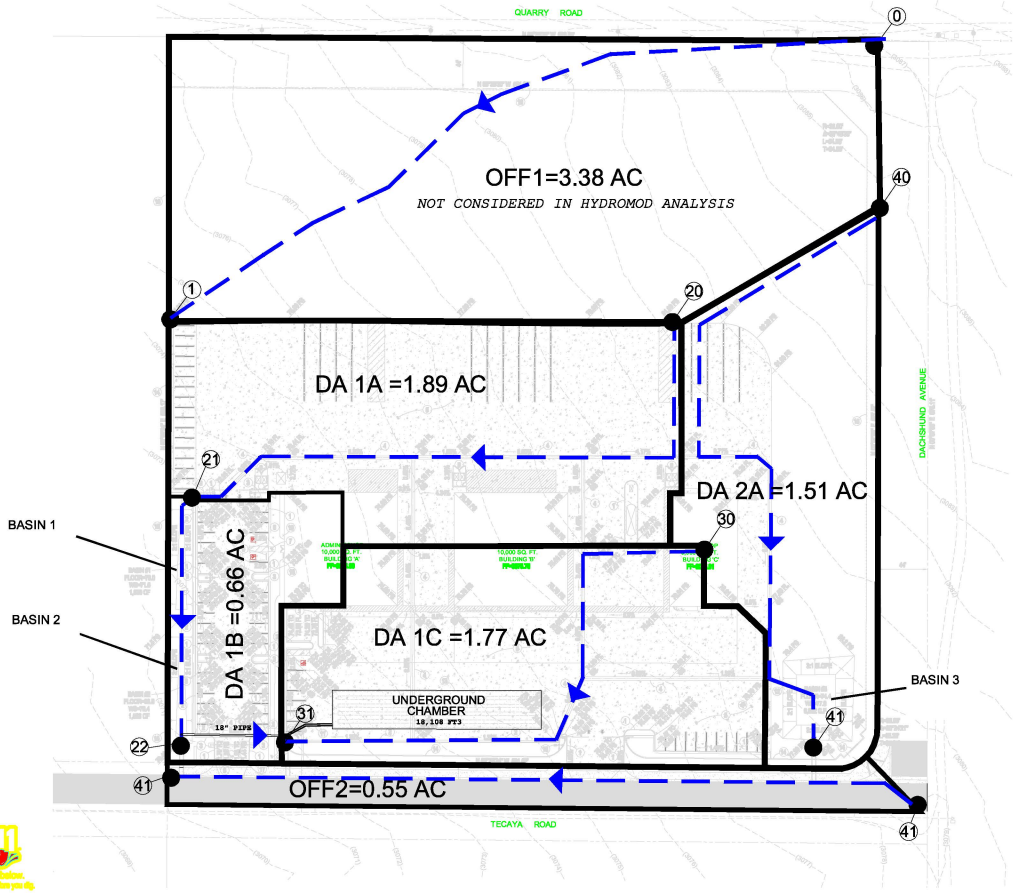


SCALE 1"=150'



Nodes	Area (ft2)	Area (Ac)	Flow Length (ft)	High El (ft)	Low El (ft)
0to1	147450	3.38	700	3087	3074.53
2to3	254007	5.83	792	3084.7	3070.7

ONSITE AND TECAYA ROAD
PROPOSED HYDROLOGY EXHIBIT



Nodes	Area (ft2)	Area (Ac)	Flow Length (ft)	High El (ft)	Low El (ft)	Grass (Ac)	Commercial (Ac)
0to1	147450	3.38	700	3087	3074.53	3.38	
20to21	82381.87	1.89	560	3081	3072.78		1.89
21to22	28812.08	0.66	250	3072.78	3070.4	0.13	0.53
30to31	76958.68	1.77	510	3078.9	3071.7		1.77
40to41	65854.37	1.51	635	3084.7	3077.9	1.06	0.45
50to51	23916	0.55	665	3079	3069.4		

Basin	Volumes (ft3)
1	1828
2	1805
3	9230
Chambers	18108
Total	30971

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

BENCHMARK:
LOCATION:
TOP OF BRASS CAP @ WEST 1/4 CORNER, SECTION 4, T6N, R3W, S.B.M. PER CSFB 42/19/287
ELEV=3134.810 (NGVD 29)

REVISIONS
NO. DATE BY

Prepared By:
ALLARD ENGINEERING
Civil Engineering – Land Surveying – Land Planning
16868 Seville Avenue
Fontana, California 92335
Phone (909) 355-1915 Fax (909) 355-1705

ROBERT K. ALLARD RCE 55349 12/05/25 DATE

TOWN OF APPLE VALLEY
ONSITE PROPOSED HYDROLOGY
APN 0463-441-07
TECAYA ROAD

PROJECT NUMBER
SCALE: 1" = 40'
SHEET 2 OF 7

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:

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.

4.3.3 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).

.

Form 4.3-3 Infiltration LID BMP - including underground BMPs (DA1,2)

1 Remaining LID DCV not met by site design BMP (ft^3): 15,185 *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 1 BMP Type Basin-1,2, CMP-1	DA2 BMP Type: CMP-1	DA3 BMP Type: Basin-3
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*	2.05	2.05	2.05
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	2.2	2.2	2.2
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	0.93	0.93	0.93
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	48	48
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	1.5	3.5	3.7
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	1.5	3.5	3.5
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*	7,978	5,868	2473
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	0	0
10 Amended soil porosity	0	0	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	0	0
12 Gravel porosity	-	-	-
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	-	-	-
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	3,633	0	9,230
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	3265	14,986	0

16 Total Retention Volume from LID Infiltration BMPs: 31,114 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 204% *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.

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	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.50
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.20
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					2.05
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					0.93

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Average Inf. Rate : 2.05 in/hr average rate from 4-tested pits
(P-1: 3.3"/hr, P-2:1.4"/hr, P3:1.9"/hr, P4:1.6"/hr)
Geotechnical & Infiltration feasibility investigation, March 14, 2025.
Design Inf Rate: 2.05/2.2 = 0.93"/hr

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

APPENDIX C
BOREHOLE PERCOLATION TESTING PROGRAM AND INFILTRATION RATE TEST RESULTS

Four borehole percolation tests were conducted in general accordance with the Shallow Percolation Test procedure as outlined in the Technical Guidance Document for Water Quality Management Plans (CDM Smith, 2013). The general locations of our tests are illustrated on Enclosure A-2 and were conducted at the requested locations and depth. Subsequent to drilling, a 3-inch diameter, perforated PVC pipe wrapped in filter fabric was placed within each test hole and 3/4-inch gravel was placed between the outside of the pipe and the hole wall. Test holes were pre-soaked the same day as drilling. Testing took place the next day, February 12, 2025, within 26 hours but not before 15 hours, of the pre-soak. The holes were filled using water from a 200 gallon water tank. Test periods consisted of allowing the water to drop in approximately 30-minute intervals. After each reading, the hole was refilled. Testing was terminated after a total of 12 readings were recorded. The percolation test data was converted to an infiltration rate using the Porchet Method as outlined by the Technical Guidance Document (CDM Smith, 2013).

Infiltration test results are summarized in the following table:

Test No.	Depth* (ft)	Infiltration Rate** (in/hr)
P-1	5.0	3.3
P-2	5.0	1.4
P-3	5.0	1.9
P-4	5.0	1.6

* depth measured below existing ground surface
** Porchet Method determined clear water rate

The results of this testing are presented as Enclosures C-1 through C-4.

Avg Inf Rate: 2.05"/hr

Infiltration Basin Capacity Calculation: Basin-1

Surface Area	1055	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	1.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**1828**	**CF**	

Infiltration Drawdown Time Calculation: Basin-1

Infiltration Surface Area Provided:	1,055	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	1,828	cu.ft	
Infiltration Volume per hour	81.92	cu.ft/hr	(1,055 sft * 0.078 ft/hr)
Infiltration Draw Down Time	22.31	Hours	(1828 cu.ft / 81.92 cu.ft/hr)
	22 hr		< 48 hr draw down time. OK

Infiltration Basin Capacity Calculation: Basin-2

Surface Area	1042	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	1.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**1805**	**CF**	

Infiltration Drawdown Time Calculation: Basin-2

Infiltration Surface Area Provided:	1,805	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	1,805	cu.ft	
Infiltration Volume per hour	140.16	cu.ft/hr	(1,805 sft * 0.078 ft/hr)
Infiltration Draw Down Time	12.88	Hours	(1805 cu.ft / 140.16 cu.ft/hr)
	13 hr		< 48 hr draw down time. OK

Infiltration Basin Capacity Calculation: Basin-3

Surface Area	2473	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	3.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**9230**	**CF**	
Vol. Needed	8203		
Over	1027		

Infiltration Drawdown Time Calculation: Basin-3

Infiltration Surface Area Provided:	2,473	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	9230	cu.ft	
Infiltration Volume per hour	192.03	cu.ft/hr	(2,473 sft * 0.078 ft/hr)
Infiltration Draw Down Time	48.06	Hours	(9,230 cu.ft / 188.30 cu.ft/hr)
	48 hr		48 hr draw down time. OK

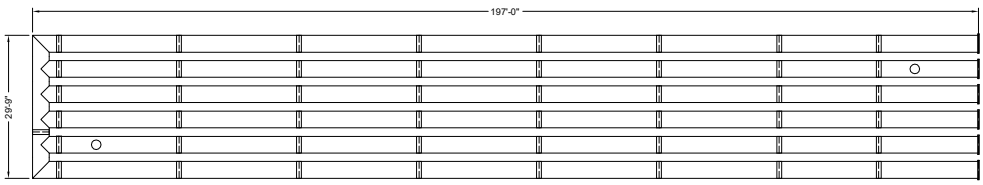
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 1,191 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 18,200 CF
- PIPE STORAGE VOLUME = 11,456 CF
- BACKFILL STORAGE VOLUME = 6,794 CF
- TOTAL STORAGE PROVIDED = 18,251 CF
- STONE VOID = 40 %

PIPE DETAILS
- DIAMETER = 42"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 21"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 6"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2 ⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN. QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

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All dimensions between the supplied information upon which this drawing is based and actual field conditions are unverified. As site work progresses, these discrepancies must be reported to Contech immediately for re-evaluation of the design. Contech accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
INFILTRATION/RETENTION SYSTEM

70998	97148	1/14/2026
DYO		DYO
DYO		DYO

Infiltration Drawdown Time Calculation: Contech CMP-1

Infiltration Surface Area Provided:	5,868	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	18251	cu.ft	
Infiltration Volume per hour	455.66	cu.ft/hr	(5868 sft * 0.078 ft/hr)
Infiltration Draw Down Time	40.05	Hours	(18251 cu.ft / 455.66 cu.ft/hr)
	40 hr	48 hr draw down time. OK	

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): 15,185 CF *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 31,114 *Copy Item 16 in Form 4.3-3*

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

5 Flow capacity provided by flow based biotreatment BMP (cfs): *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. ☐

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
Infiltration/Retention basin	Joshua Grading and Excavating, Inc.	Remove accumulated trash and debris in the basin at the start and end of the wet season. Inspect for standing water at the end of the wet season. Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin. If erosion is occurring within the basin, re-vegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is establisheds Inc.	2 times a year at the beginning and end of the rainy season (October to March)
Contech CMP Infiltration/Detention Chamber System	Joshua Grading and Excavating, Inc.	Required Inspection/Maintenance Activities per the Manufacturer/Vendor	Per the Manufacturer/Vendor recommendation

Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Joshua Grading and Excavating, Inc.	Practical education materials will be provided to property owners covering various water quality issues that will need to be addressed on their specific site. These materials will include general good house keeping practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements.	*Ongoing*
Landscape maintenance	Joshua Grading and Excavating, Inc.	Landscape planning is implemented to reduce groundwater and storm water contamination. This will be accomplished through an infiltration basin, and landscape areas.	
BMP maintenance	Joshua Grading and Excavating, Inc.	See BMP fact sheets and Table 5-1 details hereon	Ongoing with every visit
Employee training	Joshua Grading and Excavating, Inc.	Employee training may be developed by the owner	As stated
Litter debris control program	Joshua Grading and Excavating, Inc.	Litter debris control program may be developed by City of Hesperia	Ongoing with every visit
Catch basin inspection program	Joshua Grading and Excavating, Inc.	Catch basins will be inspected a minimum of once every three months during the dry season and a minimum of once every two months during the rainy season.	Place at grate installation and inspect once a year
Provide storm drain system stencilling and signage	Joshua Grading and Excavating, Inc.	Signs will be placed above storm drain inlets to warn the public of prohibitions against waste disposal	Inspect once a year
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Joshua Grading and Excavating, Inc.	Rain sensors will be incorporated into the onsite sprinkler system so that no unnecessary watering of landscaped areas occurs after storm events.	Once a year or according to Manufacturer Manuals
Finish grade of landscaped areas at a minimum of 1-2 inches below top of	Joshua Grading and Excavating, Inc.	New landscaped areas will be constructed at a minimum of 1 inch below top of curb or sidewalk.	Inspect once a year

curb, sidewalk, or pavement			
Street Sweeping	Joshua Grading and Excavating, Inc.	Street weeping and Vaccuming	Bi Monthly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan (WQMP BMP Exhibit)

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

RECORDING REQUESTED BY:

Town of Apple Valley
Apple Valley, Ca 92307

AND WHEN RECORDED MAIL TO:

Town of Apple Valley
Engineering Department
14955 Dale Evans Pkwy
Apple Valley, CA 92307

SPACE ABOVE THIS LINE FOR RECORDER'S USE

COVENANT AND AGREEMENT REGARDING WATER QUALITY MANAGEMENT PLAN AND STORMWATER BEST MANAGEMENT PRACTICES TRANSFER, ACCESS AND MAINTENANCE

THIS PAGE ADDED TO PROVIDE ADEQUATE SPACE FOR RECORDING INFORMATION

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

OWNER NAME _____

PROJECT: _____

PROPERTY ADDRESS: _____

_____

APN: 0463-441-07

THIS AGREEMENT is made and entered into in

Apple Valley ,California, this _____ day of

_____ , by and between

_____ , hereinafter

referred to as Owner, and the Town of Apple Valley, a political subdivision of the State of California, hereinafter referred to as "The Town";

WHEREAS, the Owner owns real property ("Property") in the Town, 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; and

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

_____ within the Property described herein, the Town required the project to employ Best Management Practices, hereinafter referred to as "BMPs," to minimize pollutants in urban runoff; and

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

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

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. Owner shall comply with the WQMP.

2. 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.

3. Owner hereby provides the Town'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 Town of Apple Valley, no advance notice, for the purpose of inspection, sampling, testing of the BMPs, and in case of emergency, to undertake all necessary repairs or other preventative measures at owner's expense as provided in paragraph 5 below. The Town 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 breach of this Agreement and may also be a violation of the County's Pollutant Discharge Elimination System regulations, which on the effective date of this Agreement are found in County Code Sections 35.0101 et seq. If there is reasonable cause to believe that an illicit discharge or breach of this Agreement 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. Owner recognizes that the Town may perform routine and regular inspections, as well as emergency inspections, of the BMPs. Owner or Owner's successors or assigns shall pay Town for all costs incurred by Town in the inspection, sampling, testing of the BMPs within thirty (30) calendar days of Town's invoice.

4. 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 Town, the Owner shall provide the Town with documentation identifying the material(s) removed, the quantity, and disposal destination), testing construction or reconstruction.

5. In the event Owner, or its successors or assigns, fails to accomplish the necessary maintenance contemplated by this Agreement, within five (5) business days of being given written notice by the Town, the Town 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 Town Code from the date of the notice of expense until paid in full. Owner or Owner's successors or assigns shall pay Town within thirty (30) calendar days of Town's invoice.

6. The Town may require the owner to post security in form and for a time period satisfactory to the Town to guarantee the performance of the obligations stated herein. Should the Owner fail to perform the obligations under the Agreement, the Town 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 surety(ies) to perform the obligations of this Agreement.

7. The Town agrees, from time to time, within ten (10) business days after request of Owner, to execute and deliver to Owner, or Owner's designee, an estoppel certificate requested by Owner, stating that this Agreement is in full force and effect, and that Owner is not in default hereunder with regard to any maintenance or payment obligations (or specifying in detail the nature of Owner's default). Owner shall pay all costs and expenses incurred by the Town in its investigation of whether to issue an estoppel certificate within thirty (30) calendar days after receipt of a Town invoice and prior to the Town's issuance of such certificate. Where the Town cannot issue an estoppel certificate, Owner shall pay the Town within thirty (30) calendar days of receipt of a Town invoice.

8. Owner shall not change any BMPs identified in the WQMP without an amendment to this Agreement approved by authorized representatives of both the Town and the Owner.

9. The Town and the Owner shall comply with all applicable laws, ordinances, rules, regulations, court orders and government agency orders now or hereinafter in effect in carrying out the terms of this Agreement. If a provision of this Agreement is terminated or held to be invalid, illegal or unenforceable, the validity, legality and enforceability of the remaining provisions shall remain in full effect.

10. In addition to any remedy available to the Town under this Agreement, if Owner violates any term of this Agreement and does not cure the violation within the time already provided in this Agreement, or, if not provided, within thirty (30) calendar days, or within such time authorized by the Town if said cure reasonably requires more than the subject time, the Town may bring an action at law or in equity in a court of competent jurisdiction to enforce compliance by the Owner with the terms of this Agreement. In such action, the Town may recover any damages to which the Town may be entitled for the violation, enjoin the violation by temporary or permanent injunction without the necessity of proving actual damages or the inadequacy of otherwise available legal remedies, or obtain other equitable relief, including, but not limited to, the restoration of the Property and/or the BMPs identified in the WQMP to the condition in which it/they existed prior to any such violation or injury.

11. 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 Town, including interest as herein above set forth, subject to foreclosure in event of default in payment.

12. 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 Town harmless and pay all costs incurred by the Town 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.

13. 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.

14. 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 Town at the same time such notice is provided to the successor.

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

16. 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.

17. Owner agrees to indemnify, defend (with counsel reasonably approved by the Town) and hold harmless the Town and its authorized officers, employees, agents and volunteers from any and all claims, actions, losses, damages, and/or liability arising out of this Agreement from any cause whatsoever, including the acts, errors or omissions of any person and for any costs or expenses incurred by the Town on account of any claim except where such indemnification is prohibited by law. This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The Owner's indemnification obligation applies to the Town's "active" as well as "passive" negligence but does not apply to the Town's "sole negligence" or "willful misconduct" within the meaning of Civil Code Section 2782, or to any claims, actions, losses, damages, and/or liabilities, to the extent caused by the acts or omissions of any third party contractors undertaking any work (other than field inspections) or other maintenance on the Property on behalf of the Town under this Agreement..

[REMAINDER OF THIS PAGE INTENTIONALLY LEFT BLANK]

IF TO TOWN :	**IF TO OWNER:**
Town of Apple Valley	_____
14955 Dale Evans Pkwy	_____
Apple Valley, CA 92307	_____

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

OWNER:

Company/Trust:_____

Signature: _____

Name: _____

Title: _____

Date: _____

OWNER:

Company/Trust:_____

Signature: _____

Name: _____

Title: _____

Date: _____

FOR: Maintenance Agreement, dated _____, for the project known as _____ _____ (APN)_____, As described in the WQMP dated _____.

NOTARIES ON FOLLOWING PAGE

A notary acknowledgement is required for recordation.

ACCEPTED BY:

_____

TOWN MANAGER

Date: _____

Attachment: Notary Acknowledgement

ATTACHMENT 1
Notary Acknowledgement)

EXHIBIT A
(Legal Description)

LEGAL DESCRIPTION:

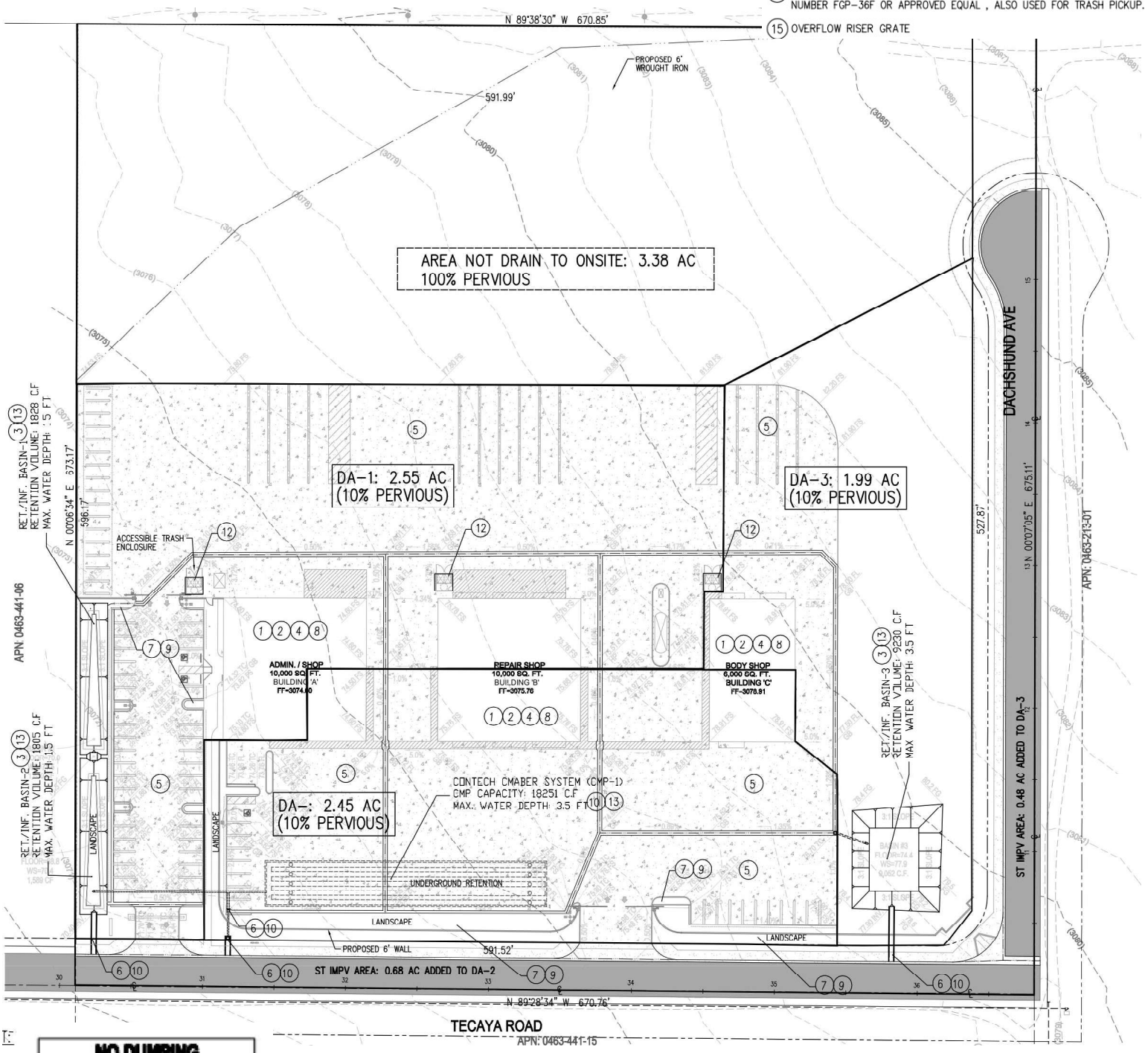
THE NORTHEAST 1/4 OF THE NORTHEAST 1/4 OF THE NORTHWEST 1/4 OF SECTION 16, TOWNSHIP 6 NORTH, RANGE 3 WEST, S.B.M., IN THE TOWN OF APPLE VALLEY, COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA.

DRAINAGE AREA	PROPOSED BMP	AREA (AC)	DESIGN CAPTURE VOL. (CF)	PROVIDED VOL. (CF)
DA-1	INF BASIN 1, 2 & CMP-1	2.55	6898	6898
DA-2	CMP-1	2.45	6627	14985
DA-3	BASIN-3	1.99	1660	9230
SITE		10.37 AC	15,185 CF	31,143 CF

DCV ACHEIVED WITH PROPOSED BMPs: 204%

BMP LIST:

1. EDUCATION OF PROPERTY OWNERS
2. ACTIVITY RESTRICTIONS
3. INF/RET. BASIN FOR WQ MITIGATION (BASIN-1,2,3
4. TRAINING/EDUCATION PROGRAM
5. PARKING LOT SWEEPING/VACUUMING
6. COMMON AREA CATCH BASIN INSPECTION
7. LANDSCAPE PLANNING (SD-10)
8. ROOF RUNOFF CONTROLS (SD-11)
9. EFFICIENT IRRIGAION (SD-12)
10. STORM DRAIN SIGNAGE (SD-13)
11. NOT USED
12. TRASH STORAGE AREAS (SD-32)
13. BELOW SURFACE CONTECH INF/RET CHAMBER SYSTEM (CMP-1) FOR WQ/ AND HIGH FLOW RETENTION VOL. INFILTRATION
14. TRAFFIC GRATE FILTER INSERT-OLDCASTLE FLOGARD INSERT FILTER MODEL NUMBER FGP-36F OR APPROVED EQUAL , ALSO USED FOR TRASH PICKUP.
15. OVERFLOW RISER GRATE



NO DUMPING
DRAINS TO WATER TABLE

CATCH BASIN STENCIL

Scale: N.T.S

Prepared By:
ALLARD ENGINEERING
Civil Engineering - Land Surveying - Land Planning
18885 Seville Avenue
Fontana, California 92335
(909) 356-1815 Fax (909) 356-1705

Prepared For:
JOSHUA GRADING
AND EXCAVATING, INC
P.O. BOX 292329
PHELAN, CA 92329
PH. (760) 559-5845

TOWN OF APPLE VALLEY, CALIFORNIA

WQMP EXHIBIT
SITE MAP

APN: 0463-441-07

Form 5-1 BMP Inspection and Maintenance (use additional forms as necessary)			
BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Infiltration/Retention basin	Joshua Grading and Excavating, Inc.	Remove accumulated trash and debris in the basin at the start and end of the wet season. Inspect for standing water at the end of the wet season. Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons. Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin. If erosion is occurring within the basin, re-vegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is establisheds Inc.	2 times a year at the beginning and end of the rainy season (October to March)
Contech CMP Infiltration/Detention Chamber System	Joshua Grading and Excavating, Inc.	Required Inspection/Maintenance Activities per the Manufacturer/Vendor	Per the Manufacturer/Vendor recommendation

Education of Property Owners, Tenants and Occupants on Stormwater BMPs	Joshua Grading and Excavating, Inc.	Practical education materials will be provided to property owners covering various water quality issues that will need to be addressed on their specific site. These materials will include general good house keeping practices that contribute to the protection of storm water quality and BMP's that eliminate or reduce pollution during property improvements.	*Ongoing*
Landscape maintenance	Joshua Grading and Excavating, Inc.	Landscape planning is implemented to reduce groundwater and storm water contamination. This will be accomplished through an infiltration basin, and landscape areas.	
BMP maintenance	Joshua Grading and Excavating, Inc.	See BMP fact sheets and Table 5-1 details hereon	Ongoing with every visit
Employee training	Joshua Grading and Excavating, Inc.	Employee training may be developed by the owner	As stated
Litter debris control program	Joshua Grading and Excavating, Inc.	Litter debris control program may be developed by City of Hesperia	Ongoing with every visit
Catch basin inspection program	Joshua Grading and Excavating, Inc.	Catch basins will be inspected a minimum of once every three months during the dry season and a minimum of once every two months during the rainy season.	Place at grate installation and inspect once a year
Provide storm drain system stencilling and signage	Joshua Grading and Excavating, Inc.	Signs will be placed above storm drain inlets to warn the public of prohibitions against waste disposal	Inspect once a year
Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control	Joshua Grading and Excavating, Inc.	Rain sensors will be incorporated into the onsite sprinkler system so that no unnecessary watering of landscaped areas occurs after storm events.	Once a year or according to Manufacturer Manuals
Finish grade of landscaped areas at a minimum of 1-2 inches below top of	Joshua Grading and Excavating, Inc.	New landscaped areas will be constructed at a minimum of 1 inch below top of curb or sidewalk.	Inspect once a year

curb, sidewalk, or pavement			
Street Sweeping	Joshua Grading and Excavating, Inc.	Street weeping and Vaccuming	Bi Monthly

SAMPLE INSPECTION FORM

Appendix I: BMP Inspection Form

INSTRUCTIONS

- *Identify Risk Level, for Risk Level 2 or 3 include highlighted text*

Risk Level 1, 2, 3 ***Visual Inspection Field Log Sheet***						
Date and Time of Inspection:				Report Date:		
Inspection Type:	□ Weekly	□ Before predicted rain	□ During rain event	□ Following qualifying rain event	□ Contained stormwater release	□ Quarterly non-stormwater
Site Information						
Construction Site Name:						
Construction stage and completed activities:					Approximate area of exposed site:	
Weather and Observations						
Date Rain Predicted to Occur:				Predicted % chance of rain:		
Estimate storm beginning: _____ (date and time)		Estimate storm duration:_____ (hours)		Estimate time since last storm: _____ (days or hours)	Rain gauge reading:_____ (inches)	
Observations: If yes identify location						
Odors	Yes □	No □				
Floating material	Yes □	No □				
Suspended Material	Yes □	No □				
Sheen	Yes □	No □				
Discolorations	Yes □	No □				
Turbidity	Yes □	No □				
Site Inspections						
Outfalls or BMPs Evaluated			**Deficiencies Noted**			
(add additional sheets or attached detailed BMP Inspection Checklists)						
Photos Taken:	Yes □		No □	Photo Reference IDs:		
Corrective Actions Identified (note if SWPPP/REAP change is needed)						
Inspector Information						
Inspector Name:				Inspector Title:		
Signature:					Date:	

CHAIN-OF-CUSTODY **DATE:** **Lab ID:**

DESTINATION LAB: ATTN: **ADDRESS:** **Office Phone:** **Cell Phone:**							REQUESTED ANALYSIS			
SAMPLED BY:										
Contact:										
Project Name										
Client Sample ID	**Sample Date**	**Sample Time**	**Sample Matrix**	**Container #**	**Container Type**	**Container Pres.**				
SENDER COMMENTS:						**RELINQUISHED BY**				
						Signature:				
						Print:				
						Company:				
						Date:				
LABORATORY COMMENTS:						**RECEIVED**				
						Signature:				
						Print:				
						Company:				
						Date:				

BMP INSPECTION REPORT

Date and Time of Inspection:			Date Report Written:	
Inspection Type: (Circle one)	Weekly *Complete Parts I,II,III and VII*	Pre-Storm *Complete Parts I,II,III,IV and VII*	During Rain Event *Complete Parts I, II, III, V, and VII*	Post-Storm *Complete Parts I,II,III,VI and VII*

Part I. General Information

Site Information

Construction Site Name:	
Construction stage and completed activities:	Approximate area of site that is exposed:

Photos Taken: (Circle one)	Yes	No	Photo Reference IDs:

Weather

Estimate storm beginning: (date and time)	Estimate storm duration: (hours)
Estimate time since last storm: (days or hours)	Rain gauge reading and location: (in)

Is a "Qualifying Event" predicted or did one occur (i.e., 0.5" rain with 48-hrs or greater between events)? (Y/N)
If yes, summarize forecast:

Exemption Documentation (explanation required if inspection could not be conducted). Visual inspections are not required outside of business hours or during dangerous weather conditions such as flooding or electrical storms.

Inspector Information

Inspector Name:	Inspector Title:
Signature:	Date:

Part II. BMP Observations. **Describe deficiencies in Part III.**			
Minimum BMPs for Risk Level _____ Sites	Failures or other short comings (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Construction Materials			
Inventory of products (excluding materials designed to be outdoors)			
Stockpiled construction materials not actively in use are covered and bermed			
All chemicals are stored in watertight containers with appropriate secondary containment, or in a completely enclosed storage shed			
Construction materials are minimally exposed to precipitation			
BMPs preventing the off-site tracking of materials are implemented and properly effective			
Good Housekeeping for Waste Management			
Wash/rinse water and materials are prevented from being disposed into the storm drain system			
Portable toilets are contained to prevent discharges of waste			
Sanitation facilities are clean and with no apparent for leaks and spills			
Equipment is in place to cover waste disposal containers at the end of business day and during rain events			
Discharges from waste disposal containers are prevented from discharging to the storm drain system / receiving water			
Stockpiled waste material is securely protected from wind and rain if not actively in use			
Procedures are in place for addressing hazardous and non-hazardous spills			
Appropriate spill response personnel are assigned and trained			
Equipment and materials for cleanup of spills is available onsite			
Washout areas (e.g., concrete) are contained appropriately to prevent discharge or infiltration into the underlying soil			
Good Housekeeping for Vehicle Storage and Maintenance			
Measures are in place to prevent oil, grease, or fuel from leaking into the ground, storm drains, or surface waters			
All equipment or vehicles are fueled, maintained, and stored in a designated area with appropriate BMPs			
Vehicle and equipment leaks are cleaned immediately and disposed of properly			

Part II. BMP Observations Continued. Describe deficiencies in Part III.			
Minimum BMPs for Risk Level _____ Sites	Adequately designed, implemented and effective (yes, no, N/A)	Action Required (yes/no)	Action Implemented (Date)
Good Housekeeping for Landscape Materials			
Stockpiled landscape materials such as mulches and topsoil are contained and covered when not actively in use			
Erodible landscape material has not been applied 2 days before a forecasted rain event or during an event			
Erodible landscape materials are applied at quantities and rates in accordance with manufacturer recommendations			
Bagged erodible landscape materials are stored on pallets and covered			
Good Housekeeping for Air Deposition of Site Materials			
Good housekeeping measures are implemented onsite to control the air deposition of site materials and from site operations			
Non-Stormwater Management			
Non-Stormwater discharges are properly controlled			
Vehicles are washed in a manner to prevent non-stormwater discharges to surface waters or drainage systems			
Streets are cleaned in a manner to prevent unauthorized non-stormwater discharges to surface waters or drainage systems.			
Erosion Controls			
Wind erosion controls are effectively implemented			
Effective soil cover is provided for disturbed areas inactive (i.e., not scheduled to be disturbed for 14 days) as well as finished slopes, open space, utility backfill, and completed lots			
The use of plastic materials is limited in cases when a more sustainable, environmentally friendly alternative exists.			
Sediment Controls			
Perimeter controls are established and effective at controlling erosion and sediment discharges from the site			
Entrances and exits are stabilized to control erosion and sediment discharges from the site			
Sediment basins are properly maintained			
Linear sediment control along toe of slope, face of slope an at grade breaks (Risk Level 2 & 3 Only)			
Limit construction activity to and from site to entrances and exits that employ effective controls to prevent offsite tracking (Risk Level 2 & 3 Only)			

Ensure all storm, drain inlets and perimeter controls, runoff control BMPs and pollutants controls at entrances and exits are maintained and protected from activities the reduce their effectiveness (Risk Level 2 & 3 Only)			
Inspect all immediate access roads daily (Risk Level 2 & 3 Only)			
Run-On and Run-Off Controls			
Run-on to the site is effectively managed and directed away from all disturbed areas.			
Other			
Are the project SWPPP and BMP plan up to date, available on-site and being properly implemented?			

Part III. Descriptions of BMP Deficiencies

Deficiency	Repairs Implemented: Note - Repairs must begin within 72 hours of identification and, complete repairs as soon as possible.	
	Start Date	Action
1.		
2.		
3.		
4.		

Part IV. Additional Pre-Storm Observations. Note the presence or absence of floating and suspended materials, sheen, discoloration, turbidity, odors, and source(s) of pollutants(s).

	Yes, No, N/A
Do stormwater storage and containment areas have adequate freeboard? If no, complete Part III.	
Are drainage areas free of spills, leaks, or uncontrolled pollutant sources? If no, complete Part VII and describe below.	
Notes:	
Are stormwater storage and containment areas free of leaks? If no, complete Parts III and/or VII and describe below.	

Notes:	

Part V. Additional During Storm Observations. **If BMPs cannot be inspected during inclement weather, list the results of visual inspections at all relevant outfalls, discharge points, and downstream locations. Note odors or visible sheen on the surface of discharges. Complete Part VII (Corrective Actions) as needed.**	
Outfall, Discharge Point, or Other Downstream Location	
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description
Location	Description

Part VI. Additional Post-Storm Observations. Visually observe (inspect) stormwater discharges at all discharge locations within two business days (48 hours) after each qualifying rain event, and observe (inspect) the discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event producing precipitation of ½ inch or more at the time of discharge. Complete Part VII (Corrective Actions) as needed.	
Discharge Location, Storage or Containment Area	**Visual Observation**

Part VII. Additional Corrective Actions Required. Identify additional corrective actions not included with BMP Deficiencies (Part III) above. Note if SWPPP change is required.	
Required Actions	**Implementation Date**

STRUCTURAL BMP SPECIFICATIONS

Infiltration Basin TC-11



Design Considerations

- Soil for Infiltration
- Slope
- Aesthetics

Targeted Constituents

☑	Sediment	■
☑	Nutrients	■
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

Description

An infiltration basin is a shallow impoundment that is designed to infiltrate stormwater. Infiltration basins use the natural filtering ability of the soil to remove pollutants in stormwater runoff. Infiltration facilities store runoff until it gradually exfiltrates through the soil and eventually into the water table. This practice has high pollutant removal efficiency and can also help recharge groundwater, thus helping to maintain low flows in stream systems. Infiltration basins can be challenging to apply on many sites, however, because of soils requirements. In addition, some studies have shown relatively high failure rates compared with other management practices.

California Experience

Infiltration basins have a long history of use in California, especially in the Central Valley. Basins located in Fresno were among those initially evaluated in the National Urban Runoff Program and were found to be effective at reducing the volume of runoff, while posing little long-term threat to groundwater quality (EPA, 1983; Schroeder, 1995). Proper siting of these devices is crucial as underscored by the experience of Caltrans in siting two basins in Southern California. The basin with marginal separation from groundwater and soil permeability failed immediately and could never be rehabilitated.

Advantages

- Provides 100% reduction in the load discharged to surface waters.
- The principal benefit of infiltration basins is the approximation of pre-development hydrology during which a

significant portion of the average annual rainfall runoff is infiltrated and evaporated rather than flushed directly to creeks.

- If the water quality volume is adequately sized, infiltration basins can be useful for providing control of channel forming (erosion) and high frequency (generally less than the 2-year) flood events.

Limitations

- May not be appropriate for industrial sites or locations where spills may occur.
- Infiltration basins require a minimum soil infiltration rate of 0.5 inches/hour, not appropriate at sites with Hydrologic Soil Types C and D.
- If infiltration rates exceed 2.4 inches/hour, then the runoff should be fully treated prior to infiltration to protect groundwater quality.
- Not suitable on fill sites or steep slopes.
- Risk of groundwater contamination in very coarse soils.
- Upstream drainage area must be completely stabilized before construction.
- Difficult to restore functioning of infiltration basins once clogged.

Design and Sizing Guidelines

- Water quality volume determined by local requirements or sized so that 85% of the annual runoff volume is captured.
- Basin sized so that the entire water quality volume is infiltrated within 48 hours.
- Vegetation establishment on the basin floor may help reduce the clogging rate.

Construction/Inspection Considerations

- Before construction begins, stabilize the entire area draining to the facility. If impossible, place a diversion berm around the perimeter of the infiltration site to prevent sediment entrance during construction or remove the top 2 inches of soil after the site is stabililized. Stabilize the entire contributing drainage area, including the side slopes, before allowing any runoff to enter once construction is complete.
- Place excavated material such that it can not be washed back into the basin if a storm occurs during construction of the facility.
- Build the basin without driving heavy equipment over the infiltration surface. Any equipment driven on the surface should have extra-wide ("low pressure") tires. Prior to any construction, rope off the infiltration area to stop entrance by unwanted equipment.
- After final grading, till the infiltration surface deeply.
- Use appropriate erosion control seed mix for the specific project and location.

Performance

As water migrates through porous soil and rock, pollutant attenuation mechanisms include precipitation, sorption, physical filtration, and bacterial degradation. If functioning properly, this approach is presumed to have high removal efficiencies for particulate pollutants and moderate removal of soluble pollutants. Actual pollutant removal in the subsurface would be expected to vary depending upon site-specific soil types. This technology eliminates discharge to surface waters except for the very largest storms; consequently, complete removal of all stormwater constituents can be assumed.

There remain some concerns about the potential for groundwater contamination despite the findings of the NURP and Nightingale (1975; 1987a,b,c; 1989). For instance, a report by Pitt et al. (1994) highlighted the potential for groundwater contamination from intentional and unintentional stormwater infiltration. That report recommends that infiltration facilities not be sited in areas where high concentrations are present or where there is a potential for spills of toxic material. Conversely, Schroeder (1995) reported that there was no evidence of groundwater impacts from an infiltration basin serving a large industrial catchment in Fresno, CA.

Siting Criteria

The key element in siting infiltration basins is identifying sites with appropriate soil and hydrogeologic properties, which is critical for long term performance. In one study conducted in Prince George's County, Maryland (Galli, 1992), all of the infiltration basins investigated clogged within 2 years. It is believed that these failures were for the most part due to allowing infiltration at sites with rates of less than 0.5 in/hr, basing siting on soil type rather than field infiltration tests, and poor construction practices that resulted in soil compaction of the basin invert.

A study of 23 infiltration basins in the Pacific Northwest showed better long-term performance in an area with highly permeable soils (Hilding, 1996). In this study, few of the infiltration basins had failed after 10 years. Consequently, the following guidelines for identifying appropriate soil and subsurface conditions should be rigorously adhered to.

- Determine soil type (consider RCS soil type 'A, B or C' only) from mapping and consult USDA soil survey tables to review other parameters such as the amount of silt and clay, presence of a restrictive layer or seasonal high water table, and estimated permeability. The soil should not have more than 30% clay or more than 40% of clay and silt combined. Eliminate sites that are clearly unsuitable for infiltration.

- Groundwater separation should be at least 3 m from the basin invert to the measured ground water elevation. There is concern at the state and regional levels of the impact on groundwater quality from infiltrated runoff, especially when the separation between groundwater and the surface is small.

- Location away from buildings, slopes and highway pavement (greater than 6 m) and wells and bridge structures (greater than 30 m). Sites constructed of fill, having a base flow or with a slope greater than 15% should not be considered.

- Ensure that adequate head is available to operate flow splitter structures (to allow the basin to be offline) without ponding in the splitter structure or creating backwater upstream of the splitter.

- Base flow should not be present in the tributary watershed.

Secondary Screening Based on Site Geotechnical Investigation

- At least three in-hole conductivity tests shall be performed using USBR 7300-89 or Bouwer-Rice procedures (the latter if groundwater is encountered within the boring), two tests at different locations within the proposed basin and the third down gradient by no more than approximately 10 m. The tests shall measure permeability in the side slopes and the bed within a depth of 3 m of the invert.

- The minimum acceptable hydraulic conductivity as measured in any of the three required test holes is 13 mm/hr. If any test hole shows less than the minimum value, the site should be disqualified from further consideration.

- Exclude from consideration sites constructed in fill or partially in fill unless no silts or clays are present in the soil boring. Fill tends to be compacted, with clays in a dispersed rather than flocculated state, greatly reducing permeability.

- The geotechnical investigation should be such that a good understanding is gained as to how the stormwater runoff will move in the soil (horizontally or vertically) and if there are any geological conditions that could inhibit the movement of water.

Additional Design Guidelines

(1) Basin Sizing - The required water quality volume is determined by local regulations or sufficient to capture 85% of the annual runoff.

(2) Provide pretreatment if sediment loading is a maintenance concern for the basin.

(3) Include energy dissipation in the inlet design for the basins. Avoid designs that include a permanent pool to reduce opportunity for standing water and associated vector problems.

(4) Basin invert area should be determined by the equation:

$$A = \frac{WQV}{kt}$$

where A = Basin invert area (m^2)

WQV = water quality volume (m^3)

k = 0.5 times the lowest field-measured hydraulic conductivity (m/hr)

t = drawdown time (48 hr)

(5) The use of vertical piping, either for distribution or infiltration enhancement shall not be allowed to avoid device classification as a Class V injection well per 40 CFR146.5(e)(4).

Maintenance

Regular maintenance is critical to the successful operation of infiltration basins. Recommended operation and maintenance guidelines include:

- Inspections and maintenance to ensure that water infiltrates into the subsurface completely (recommended infiltration rate of 72 hours or less) and that vegetation is carefully managed to prevent creating mosquito and other vector habitats.
- Observe drain time for the design storm after completion or modification of the facility to confirm that the desired drain time has been obtained.
- Schedule semiannual inspections for beginning and end of the wet season to identify potential problems such as erosion of the basin side slopes and invert, standing water, trash and debris, and sediment accumulation.
- Remove accumulated trash and debris in the basin at the start and end of the wet season.
- Inspect for standing water at the end of the wet season.
- Trim vegetation at the beginning and end of the wet season to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and regrade when the accumulated sediment volume exceeds 10% of the basin.
- If erosion is occurring within the basin, revegetate immediately and stabilize with an erosion control mulch or mat until vegetation cover is established.
- To avoid reversing soil development, scarification or other disturbance should only be performed when there are actual signs of clogging, rather than on a routine basis. Always remove deposited sediments before scarification, and use a hand-guided rotary tiller, if possible, or a disc harrow pulled by a very light tractor.

Cost

Infiltration basins are relatively cost-effective practices because little infrastructure is needed when constructing them. One study estimated the total construction cost at about $2 per ft (adjusted for inflation) of storage for a 0.25-acre basin (SWRPC, 1991). As with other BMPs, these published cost estimates may deviate greatly from what might be incurred at a specific site. For instance, Caltrans spent about $18/ft^3 for the two infiltration basins constructed in southern California, each of which had a water quality volume of about 0.34 ac.-ft. Much of the higher cost can be attributed to changes in the storm drain system necessary to route the runoff to the basin locations.

Infiltration basins typically consume about 2 to 3% of the site draining to them, which is relatively small. Additional space may be required for buffer, landscaping, access road, and fencing. Maintenance costs are estimated at 5 to 10% of construction costs.

One cost concern associated with infiltration practices is the maintenance burden and longevity. If improperly maintained, infiltration basins have a high failure rate. Thus, it may be necessary to replace the basin with a different technology after a relatively short period of time.

References and Sources of Additional Information

Caltrans, 2002, BMP Retrofit Pilot Program Proposed Final Report, Rpt. CTSW-RT-01-050, California Dept. of Transportation, Sacramento, CA.

Galli, J. 1992. *Analysis of Urban BMP Performance and Longevity in Prince George's County, Maryland*. Metropolitan Washington Council of Governments, Washington, DC.

Hilding, K. 1996. Longevity of infiltration basins assessed in Puget Sound. *Watershed Protection Techniques* 1(3):124–125.

Maryland Department of the Environment (MDE). 2000. *Maryland Stormwater Design Manual*. http://www.mde.state.md.us/environment/wma/stormwatermanual. Accessed May 22, 2002.

Metzger, M. E., D. F. Messer, C. L. Beitia, C. M. Myers, and V. L. Kramer. 2002. The Dark Side Of Stormwater Runoff Management: Disease Vectors Associated With Structural BMPs. Stormwater 3(2): 24-39.

Nightingale, H.I., 1975, "Lead, Zinc, and Copper in Soils of Urban Storm-Runoff Retention Basins," American Water Works Assoc. Journal. Vol. 67, p. 443-446.

Nightingale, H.I., 1987a, "Water Quality beneath Urban Runoff Water Management Basins," Water Resources Bulletin, Vol. 23, p. 197-205.

Nightingale, H.I., 1987b, "Accumulation of As, Ni, Cu, and Pb in Retention and Recharge Basin Soils from Urban Runoff," Water Resources Bulletin, Vol. 23, p. 663-672.

Nightingale, H.I., 1987c, "Organic Pollutants in Soils of Retention/Recharge Basins Receiving Urban Runoff Water," Soil Science Vol. 148, pp. 39-45.

Nightingale, H.I., Harrison, D., and Salo, J.E., 1985, "An Evaluation Technique for Groundwater Quality Beneath Urban Runoff Retention and Percolation Basins," Ground Water Monitoring Review, Vol. 5, No. 1, pp. 43-50.

Oberts, G. 1994. Performance of Stormwater Ponds and Wetlands in Winter. *Watershed Protection Techniques* 1(2): 64–68.

Pitt, R., et al. 1994, *Potential Groundwater Contamination from Intentional and Nonintentional Stormwater Infiltration*, EPA/600/R-94/051, Risk Reduction Engineering Laboratory, U.S. EPA, Cincinnati, OH.

Schueler, T. 1987. *Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs*. Metropolitan Washington Council of Governments, Washington, DC.

Schroeder, R.A., 1995, *Potential For Chemical Transport Beneath a Storm-Runoff Recharge (Retention) Basin for an Industrial Catchment in Fresno, CA*, USGS Water-Resource Investigations Report 93-4140.

Southeastern Wisconsin Regional Planning Commission (SWRPC). 1991. *Costs of Urban Nonpoint Source Water Pollution Control Measures*. Southeastern Wisconsin Regional Planning Commission, Waukesha, WI.

U.S. EPA, 1983, *Results of the Nationwide Urban Runoff Program: Volume 1 – Final Report*, WH-554, Water Planning Division, Washington, DC.

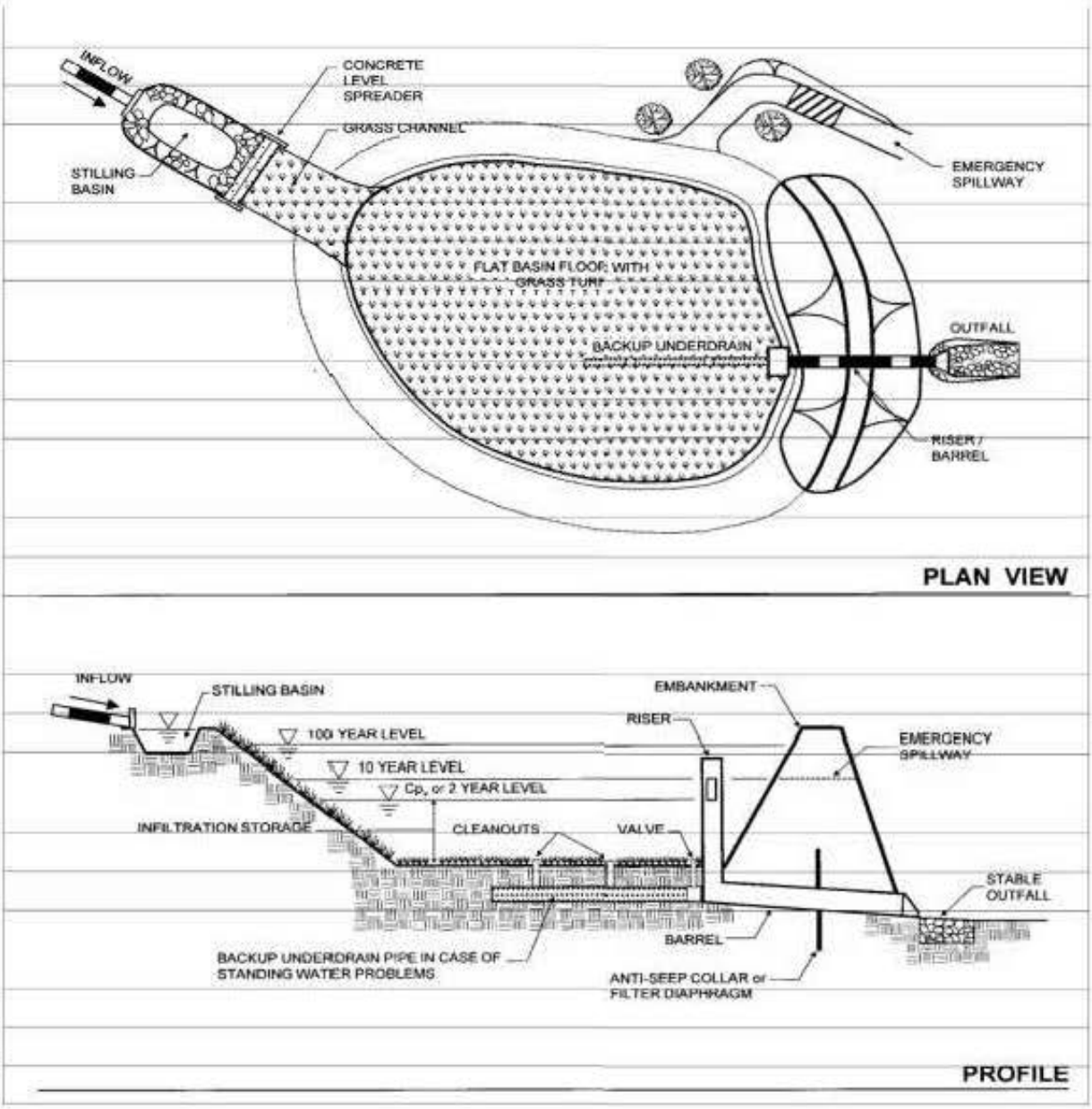
Watershed Management Institute (WMI). 1997. *Operation, Maintenance, and Management of Stormwater Management Systems*. Prepared for U.S. Environmental Protection Agency Office of Water, Washington, DC.

Information Resources

Center for Watershed Protection (CWP). 1997. *Stormwater BMP Design Supplement for Cold Climates*. Prepared for U.S. Environmental Protection Agency Office of Wetlands, Oceans and Watersheds. Washington, DC.

Ferguson, B.K., 1994. *Stormwater Infiltration*. CRC Press, Ann Arbor, MI.

USEPA. 1993. *Guidance to Specify Management Measures for Sources of Nonpoint Pollution in Coastal Waters*. EPA-840-B-92-002. U.S. Environmental Protection Agency, Office of Water, Washington, DC.


INFLOW
CONCRETE LEVEL SPREADER
GRASS CHANNEL
STILLING BASIN
EMERGENCY SPILLWAY
FLAT BASIN FLOOR WITH GRASS TURF
OUTFALL
BACKUP UNDERDRAIN
RISER / BARREL
PLAN VIEW
INFLOW
STILLING BASIN
EMBANKMENT
RISER
100 YEAR LEVEL
EMERGENCY SPILLWAY
10 YEAR LEVEL
Cp, or 2 YEAR LEVEL
INFILTRATION STORAGE
CLEANOUTS
VALVE
STABLE OUTFALL
BARREL
BACKUP UNDERDRAIN PIPE IN CASE OF STANDING WATER PROBLEMS
ANTI-SEEP COLLAR or FILTER DIAPHRAGM
PROFILE

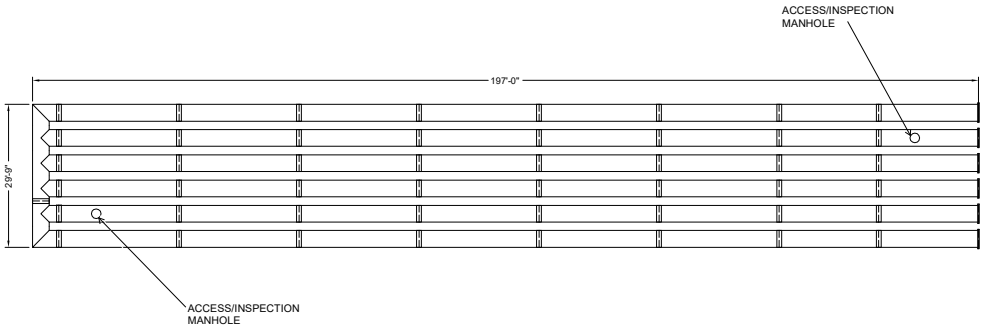
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 1,191 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 18,200 CF
- PIPE STORAGE VOLUME = 11,456 CF
- BACKFILL STORAGE VOLUME = 6,794 CF
- TOTAL STORAGE PROVIDED = 18,251 CF
- STONE VOID = 40 %

PIPE DETAILS
- DIAMETER = 42"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 21"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 6"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2 ⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN. QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

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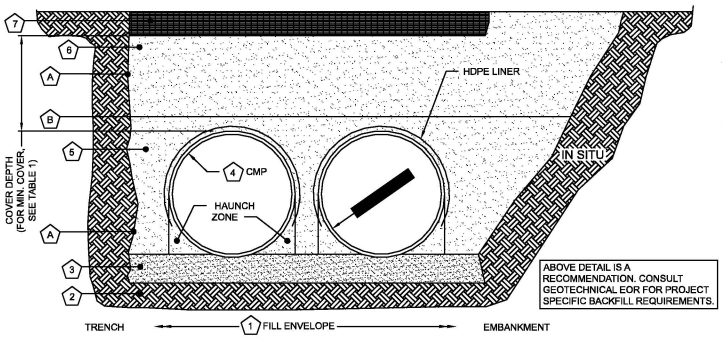
DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
INFILTRATION/RETENTION SYSTEM

70998	97148	1/14/2026
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TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	**IN
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:
- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.
- * APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

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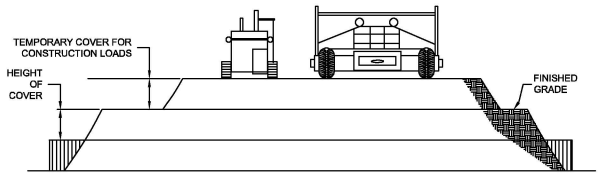
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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
INFILTRATION/RETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
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DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

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CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A-929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
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PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

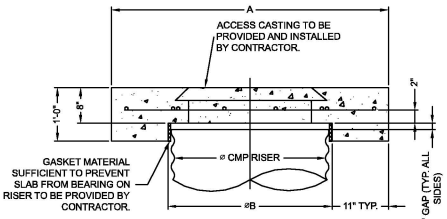
APPLICABLE POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

APPLICABLE HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

REQUIREMENTS
INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

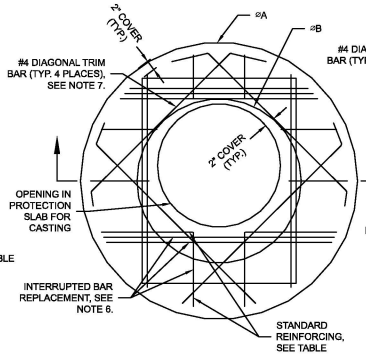
IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.



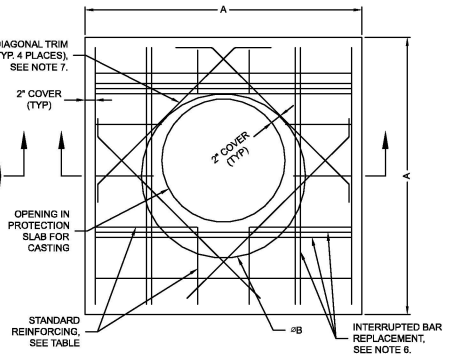
SECTION VIEW

REINFORCING TABLE				
⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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DYO97148 Conco Construction-Quarry
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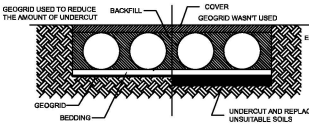
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

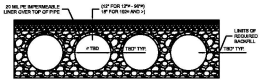
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

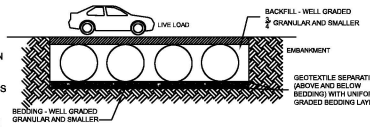
THE RESISTIVITY OF A PROJECT SITE MAY CHANGE OVER TIME DUE TO THE USE OF VARIOUS SALTING, DE-ICING, AND AGRICULTURAL AGENTS APPLIED ON OR NEAR THE AREA. TO MITIGATE THE POTENTIAL IMPACT OF THESE AGENTS, AN HDPE MEMBRANE LINER WILL BE INSTALLED ON THE CROWN OF EACH PIPE, CREATING AN IMPERMEABLE BARRIER. THIS MEASURE IS DESIGNED TO PROTECT THE SYSTEM FROM ENVIRONMENTAL CHANGES THAT COULD LEAD TO PREMATURE CORROSION AND REDUCE THE OVERALL SERVICE LIFE.



IN-SITU TRENCH WALL

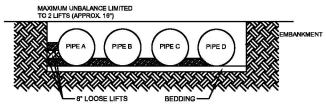
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



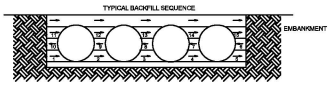
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

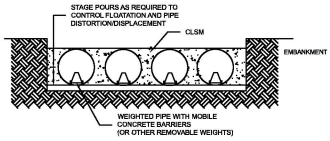


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

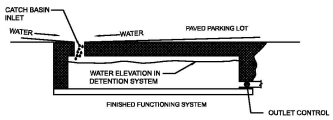


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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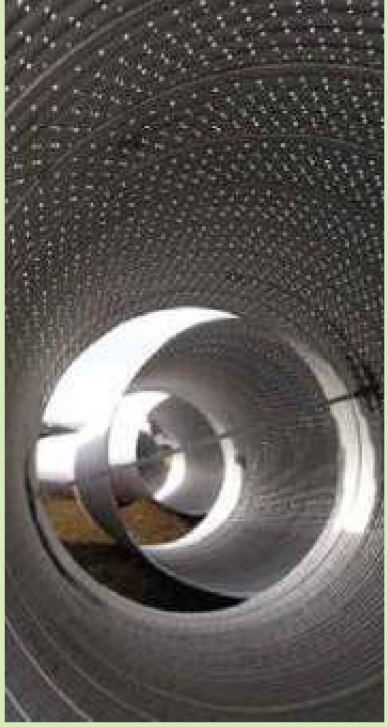
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800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
INFILTRATION/RETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
70998	97148	1/14/2026
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

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CONTECH®
ENGINEERED SOLUTIONS

Corrugated Metal Pipe Infiltration System

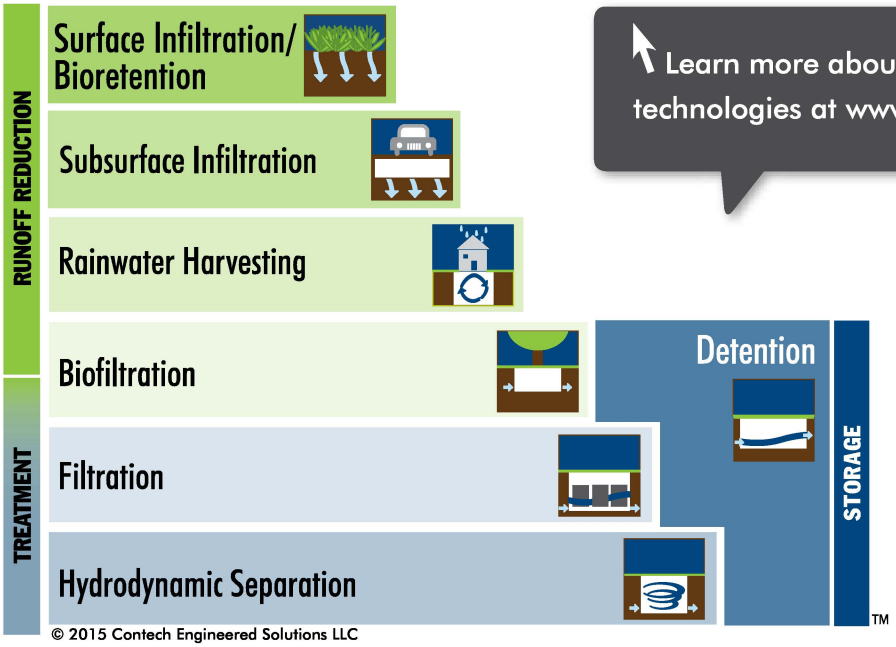
Solutions Guide



Stormwater Solutions from Contech

Selecting the Right Stormwater Solution Just Got Easier...

It's simple to choose the right stormwater solution to achieve your goals with the Contech Stormwater Solutions Staircase. First, select the runoff reduction practices that are most appropriate for your site, paying particular attention to pretreatment needs. If the entire design storm cannot be retained, select a treatment best management practice (BMP) for the balance. Finally, select a detention system to address any outstanding downstream erosion.



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Learn more about all of our stormwater technologies at www.ContechES.com/stormwater

DYODS

Design Your Own Detention or Infiltration System

The Contech Design Your Own Detention System (DYODS®) tool fully automates the layout process for stormwater detention and infiltration systems and produces CAD and PDF files that can be used for creating plans and specs, and for estimating total installed costs.



To use the *Design Your Own Detention or Infiltration System* tool, visit: www.ContechES.com/dyods

Subsurface Infiltration as a Stormwater Management Strategy

The only sure way to eliminate stormwater pollution is to eliminate stormwater runoff. In recognition of this fact, Green Infrastructure and Low Impact Development based stormwater management regulations prioritizing runoff reduction have proliferated throughout the United States.

Where site conditions allow, infiltration is typically the most cost effective and reliable runoff reduction approach. In urban environments where there are competing demands for land, subsurface infiltration can provide many of the benefits of landscape based systems but without requiring dedicated land area. Infiltration systems are commonly comprised of a pretreatment component designed to remove sediment, trash, and oil, followed by plastic, metal or concrete storage units surrounded by permeable stone creating a high voids storage gallery. Infiltration systems are typically designed to support vehicular loading and to withstand lateral pressures from surrounding soil that allows the overlying land to be used for virtually any non-building application.

Subsurface infiltration meets the objectives of LID by reducing runoff with the added benefit of saving land space in urban environments.



LID benefits include runoff volume reduction, peak flow control, ground water recharge, and water quality improvement.



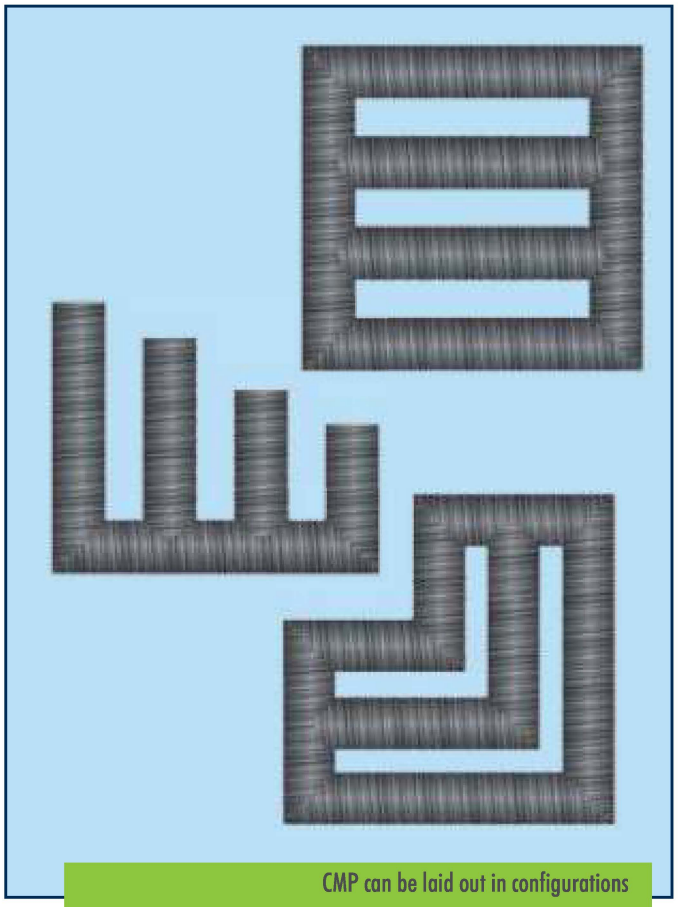
CMP infiltration is used at Pitzer College in Claremont, California.

CMP – the "Go To" Material for Subsurface Infiltration

The purpose of the storage vessel is to hold stormwater runoff underground while allowing it to infiltrate the surrounding soil. For the majority of applications, corrugated metal pipe (CMP) is the "go to" material for subsurface infiltration.

- 75+ year service life guidance for certain materials/coatings in recommended environments.* Please refer to the Corrugated Metal Pipe Detention Design Guide for additional information.
- Various pipe coatings and materials are available to accommodate site-specific needs: Aluminized Steel Type 2 (ALT2), Galvanized, CORLIX® Aluminum, and Polymer Coated.
- Wide range of gages, corrugations, and shapes, in diameters 12" – 144".
- Pipe can be fully or partially perforated for infiltration, retention, or groundwater recharge applications.
- Custom access risers and manifolds provide direct access for maintenance.
- Outlet control devices can be incorporated within the system, eliminating the need for a separate structure.
- Customizable - a variety of fittings allow CMP to match most layout configurations.
- May be designed for heavy loading and high maximum cover.
- Contributes to LEED points.
- Available locally; quick turnaround time.
- The most economical installed solution.

With its low cost, a wide variety of diameters, layout configurations, and materials, no other material can match CMP's flexibility and versatility.



CMP can be laid out in configurations not achievable with other materials.



A wide range of CMP diameters and coatings are available to meet site specific needs.

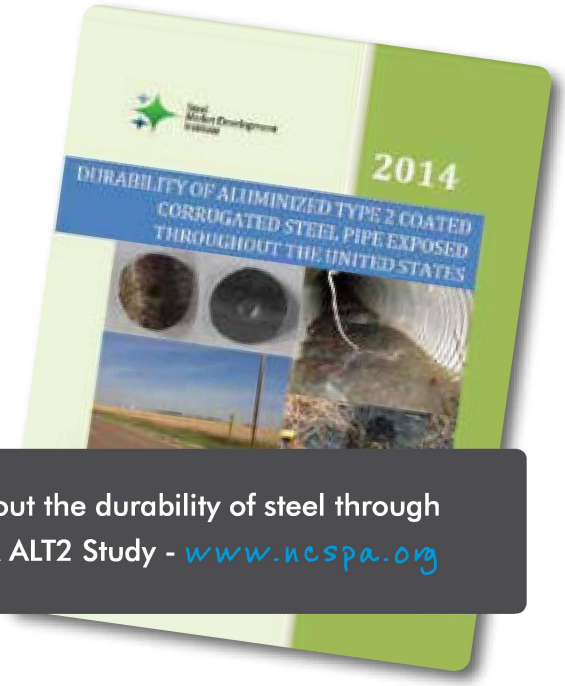
* Service life guidance provided by National Corrugated Steel Pipe Association (NCSPA) and/or AK Steel Corporation. See NCSPA.org website or consult your engineer of record for additional information on service life, recommended environments and field studies on various materials and coatings. Corrosive environments, such as seawater and road/de-icing salt infiltration, and other environments with pH and resistivity outside of the recommended range may cause premature corrosion and reduce actual service life. Because site conditions vary, Contech does not guaranty or warrant service life guidance for materials and coatings.

Addressing the Question of Longevity

Some engineers are hesitant to use corrugated metal pipe (CMP) for infiltration because they have heard about CMP drainage culverts that have corroded due to abrasion. Factors affecting longevity differ between culvert and infiltration applications. Culverts experience high velocity flows carrying abrasive sediment, which can wear off galvanized coatings used in older CMP culverts. Infiltration systems are designed for storage rather than conveyance, so velocity and abrasive forces are minimized. In addition, improved CMP coatings, such as Aluminized Type 2 (ALT2), are more abrasion resistant and have demonstrated superior in-ground performance against abrasion in long-term durability studies. Field studies also have indicated that ALT2 coating may extend service life in wider pH and resistivity ranges than galvanized coatings. Confirming and maintaining recommended environmental conditions helps ensure system longevity projected by the long term studies. Finally, properly designed infiltration systems include pretreatment, flow control and a stone backfill envelope that can reduce exposure to abrasion.



CMP has a proven service life



Learn more about the durability of steel through the recent NCSPA ALT2 Study - www.ncspa.org

- National Corrugated Steel Pipe Association (NCSPA) service life guidance of 75+ years for certain materials/coatings in recommended environments.
- CMP infiltration systems can be designed to meet HS-20 or greater load requirements with proper depths of cover.
- With low flows, CMP infiltration systems have little susceptibility to abrasion inside the pipe that holds stormwater runoff.
- Various pipe coatings and materials are available to accommodate site-specific needs: Aluminized Steel Type 2 (ALT2), Galvanized, CORLIX® Aluminum, and Polymer Coated.
- CMP infiltration systems are to be surrounded by clean crushed rock to provide increased storage capacity and reduce contact with native soils. The entire system may be wrapped with fabric or liner on the sides and top to help further reduce contact with native soils.
- CMP infiltration systems may be used in wide range of recommended environments. AK Steel Corporation's field studies and technical guidance indicate 75 year service life guidance for 16 gage ALT2 for pH of 5-9 and resistivity greater than 1,500 ohm-cm and 100 year service life guidance for 16 gage ALT2 for pH of 6-8 and resistivity greater than 5,000 ohm-cm.
- Corrosive environments, such as seawater and road/de-icing salt infiltration, acidic minewater, and sanitary sewage, and other environments with pH and resistivity outside of the recommended range may cause premature corrosion and reduce actual service life.
- Infiltration systems are to be inspected and maintained in accordance with Contech's guidelines. See Corrugated Metal Pipe Detention Design Guide for additional information on CMP infiltration systems.

Learn more at www.ContechES.com/cmp-detention

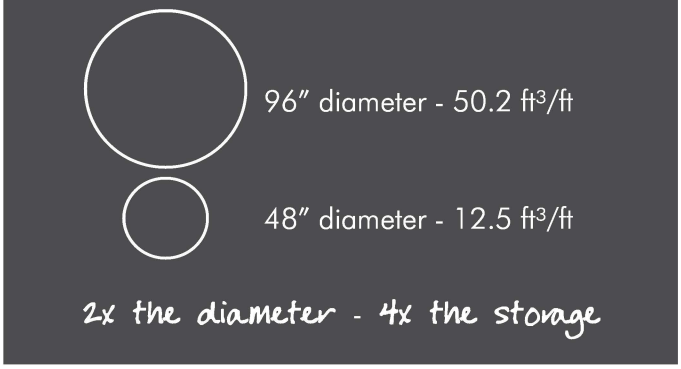
Maximizing Vertical Space: Every Inch Counts

One of the most overlooked advantages of CMP is its ability to maximize vertical storage space.

Increasing the depth of a CMP infiltration system allows for more water storage in the same footprint. For example, doubling the diameter of pipe yields four times as much storage volume in the pipe. This provides a significant cost savings per cubic foot of storage. In addition, more vertical storage space means a smaller footprint, less excavation, and lower project costs.

Contech's Corrugated Metal Pipe Detention systems maximize vertical storage space.





Sizing

Round Pipe – CMP → 6-in to 144-in

Diameter (inches)	Volume (ft³/ft)	Min. Cover Height	Diameter (inches)	Volume (ft³/ft)	Min. Cover Height
12	.78	12″	78	33.2	12″
15	1.22	12″	84	38.5	12″
18	1.76	12″	90	44.2	12″
21	2.40	12″	96	50.3	12″
24	3.14	12″	102	56.8	18″
30	4.9	12″	108	63.6	18″
36	7.1	12″	114	70.9	18″
42	9.6	12″	120	78.5	18″
48	12.6	12″	126	86.6	18″
54	15.9	12″	132	95.0	18″
60	19.6	12″	138	103.9	18″
66	23.8	12″	144	113.1	18″
72	28.3	12″			

The Need for Effective Pretreatment

Infiltration systems have multiple components, and one of the most important is pretreatment. The purpose of a pretreatment device is to prolong the life of the infiltration system by removing debris and sediment that can collect on the invert and within the stone backfill voids. Pretreatment will maintain the efficiency of an infiltration system as well as extend the life cycle, therefore preventing a premature replacement. Pretreatment also offers these additional benefits:

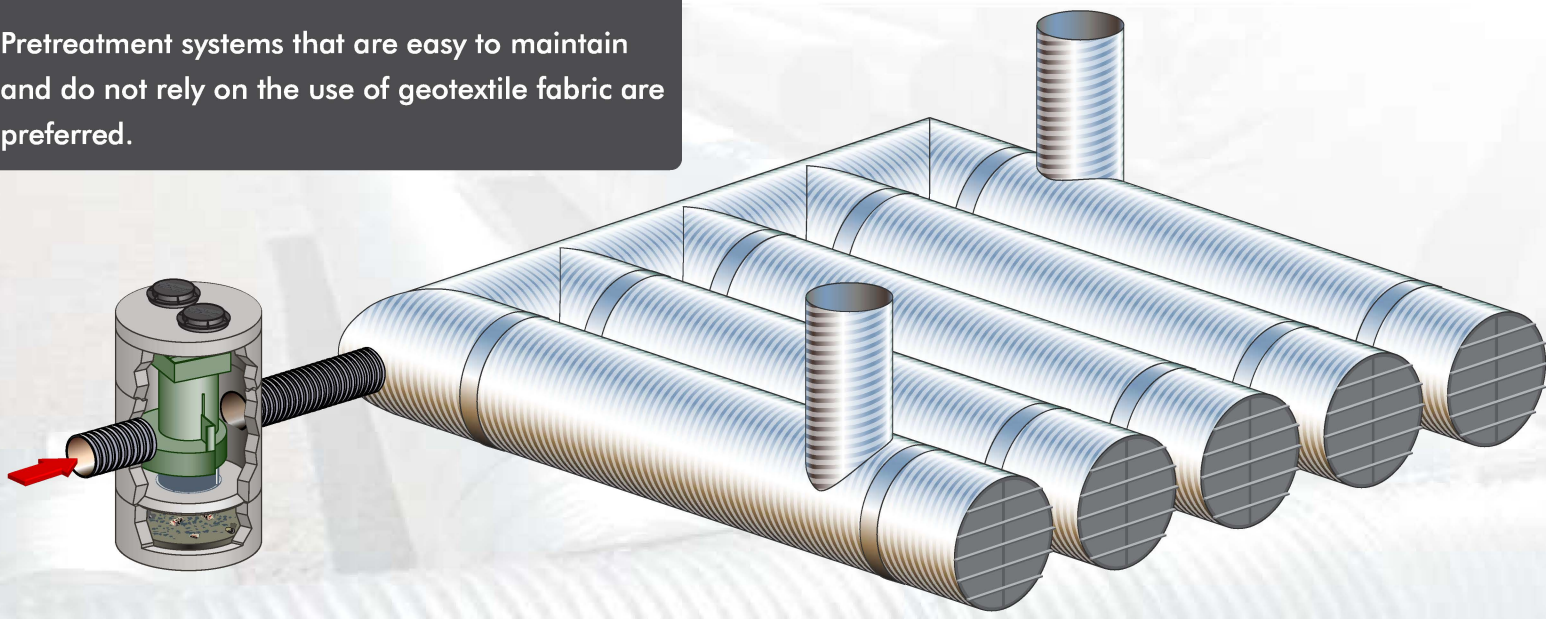
- Easier to clean and maintain compared to the infiltration system itself.
- Cost savings due to the extended service life of the system.
- Removing trash and debris protects downstream outlet control structures from clogging.

Pretreatment Design Considerations

When choosing a pretreatment system, it is important to consider the following:

- Downstream outlet control structures may require protection from a pretreatment device that screens trash and debris.
- Pretreatment system selection depends on pollutant targets. Trash, debris, and larger particles can be removed with hydrodynamic separators. Removing high percentages of fine particles and associated heavy metals and nutrients requires filtration.
- Reduced long term maintenance or replacement cost of the infiltration system can help justify pretreatment construction costs.
- Inlet and pipe layout will influence the number and type of pretreatment systems used. A combination of different systems may be appropriate for the various inlet locations and flows.

Pretreatment systems that are easy to maintain and do not rely on the use of geotextile fabric are preferred.



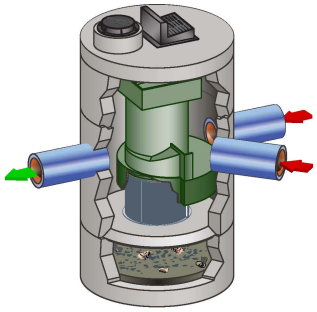
Learn more at www.ContechES.com/cmp-detention

7

Pretreatment Options

Contech offers a number of pretreatment options, all of which will extend the life of subsurface infiltration systems and improve water quality. The type of system chosen will depend on a number of factors including footprint, soil conditions, local regulations, and the desired level of pretreatment.

CDS provides direct access to cleaning, and the built-in high flow bypass weir eliminates the need for a separate bypass structure.



Hydrodynamic Separation

Hydrodynamic Separation (HDS) provides a basic level of pretreatment by capturing and retaining trash and debris, sediment, and oil from stormwater runoff.

CDS®

The CDS uses a combination of swirl concentration and indirect screening and is the only non-blocking screening technology available in an HDS system.



Filtration

Filtration provides a higher level of pretreatment and improved water quality by removing trash and debris, oil, fine solids, and dissolved pollutants such as metals, hydrocarbons, and nutrients.

Filterra® Bioretention System

Filterra is an engineered bioretention system that has been optimized for high volume/flow treatment and high pollutant removal.



The Stormwater Management StormFilter®

The StormFilter system is comprised of a structure that houses rechargeable, media-filled cartridges. The media can be customized to target site-specific pollutants.



Jellyfish® Filter

The Jellyfish filter uses membrane filtration in a compact footprint to remove a high level and a wide variety of stormwater pollutants such as fine particulates, oil, trash and debris, metals, and nutrients.

Alternative Materials for Subsurface Infiltration

There may be instances where alternative materials are needed for subsurface infiltration due to site specific needs.

Plastic Chambers

Plastic chambers are best suited to shallow depth applications; minimum cover is 18 inches, and maximum cover is 96 inches. Some benefits of chambers are:

- Chambers may be beneficial for sites with limited vertical storage.
- Lightweight and installed by hand.
- Heavy equipment is not required to set units into place.
- Centralized stocking locations for short lead times.

Concrete Structures/Vaults

Some concrete structures and vaults are best suited for high loading applications such as railroads or airports. Concrete units are also ideal in corrosive environments or areas with high salinity. Some benefits of concrete structures are:

- Wide range of spans and heights.
- Greater underground infiltration storage in a smaller footprint.
- Ample and easy maintenance access.
- Fast installation.



Project Profiles: CMP Infiltration Systems in Action

Edie and Lew Wasserman Building, UCLA

Westwood, California

- The new six-story, 100,000 square foot Edie and Lew Wasserman Building was built on a very dense site that needed to meet sustainability requirements.
- The design needed to maximize infiltration volume, match existing inverts, and work around existing utilities.
- The stormwater management systems included a CDS pretreatment system and a CMP infiltration system using 57' of 72" perforated CMP.
- Perforated CMP was selected to avoid utilities, minimize excavation, meet the City of LA LID requirements, contribute to the building's LEED certification, and to provide space for the buildings "outdoor room" and gardens.





Creative Office Space

El Segundo, California

- A stormwater infiltration solution was needed for a new group of office buildings.
- The owner wanted to maximize the use of the parking area in the urban setting.
- The site had a tight footprint and multiple utility constraints, requiring the design of five separate systems.
- A total of 860 LF of perforated CMP was installed providing of 25,265 CF of storage.
- Perforated CMP was selected for its design flexibility, cost effectiveness, and ease of installation.

City Center Regional Stormwater Facility

Mountlake Terrace, Washington

- The city of Mountlake Terrace, Washington needed a new stormwater retention facility to provide stormwater treatment and downstream flood control.
- There was limited footprint for 80,000 CF of runoff, and the system was required to be very deep, with about 15' of cover.
- Engineers designed a system consisting of a CDS pretreatment system in front of 800 linear feet of 120" diameter, perforated, aluminized type 2 CMP that allows the runoff to slowly infiltrate the surrounding soil.
- Perforated CMP was selected for its ability to accommodate the deep bury, the relatively small footprint, and cost effectiveness.



The Right Partner Can Make All the Difference

Regardless of your project's objectives and constraints, our team of stormwater design engineers, regulatory managers, and local stormwater consultants are here to provide you with expert advice and assistance. If your goal is to eliminate or detain runoff, you can rely on Contech for a wide range of subsurface infiltration, detention, and rainwater harvesting solutions. If treatment is needed, our landscape-based biofiltration or subsurface filtration designs can fit into virtually any site and can be tailored to address specific pollutants.

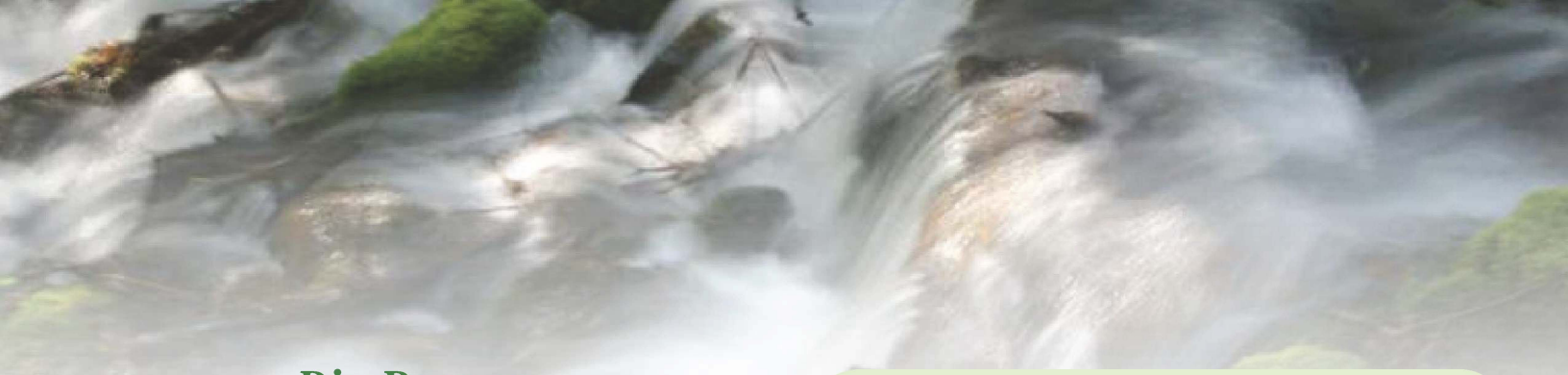
At every stage of your project, count on Contech to provide engineering services including:

- Regulatory guidance and permitting assistance
- Preliminary standard details and/or site specific final CAD drawings and specifications
- Low Impact Development design assistance
- Engineering calculations for hydraulics/hydrology, rainwater harvesting, and detention/retention
- Online "Design Your Own" tools
- Review of preliminary site design, feasibility screening, and layout assistance
- Value engineering – cost estimates and options analysis
- Pre-construction support, project scheduling, and contractor coordination
- Installation and construction support
- Maintenance support:
  - » Guidance manuals
  - » Demonstrations
  - » Qualified contractor identification

The result: an efficient design process, the right product, greater land space savings, and faster permitting. The entire Contech stormwater team welcomes the opportunity to work with you on your stormwater projects.

To get started, please visit www.conteches.com/localresources or call us at 800-338-1122.





Dig Deeper

Find all the information you need at www.ContechES.com, including field and laboratory test results, approvals, brochures, design guides, standard details, and specifications within the product section of our site.

Connect with Us

We're here to make your job easier – and that includes being able to get in touch with us when you need to. Go to www.ContechES.com/ConnectwithContech.

While you're there, be sure to check out our upcoming seminar schedule or request an in-house technical presentation.

Start a Project

If you are ready to begin a project, contact your local representative to get started. Or you can check out our design toolbox for all our online resources at www.ContechES.com/designtoolbox.

Links to Stormwater Tools:

To use the Land Value Calculator, visit:
www.ContechES.com/lvc
(Look under the Stormwater Management section to download the Land Value Calculator)

To use the Design Your Own Detention System tool, visit:
www.ContechES.com/dyods

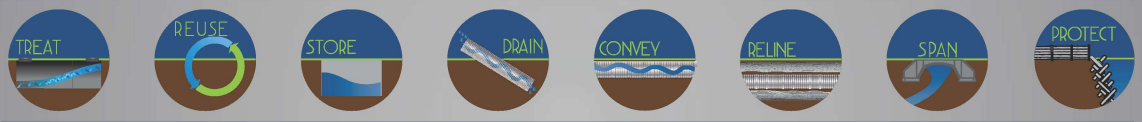
To use the Design Your Own Hydrodynamic Separator tool, visit: www.ContechES.com/dyohds

To use the Rainwater Harvesting Runoff Reduction Calculator tool, visit: www.ContechES.com/rwh-calculator

To use the LID Site Planner , visit:
www.ContechES.com/LIDsiteplanner

CONTECH® ENGINEERED SOLUTIONS

COMPLETE SITE SOLUTIONS



Stormwater Solutions
Helping to satisfy stormwater management requirements on land development projects
- Stormwater Treatment
- Detention/Infiltration
- Rainwater Harvesting
- Biofiltration/Bioretention

Pipe Solutions
Meeting project needs for durability, hydraulics, corrosion resistance, and stiffness
- Corrugated Metal Pipe (CMP)
- Steel Reinforced Polyethylene (SRPE)
- High Density Polyethylene (HDPE)
- Polyvinyl Chloride (PVC)

Structures Solutions
Providing innovative options and support for crossings, culverts, and bridges
- Plate, Precast & Truss bridges
- Hard Armor
- Retaining Walls
- Tunnel Liner Plate

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Get Social With Us!

CMP Infiltration Bro 5M 2/17

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FSC

Contech® CMP Detention Inspection and Maintenance Guide

Underground stormwater detention and infiltration systems must be inspected and maintained at regular intervals for purposes of performance and longevity.

Inspection

Inspection is the key to effective maintenance of CMP detention systems and is easily performed. Contech recommends ongoing, annual inspections. Sites with high trash load or small outlet control orifices may need more frequent inspections. The rate at which the system collects pollutants will depend more on-site specific activities rather than the size or configuration of the system.

Inspections should be performed more often in equipment washdown areas, in climates where sanding and/or salting operations take place, and in other various instances in which one would expect higher accumulations of sediment or abrasive/corrosive conditions. A record of each inspection is to be maintained for the life of the system.

Maintenance

CMP detention systems should be cleaned when an inspection reveals accumulated sediment or trash is clogging the discharge orifice. Accumulated sediment and trash can typically be evacuated through the manhole over the outlet orifice. If maintenance is not performed as recommended, sediment and trash may accumulate in front of the outlet orifice. Manhole covers should be securely seated following cleaning activities. Contech suggests that all systems be designed with an access/inspection manhole situated at or near the inlet and the outlet orifice. Should it be necessary to get inside the system to perform maintenance activities, all appropriate precautions regarding confined space entry and OSHA regulations should be followed.

Annual inspections are best practice for all underground systems. During this inspection if evidence of salting/de-icing agents is observed within the system, it is best practice for the system to be rinsed, including above the spring line soon after the spring thaw as part of the maintenance program for the system.

Maintaining an underground detention or infiltration system is easiest when there is no flow entering the system. For this reason, it is a good idea to schedule the cleanout during dry weather.

The foregoing inspection and maintenance efforts help ensure underground pipe systems used for stormwater storage continue to function as intended by identifying recommended regular inspection and maintenance practices. Inspection and maintenance related to the structural integrity of the pipe or the soundness of pipe joint connections is beyond the scope of this guide.



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CMP MAINTENANCE GUIDE 10/19 PDF

CONTECH® CMP DETENTION SYSTEMS

CONTECH® ENGINEERED SOLUTIONS

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Fueling Areas SD-30



Photo Credit: Geoff Brosseau

Design Objectives

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

Description

Fueling areas have the potential to contribute oil and grease, solvents, car battery acid, coolant and gasoline to the stormwater conveyance system. Spills at vehicle and equipment fueling areas can be a significant source of pollution because fuels contain toxic materials and heavy metals that are not easily removed by stormwater treatment devices.

Approach

Project plans must be developed for cleaning near fuel dispensers, emergency spill cleanup, containment, and leak prevention.

Suitable Applications

Appropriate applications include commercial, industrial, and any other areas planned to have fuel dispensing equipment, including retail gasoline outlets, automotive repair shops, and major non-retail dispensing areas.

Design Considerations

Design requirements for fueling areas are governed by Building and Fire Codes and by current local agency ordinances and zoning requirements. Design requirements described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements.

Designing New Installations

Covering

Fuel dispensing areas should provide an overhanging roof structure or canopy. The cover's minimum dimensions must be equal to or greater than the area within the grade break. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area should drain to the project's treatment control BMP(s) prior to discharging to the stormwater conveyance system. Note - If fueling large equipment or vehicles that would prohibit the use of covers or roofs, the fueling island should be designed to sufficiently accommodate the larger vehicles and equipment and to prevent stormwater run-on and runoff. Grade to direct stormwater to a dead-end sump.

Surfacing

Fuel dispensing areas should be paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete should be prohibited. Use asphalt sealant to protect asphalt paved areas surrounding the fueling area. This provision may be made to sites that have pre-existing asphalt surfaces.

The concrete fuel dispensing area should be extended a minimum of 6.5 ft from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 ft, whichever is less.

Grading/Contouring

Dispensing areas should have an appropriate slope to prevent ponding, and be separated from the rest of the site by a grade break that prevents run-on of urban runoff. (Slope is required to be 2 to 4% in some jurisdictions' stormwater management and mitigation plans.)

Fueling areas should be graded to drain toward a dead-end sump. Runoff from downspouts/roofs should be directed away from fueling areas. Do not locate storm drains in the immediate vicinity of the fueling area.

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

- In the case of an emergency, provide storm drain seals, such as isolation valves, drain plugs, or drain covers, to prevent spills or contaminated stormwater from entering the stormwater conveyance system.

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.

Spill-Chek Environmental Products & Services

We do not inherit the earth from our ancestors, we borrow it from our children

Hydrocarbon Flow Filter









Product Description:
The Hydrocarbon Flow Filter (HFF), aka oil stop valve, is a versatile device that filters and processes water removing hydrocarbons to a non-detectable level. The HFF is



Hydrocarbon Flow Filter



Pad Mount Install



constructed from a non-woven, geotextile fabric in combination with a proprietary blend of USDA food grade polymers. The granules are capable of encapsulating and capturing all organic hydrocarbons such as sheen, gasoline, diesel, refined oils and more. The HFF allows water to flow through as it removes and captures hydrocarbons including most volatile organic compounds. In the event of a major release, the HFF automatically shuts off the flow to contain the hydrocarbon providing a cost-effective and environmentally friendly solution for your secondary containment needs. Each HFF is designed for the site specific application.

Product Applications:

All secondary containment units have to incorporate some type of drainage system to evacuate water. The HFF is ideal for this application as it filters and processes water removing the hydrocarbons to a non-detectable level. HFF is currently being used in the following applications

- Storm drain inserts
- Electrical substation
- Storm water run-offs
- Bulk storage tank farms
- Retention Pond out-flows
- Oil-water separator out-falls

Product Specifications:

Each HFF is capable of processing water at the pre-determined rate specified by the customer and will remove all organic hydrocarbons from the water.

Product Benefits:

- Filters all organic hydrocarbons to <5ppm; most will be at non-detectable levels
- Removes sheen, gasoline, diesel, refined oils, and the other volatile organic compounds
- Low maintenance required when usedwit a reusable pre-filter to catch debris, silt, dirt, paper etc.
- Will not drip or leach out.

Steady State Water Flow Rates (Gallons/Minute)

Device		Vertical Mount Flow Rate at Water Head			Horizontal Mount Flow Rate at Water Head			
C.I.Agent® 2"	x 1.3	12" 3.7	Average Flow		1.0	5.1	8.0	0.2
C.I.Agent® 4"	x 5.0	12" 11.0	Average Flow		4.0	9.0	18.0	1.1
C.I.Agent® 4"	x 9.0	24" 12.0	Average Flow		4.2	12.4	23.0	2.0

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COR
ENFORM
ISN Collect. Verify. Connect.
ISO 9001:2008 REGISTERED FIRM

Oldcastle Precast®

FLOGARD+PLUS®
CATCH BASIN INSERT FILTER

Inspection and Maintenance Guide

DRAINAGE PROTECTION SYSTEMS
DPS
A division of Oldcastle Precast

Stormwater

SCOPE:

Federal, State and Local Clean Water Act regulations and those of insurance carriers require that stormwater filtration systems be maintained and serviced on a recurring basis. The intent of the regulations is to ensure that the systems, on a continuing basis, efficiently remove pollutants from stormwater runoff thereby preventing pollution of the nation's water resources. These specifications apply to the FloGard+Plus® Catch Basin Insert Filter.

RECOMMENDED FREQUENCY OF SERVICE:

Drainage Protection Systems (DPS) recommends that installed FloGard+Plus Catch Basin Insert Filters be serviced on a recurring basis. Ultimately, the frequency depends on the amount of runoff, pollutant loading and interference from debris (leaves, vegetation, cans, paper, etc.); however, it is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. DPS technicians are available to do an onsite evaluation, upon request.

RECOMMENDED TIMING OF SERVICE:

DPS guidelines for the timing of service are as follows:

1. For areas with a definite rainy season: Prior to, during and following the rainy season.
2. For areas subject to year-round rainfall: On a recurring basis (at least three times per year).
3. For areas with winter snow and summer rain: Prior to and just after the snow season and during the summer rain season.
4. For installed devices not subject to the elements (washracks, parking garages, etc.): On a recurring basis (no less than three times per year).

SERVICE PROCEDURES:

1. The catch basin grate shall be removed and set to one side. The catch basin shall be visually inspected for defects and possible illegal dumping. If illegal dumping has occurred, the proper authorities and property owner representative shall be notified as soon as practicable.
2. Using an industrial vacuum, the collected materials shall be removed from the liner. (Note: DPS uses a truck-mounted vacuum for servicing FloGard+Plus catch basin inserts.)
3. When all of the collected materials have been removed, the filter medium pouches shall be removed by unsnapping the tether from the D-ring and set to one side. The filter liner, gaskets, stainless steel frame and mounting brackets, etc., shall be inspected for continued serviceability. Minor damage or defects found shall be corrected on-the-spot and a notation made on the Maintenance Record. More extensive deficiencies that affect the efficiency of the filter (torn liner, etc.), if approved by the customer representative, will be corrected and an invoice submitted to the representative along with the Maintenance Record.
4. The filter medium pouches shall be inspected for defects and continued serviceability and replaced as necessary and the pouch tethers re-attached to the liner's D-ring. See below.
5. The grate shall be replaced.

REPLACEMENT AND DISPOSAL OF EXPOSED FILTER MEDIUM AND COLLECTED DEBRIS

The frequency of filter medium exchange will be in accordance with the existing DPS-Customer Maintenance Contract. DPS recommends that the medium be changed at least once per year. During the appropriate service, or if so determined by the service technician during a non-scheduled service, the filter medium will be replaced with new material. Once the exposed pouches and debris have been removed, DPS has possession and must dispose of it in accordance with local, state and federal agency requirements.

DPS also has the capability of servicing all manner of storm drain filters, catch basin inserts and catch basins without inserts, underground oil/water separators, stormwater interceptors and other such devices. All DPS personnel are highly qualified technicians and are confined space trained and certified. Call us at (888) 950-8826 for further information and assistance.

FLOGARD+PLUS®
CATCH BASIN INSERT FILTER

OUR MARKETS



BUILDING STRUCTURES



COMMUNICATIONS



WATER



ENERGY



TRANSPORTATION

Educational Material

Pick up after your pooch to curb pollution.



Maybe you weren't aware, but dog waste left on the ground gets into storm drains, polluting rivers, lakes and beaches.

The bacteria and risk of disease threatens the health of our kids and communities. Wherever you live in San Bernardino County, this pollution is a problem. The answer? Pick up after your dog, to help prevent pollution and protect our health. It's in your hands.

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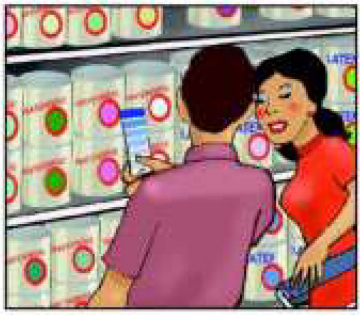
San Bernardino County
STORMWATER PROGRAM

♻ Printed on recycled paper

STORMWATER Pollution Prevention

PAINTING

Paints, solvents, adhesives and other toxic chemicals used in painting often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect our health.



Water-Based Paints
Use water-based paints whenever possible. They are less toxic than oil-based paints and easier to clean up. Look for products labeled "latex" or "cleans with water."



Paint Removal
Sweep up paint stripping residue, chips and dust instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Painting Cleanup
Never clean brushes or rinse paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which can be reused by putting it in a jar to settle out the paint particles and then pouring off the clear liquid for future use. Wrap dried paint residue in newspaper and dispose of it in the trash.

Exterior Paint Removal
When stripping or cleaning building exteriors with high-pressure water, block nearby storm drains and divert washwater onto a designated dirt area. Ask your local wastewater treatment authority if you can collect building cleaning water and discharge it to the sewer.



Recycling Paint
Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.

To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

PUBLIC SERVICES
CITY OF FONTANA

STORMWATER Pollution Prevention

HOME REPAIR & REMODELING

Paints, solvents, adhesives and other toxic substances used in home repair and remodeling often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



Construction Projects

Keep construction debris away from the street, gutter and storm drains. Schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of soil, sand or gravel, protected from rain, wind and runoff. Prevent erosion by planting fast-growing annual and perennial grass, which can shield and bind soil.

Recycle Household Hazardous Waste

Household cleaners, paint and other home improvement products like wallpaper and tile adhesives are too toxic to trash. Recycle them instead, at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Landscaping & Gardening

Avoid applying fertilizers or pesticide near curbs and driveways, and store covered, protected from rain, wind and runoff. Try using organic or non-toxic alternatives. Reduce runoff and lower your water bill by using drip irrigation, soaker hoses or micro-spray systems. Recycle leaves instead of blowing, sweeping or raking them into the street, gutter or storm drain.

Paint Removal

Paint stripping residue, chips and dust from marine paints and paints containing lead or tributyl tin are hazardous wastes. Sweep them up instead of hosing into the street and dispose of them safely at a household hazardous waste collection facility.



Painting Cleanup

Avoid cleaning brushes or rinsing paint containers in the street, gutter or near a storm drain. Clean water-based paints in the sink. Clean oil-based paints with thinner, which you can filter and reuse. Recycle leftover paint at a household hazardous waste collection facility, save it for touch ups or give it to someone who can use it, like a theatre group, school, city or community organization.



Concrete and Masonry

Store bags of cement and plaster away from gutters and storm drains, and cover them to protect against rain, wind and runoff. Sweep or scoop up cement washout or concrete dust instead of hosing into driveways, streets, gutters or storm drains.



PUBLIC SERVICES
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To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

HOME & GARDEN

Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health.



Recycle Household Hazardous Waste
Household products like paint, pesticides, solvents and cleaners are too dangerous to dump and too toxic to trash. Take them to be recycled at a convenient household hazardous waste collection facility. Call (800) CLEANUP for the facility in your area.



Disposing of Yard Waste
Recycle leaves, grass clippings and other yard waste, instead of blowing, sweeping or hosing into the street. Try grasscycling, leaving grass clippings on your lawn instead of using a grass catcher. The clippings act as a natural fertilizer, and because grass is mostly water, it also irrigates your lawn, conserving water.



Use Fertilizers & Pesticides Safely
Fertilizers and pesticides are often carried into the storm drain system by sprinkler runoff. Try using organic or non-toxic alternatives. If you use chemical fertilizers or pesticides, avoid applying near curbs and driveways and never apply before a rain.



Planting in the Yard
Produce less yard waste and save water by planting low maintenance, drought-tolerant trees and shrubs. Using drip irrigation, soaker hoses or micro-spray systems for flower beds and vegetation can also help reduce your water bill and prevent runoff.



Use Water Wisely
Cut your water costs and prevent runoff by controlling the amount of water and direction of sprinklers. The average lawn needs about an inch of water a week, including rainfall, or 10 to 20 minutes of watering. A half-inch per week is enough for fall and spring. Sprinklers should be on long enough to allow water to soak into the ground but not so long as to cause runoff.

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To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

Fertilizer Tips to Prevent Pollution

Water that runs off your lawn and garden can carry excess fertilizer into the San Bernardino County storm drain system, and it does not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these simple tips to prevent pollution and protect your health:



- Read the product label and follow the directions carefully, using only as directed.
- Avoid applying near driveways or gutters.
- Never apply fertilizer before a rain.
- Store fertilizers and chemicals in a covered area and in sealed, waterproof containers.
- Take unwanted lawn or garden chemicals to a household hazardous waste collection facility. Call (800) 253-2687.
- Use non-toxic products for your garden and lawn whenever possible.

PUBLIC SERVICES
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San Bernardino County STORMWATER PROGRAM

To report illegal dumping or for more information on Stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

FRESH CONCRETE & MORTAR APPLICATION

Cement wash, sediment, vehicle fluids, dust and hazardous debris from construction sites often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Storing Materials

Keep construction materials and debris away from the street, gutter and storm drains. Secure open bags of cement and cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.



Ordering Materials & Recycling Waste

Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. When breaking up paving, recycle the pieces at a crushing company. You can also recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. Call (909) 386-8401 for recycling and disposal information.



During Construction

Schedule excavation and grading during dry weather. Prevent mortar and cement from entering the street and storm drains by placing erosion controls. Setup small mixers on tarps or drop cloths, for easy cleanup of debris. Never bury waste material. Recycle or dispose of it as hazardous waste.



Cleaning Up

Wash concrete dust onto designated dirt areas, not down driveways or into the street or storm drains. Wash out concrete mixers and equipment in specified washout areas, where water can flow into a containment pond. Cement washwater can be recycled by pumping it back into cement mixers for reuse. Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.



PUBLIC SERVICES
CITY OF FONTANA

To report illegal dumping or for more information on stormwater pollution prevention, call:

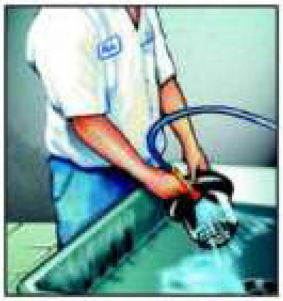
1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

AUTO MAINTENANCE

Oil, grease, anti-freeze and other toxic automotive fluids often make their way into the San Bernardino County storm drain system, and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow these best management practices to prevent pollution and protect public health.



Cleaning Auto Parts

Scrape parts with a wire brush or use a bake oven rather than liquid cleaners. Arrange drip pans, drying racks and drain boards so that fluids are directed back into the parts washer or the fluid holding tank. Do not wash parts or equipment in a shop sink, parking lot, driveway or street.



Storing Hazardous Waste

Keep your liquid waste segregated. Many fluids can be recycled via hazardous waste disposal companies if they are not mixed. Store all materials under cover with spill containment or inside to prevent contamination of rainwater runoff.



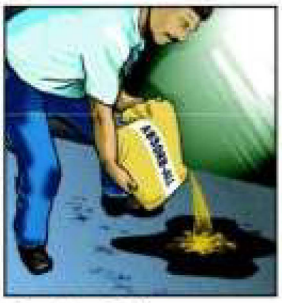
Metal Grinding and Polishing

Keep a bin under your lathe or grinder to capture metal filings. Send uncontaminated filings to a scrap metal recycler for reclamation. Store metal filings in a covered container or indoors.



Preventing Leaks and Spills

Place drip pans underneath to capture fluids. Use absorbent cleaning agents instead of water to clean work areas.



Cleaning Spills

Use dry methods for spill cleanup (sweeping, absorbent materials). Follow your hazardous materials response plan, as filed with your local fire department or other hazardous materials authority. Be sure that all employees are aware of the plan and are capable of implementing each phase. To report serious toxic spills, call 911.



Proper Disposal of Hazardous Waste

Recycle used motor oil and oil filters, anti-freeze and other hazardous automotive fluids, batteries, tires and metal filings collected from grinding or polishing auto parts. Contact a licensed hazardous waste hauler. For more recycling information, call (909) 386-8401.



PUBLIC SERVICES
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To report illegal dumping or for more information on stormwater pollution prevention, call:

1 (800) CLEANUP

www.1800cleanup.org

Infiltration/Retention Basin- and CMP chamber system sizing and Detail

Infiltration Basin Capacity Calculation: Basin-1

Surface Area	1055	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	1.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**1828**	**CF**	

Infiltration Drawdown Time Calculation: Basin-1

Infiltration Surface Area Provided:	1,055	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	1,828	cu.ft	
Infiltration Volume per hour	81.92	cu.ft/hr	(1,055 sft * 0.078 ft/hr)
Infiltration Draw Down Time	22.31	Hours	(1828 cu.ft / 81.92 cu.ft/hr)
	22 hr		< 48 hr draw down time. OK

Infiltration Basin Capacity Calculation: Basin-2

Surface Area	1042	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	1.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**1805**	**CF**	

Infiltration Drawdown Time Calculation: Basin-2

Infiltration Surface Area Provided:	1,805	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	1,805	cu.ft	
Infiltration Volume per hour	140.16	cu.ft/hr	(1,805 sft * 0.078 ft/hr)
Infiltration Draw Down Time	12.88	Hours	(1805 cu.ft / 140.16 cu.ft/hr)
	13 hr		< 48 hr draw down time. OK

Infiltration Basin Capacity Calculation: Basin-3

Surface Area	2473	SF	Surface Area at halfway water depth
Rock Depth	0	FT	
Surface Depth	3.5	FT	
Infiltration	*0.2325*	*FT*	Avg Design Inf rate 0.93"/hr [(0.93/12)*3]
Volume Provided	**9230**	**CF**	
Vol. Needed	8203		
Over	1027		

Infiltration Drawdown Time Calculation: Basin-3

Infiltration Surface Area Provided:	2,473	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	9230	cu.ft	
Infiltration Volume per hour	192.03	cu.ft/hr	(2,473 sft * 0.078 ft/hr)
Infiltration Draw Down Time	48.06	Hours	(9,230 cu.ft / 188.30 cu.ft/hr)
	48 hr		48 hr draw down time. OK

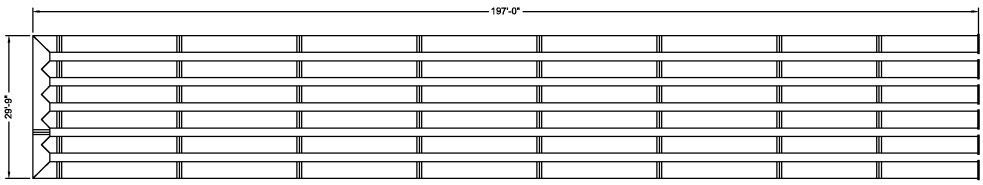
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 1,191 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 18,200 CF
- PIPE STORAGE VOLUME = 11,456 CF
- BACKFILL STORAGE VOLUME = 6,794 CF
- TOTAL STORAGE PROVIDED = 18,251 CF
- STONE VOID = 40%

PIPE DETAILS
- DIAMETER = 42"
- CORRUGATION = 2 2/3x1/2
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 21"

BACKFILL DETAILS
- WIDTH AT ENDS = 12"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 12"
- BELOW PIPE = 6"



NOTES

- ALL RISER AND STUB DIMENSIONS ARE TO CENTERLINE. ALL ELEVATIONS, DIMENSIONS, AND LOCATIONS OF RISERS AND INLETS, SHALL BE VERIFIED BY THE ENGINEER OF RECORD PRIOR TO RELEASING FOR FABRICATION.
- ALL FITTINGS AND REINFORCEMENT COMPLY WITH ASTM A998.
- ALL RISERS AND STUBS ARE 2⅔" x ½" CORRUGATION AND 16 GAGE UNLESS OTHERWISE NOTED.
- RISERS TO BE FIELD TRIMMED TO GRADE.
- QUANTITY OF PIPE SHOWN DOES NOT PROVIDE EXTRA PIPE FOR CONNECTING THE SYSTEM TO EXISTING PIPE OR DRAINAGE STRUCTURES. OUR SYSTEM AS DETAILED PROVIDES NOMINAL INLET AND/OR OUTLET PIPE STUB FOR CONNECTION TO EXISTING DRAINAGE FACILITIES. IF ADDITIONAL PIPE IS NEEDED IT IS THE RESPONSIBILITY OF THE CONTRACTOR.
- BAND TYPE TO BE DETERMINED UPON FINAL DESIGN.
- THE PROJECT SUMMARY IS REFLECTIVE OF THE DYODS DESIGN. QUANTITIES ARE APPROX. AND SHOULD BE VERIFIED UPON FINAL DESIGN AND APPROVAL. FOR EXAMPLE, TOTAL EXCAVATION DOES NOT CONSIDER ALL VARIABLES SUCH AS SHORING AND ONLY ACCOUNTS FOR MATERIAL WITHIN THE ESTIMATED EXCAVATION FOOTPRINT.
- THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

ASSEMBLY
SCALE: 1" = 20'

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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

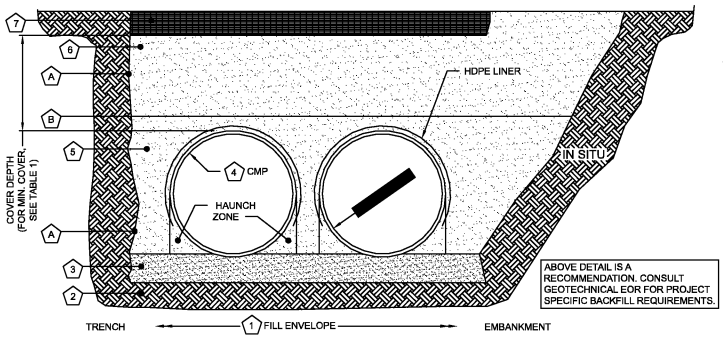
DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
70998	97148	1/14/2026
DESIGNED: DYO		DRAWN: DYO
CHECKED: DYO		APPROVED: DYO
SHEET NO.: 1		

TABLE 1:

DIAMETER, D	MIN. COVER	CORR. PROFILE
6"-10"	12"	1 1/2" x 1/4"
12"-48"	12"	2 2/3" x 1/2"
>48"-96"	12"	3" x 1", 5" x 1"
>96"	D/8	3" x 1", 5" x 1"

- STRUCTURAL BACKFILL MUST EXTEND TO LIMITS OF THE TABLE
- TOTAL HEIGHT OF COMPACTED COVER FOR CONVENTIONAL HIGHWAY LOADS IS MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TOP OF RIGID PAVEMENT.



ABOVE DETAIL IS A RECOMMENDATION. CONSULT GEOTECHNICAL EOR FOR PROJECT SPECIFIC BACKFILL REQUIREMENTS.

MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT

INSTALLATION NOTES

1. WHEN PLACING THE FIRST LIFTS OF BACKFILL IT IS IMPORTANT TO MAKE SURE THAT THE BACKFILL IS PROPERLY COMPACTED UNDER AND AROUND THE PIPE HAUNCHES.
2. OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS, AS APPROVED BY SITE ENGINEER.
3. AN HDPE MEMBRANE LINER WILL BE PLACED ON THE CROWN OF EACH PIPE TO PROVIDE AN IMPERMEABLE BARRIER AGAINST ENVIRONMENTAL CHANGES THAT MAY ADVERSELY AFFECT THE SYSTEM OVER TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL TECHNICAL DETAILS.

TABLE 2: PERFORATED STANDARD

CMP RETENTION STANDARD BACKFILL SPECIFICATIONS

	MATERIAL LOCATION	MATERIAL SPECIFICATION	DESCRIPTION	
1	FILL ENVELOPE WIDTH	PER ENGINEER OF RECORD	MINIMUM TRENCH WIDTH MUST ALLOW ROOM FOR PROPER COMPACTION OF HAUNCH MATERIALS UNDER THE PIPE. THE SUGGESTED MINIMUM TRENCH WIDTH, OR EOR RECOMMENDATION: PIPE ≤ 12": D + 16" PIPE > 12": 1.5D + 12"	MINIMUM EMBANKMENT WIDTH (IN FEET) FOR INITIAL FILL ENVELOPE: PIPE < 24": 3.0D PIPE 24" - 144": D + 4'0" PIPE > 144": D + 10'0"
2	FOUNDATION	**AASHTO 26.5.2** - PER ENGINEER OF RECORD	PRIOR TO PLACING THE BEDDING, THE FOUNDATION MUST BE CONSTRUCTED TO A UNIFORM AND STABLE GRADE. IN THE EVENT THAT UNSUITABLE FOUNDATION MATERIALS ARE ENCOUNTERED DURING EXCAVATION, THEY SHALL BE REMOVED AND FOUNDATION BROUGHT BACK TO GRADE WITH A FILL MATERIAL APPROVED BY THE ENGINEER OF RECORD.	
3	BEDDING	**AASHTO M 43: 3, 357, 4, 467, 5, 56, 57**	ENGINEER OF RECORD TO DETERMINE IF BEDDING IS REQUIRED. PIPE MAY BE PLACED ON THE TRENCH BOTTOM OF A RELATIVELY LOOSE, NATIVE SUITABLE WELL GRADED GRANULAR MATERIAL THAT IS ROUGHLY SHAPED TO FIT THE BOTTOM OF THE PIPE, 2" MIN DEPTH. THE BEDDING MATERIAL MAY BE SUITABLE OPEN GRADED GRANULAR BEDDING CONFORMING TO AASHTO SOIL CLASSIFICATIONS A1, A2, OR A3 WITH MAXIMUM PARTICLE SIZE OF 3" PER AASHTO 26.3.8.1	
4	CORRUGATED METAL PIPE			
5	BACKFILL	FREE-DRAINING, ANGULAR, NATURALLY OCCURRING WASHED-STONE PER **AASHTO M 43: 3, 357, 4, 467, 5, 56, 57** OR APPROVED EQUAL *	HAUNCH ZONE MATERIAL SHALL BE HAND SHOVELED OR SHOVEL SLICED INTO PLACE TO ALLOW FOR PROPER COMPACTION WITHOUT SOFT SPOTS. BACKFILL SHALL BE PLACED IN 8" +/- LOOSE LIFTS AND COMPACTED TO 90% STANDARD PROCTOR PER AASHTO T 99. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO LIFT (16") DIFFERENTIAL BETWEEN ANY OF THE PIPES AT ANY TIME DURING THE BACKFILL PROCESS. THE BACKFILL SHOULD BE ADVANCED ALONG THE LENGTH OF THE SYSTEM TO AVOID DIFFERENTIAL LOADING. WHERE CONVENTIONAL COMPACTION TESTING IS NOT PRACTICAL, THE MATERIAL SHALL BE MECHANICALLY COMPACTED UNTIL NO FURTHER YIELDING OF MATERIAL IS OBSERVED UNDER THE COMPACTOR. AREAS WITH HIGH WATER TABLE FLUCTUATIONS THAT INTERACT WITH THE PIPE ZONE, CONSIDER INSTALLING A GEOTEXTILE SEPARATION LAYER TO PREVENT SOIL MIGRATION.	**IN
6	COVER MATERIAL	UP TO MIN. COVER - **AASHTO M 145: A-1, A-2, A-3** ABOVE MIN. COVER - PER ENGINEER OF RECORD	COVER MATERIAL MAY INCLUDE NON-BITUMINOUS, GRANULAR ROADBASE MATERIAL WITHIN MIN COVER LIMITS	
7	RIGID OR FLEXIBLE PAVEMENT (IF APPLICABLE)	PER ENGINEER OF RECORD	FLEXIBLE PAVEMENT SHOULD NOT BE COUNTED AS PART OF THE FILL HEIGHT OVER THE CMP. FINAL BACKFILL MATERIAL SELECTION AND COMPACTION REQUIREMENTS SHALL FOLLOW THE PROJECT PLANS AND SPECIFICATIONS PER THE ENGINEER OF RECORD.	
A	OPTIONAL SIDE GEOTEXTILE	NONE	GEOTEXTILE LAYER IS RECOMMENDED ON SIDES OF EXCAVATION TO PREVENT SOIL MIGRATION.	
B	GEOTEXTILE BETWEEN LAYERS	NONE	IF SOIL TYPES DIFFER AT ANY POINT ABOVE PIPE INVERT, A GEOTEXTILE LAYER IS RECOMMENDED TO BE PLACED BETWEEN THE LAYERS TO PREVENT SOIL MIGRATION.	

NOTES:

- FOR MULTIPLE BARREL INSTALLATIONS, THE RECOMMENDED STANDARD SPACING BETWEEN PARALLEL PIPE RUNS SHALL BE THE PIPE DIAMETER /2 BUT NO LESS THAN 12" FOR DIAMETERS <72". FOR 72" AND LARGER DIAMETERS, THE MINIMUM SPACING IS 36". CONTACT YOUR CONTECH REPRESENTATIVE FOR NONSTANDARD SPACING.

* APPROVED REGIONAL EQUIVALENTS FOR SECTION 5 INCLUDE CA-7, MIDOT 6AA, 6A, OR 5G, PROVIDED THEY MEET THE PARTICLE SIZES INDICATED.

MANUFACTURER RECOMMENDED BACKFILL

NOT TO SCALE

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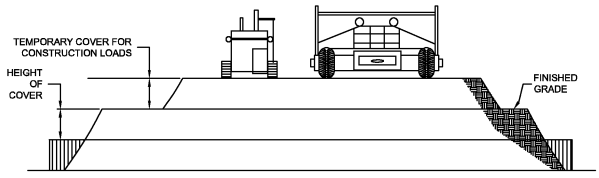
CONTECH CMP DETENTION SYSTEMS

CONTECH DYODS DRAWING

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
70998	97148	1/14/2026
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

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CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

*MINIMUM COVER MAY VARY, DEPENDING ON LOCAL CONDITIONS. THE CONTRACTOR MUST PROVIDE THE ADDITIONAL COVER REQUIRED TO AVOID DAMAGE TO THE PIPE. MINIMUM COVER IS MEASURED FROM THE TOP OF THE PIPE TO THE TOP OF THE MAINTAINED CONSTRUCTION ROADWAY SURFACE.

CONSTRUCTION LOADING DIAGRAM

SCALE: N.T.S.

SPECIFICATION FOR DESIGNED DETENTION SYSTEM:

SCOPE
THIS SPECIFICATION COVERS THE MANUFACTURE AND INSTALLATION OF THE DESIGNED DETENTION SYSTEM DETAILED IN THE PROJECT PLANS.

MATERIAL
THE MATERIAL SHALL CONFORM TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2 STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-274 OR ASTM A-92.

THE GALVANIZED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-218 OR ASTM A929.

THE POLYMER COATED STEEL COILS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M-246 OR ASTM A-742.

THE ALUMINUM COILS SHALL CONFORM TO THE APPLICABLE OF AASHTO M-197 OR ASTM B-744.

CONSTRUCTION LOADS
CONSTRUCTION LOADS MAY BE HIGHER THAN FINAL LOADS. FOLLOW THE MANUFACTURER'S OR NCSPA GUIDELINES.

NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.

PIPE
THE PIPE SHALL BE MANUFACTURED IN ACCORDANCE TO THE APPLICABLE REQUIREMENTS LISTED BELOW:

ALUMINIZED TYPE 2: AASHTO M-36 OR ASTM A-760

GALVANIZED: AASHTO M-36 OR ASTM A-760

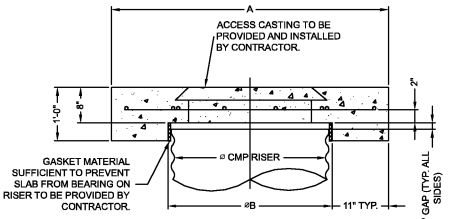
POLYMER COATED: AASHTO M-245 OR ASTM A-762

ALUMINUM: AASHTO M-196 OR ASTM B-745

APPLICABLE HANDLING AND ASSEMBLY
SHALL BE IN ACCORDANCE WITH NCSP'S (NATIONAL CORRUGATED STEEL PIPE ASSOCIATION) FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL. SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS FOR ALUMINUM PIPE.

REQUIREMENTS
INSTALLATION
SHALL BE IN ACCORDANCE WITH AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 26, DIVISION II DIVISION II OR ASTM A-798 (FOR ALUMINIZED TYPE 2, GALVANIZED OR POLYMER COATED STEEL) OR ASTM B-788 (FOR ALUMINUM PIPE) AND IN CONFORMANCE WITH THE PROJECT PLANS AND SPECIFICATIONS. IF THERE ARE ANY INCONSISTENCIES OR CONFLICTS THE CONTRACTOR SHOULD DISCUSS AND RESOLVE WITH THE SITE ENGINEER.

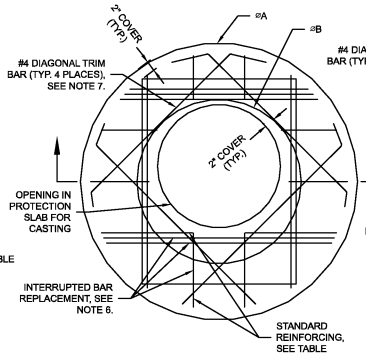
IT IS ALWAYS THE RESPONSIBILITY OF THE CONTRACTOR TO FOLLOW OSHA GUIDELINES FOR SAFE PRACTICES.



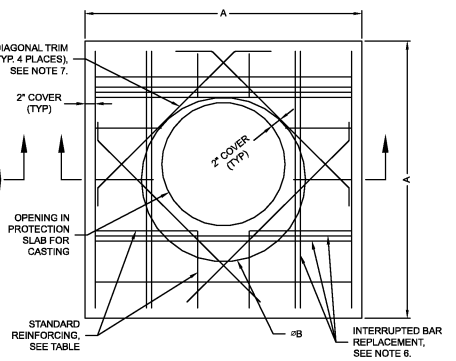
SECTION VIEW

REINFORCING TABLE				
⌀ CMP RISER	A	⌀ B	REINFORCING	**BEARING PRESSURE (PSF)
24"	⌀ 4' 4'X4'	26"	#5 @ 12" OCEW #5 @ 12" OCEW	2,410 1,780
30"	⌀ 4'-6" 4'-6" X 4'-6"	32"	#5 @ 12" OCEW #5 @ 12" OCEW	2,120 1,530
36"	⌀ 5' 5' X 5'	38"	#5 @ 10" OCEW #5 @ 10" OCEW	1,890 1,350
42"	⌀ 5'-6" 5'-6" X 5'-6"	44"	#5 @ 10" OCEW #5 @ 9" OCEW	1,720 1,210
48"	⌀ 6' 6' X 6'	50"	#5 @ 9" OCEW #5 @ 8" OCEW	1,600 1,100

** ASSUMED SOIL BEARING CAPACITY



ROUND OPTION PLAN VIEW



SQUARE OPTION PLAN VIEW

NOTES:

1. DESIGN IN ACCORDANCE WITH AASHTO, 17th EDITION.
2. DESIGN LOAD HS25.
3. EARTH COVER = 1' MAX.
4. CONCRETE STRENGTH = 3,500 psi
5. REINFORCING STEEL = ASTM A615, GRADE 60.
6. PROVIDE ADDITIONAL REINFORCING AROUND OPENINGS EQUAL TO THE BARS INTERRUPTED, HALF EACH SIDE. ADDITIONAL BARS TO BE IN THE SAME PLANE.
7. TRIM OPENING WITH DIAGONAL #4 BARS, EXTEND BARS A MINIMUM OF 12" BEYOND OPENING, BEND BARS AS REQUIRED TO MAINTAIN BAR COVER.
8. PROTECTION SLAB AND ALL MATERIALS TO BE PROVIDED AND INSTALLED BY CONTRACTOR.
9. DETAIL DESIGN BY DELTA ENGINEERING, BINGHAMTON, NY.

MANHOLE CAP DETAIL

SCALE: N.T.S.

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CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
DETENTION SYSTEM

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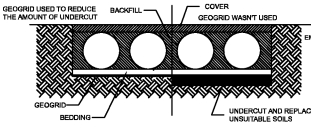
CMP DETENTION INSTALLATION GUIDE

PROPER INSTALLATION OF A FLEXIBLE UNDERGROUND DETENTION SYSTEM WILL ENSURE LONG-TERM PERFORMANCE. THE CONFIGURATION OF THESE SYSTEMS OFTEN REQUIRES SPECIAL CONSTRUCTION PRACTICES THAT DIFFER FROM CONVENTIONAL FLEXIBLE PIPE CONSTRUCTION. CONTECH ENGINEERED SOLUTIONS STRONGLY SUGGESTS SCHEDULING A PRE-CONSTRUCTION MEETING WITH YOUR LOCAL SALES ENGINEER TO DETERMINE IF ADDITIONAL MEASURES, NOT COVERED IN THIS GUIDE, ARE APPROPRIATE FOR YOUR SITE.

FOUNDATION

CONSTRUCT A FOUNDATION THAT CAN SUPPORT THE DESIGN LOADING APPLIED BY THE PIPE AND ADJACENT BACKFILL WEIGHT AS WELL AS MAINTAIN ITS INTEGRITY DURING CONSTRUCTION.

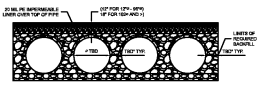
IF SOFT OR UNSUITABLE SOILS ARE ENCOUNTERED, REMOVE THE POOR SOILS DOWN TO A SUITABLE DEPTH AND THEN BUILD UP TO THE APPROPRIATE ELEVATION WITH A COMPETENT BACKFILL MATERIAL. THE STRUCTURAL FILL MATERIAL GRADATION SHOULD NOT ALLOW THE MIGRATION OF FINES, WHICH CAN CAUSE SETTLEMENT OF THE DETENTION SYSTEM OR PAVEMENT ABOVE. IF THE STRUCTURAL FILL MATERIAL IS NOT COMPATIBLE WITH THE UNDERLYING SOILS AN ENGINEERING FABRIC SHOULD BE USED AS A SEPARATOR. IN SOME CASES, USING A STIFF REINFORCING GEOGRID REDUCES OVER EXCAVATION AND REPLACEMENT FILL QUANTITIES.



GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING SATURATION OF THE SUBGRADE.

GEOMEMBRANE BARRIER

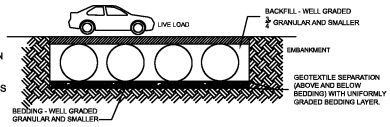
THE RESISTIVITY OF A PROJECT SITE MAY CHANGE OVER TIME DUE TO THE USE OF VARIOUS SALTING, DE-ICING, AND AGRICULTURAL AGENTS APPLIED ON OR NEAR THE AREA. TO MITIGATE THE POTENTIAL IMPACT OF THESE AGENTS, AN HDPE MEMBRANE LINER WILL BE INSTALLED ON THE CROWN OF EACH PIPE, CREATING AN IMPERMEABLE BARRIER. THIS MEASURE IS DESIGNED TO PROTECT THE SYSTEM FROM ENVIRONMENTAL CHANGES THAT COULD LEAD TO PREMATURE CORROSION AND REDUCE THE OVERALL SERVICE LIFE.



IN-SITU TRENCH WALL

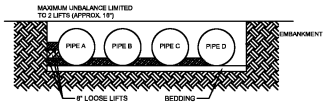
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION BEYOND THE SPRING LINE OF THE OUTER MOST PIPES.

IN MOST CASES THE REQUIREMENTS FOR A SAFE WORK ENVIRONMENT AND PROPER BACKFILL PLACEMENT AND COMPACTION TAKE CARE OF THIS CONCERN.



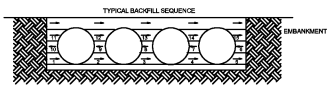
BACKFILL PLACEMENT

MATERIAL SHALL BE WORKED INTO THE PIPE HAUNCHES BY MEANS OF SHOVEL-SLICING, RODDING, AIR TAMPER, VIBRATORY ROD, OR OTHER EFFECTIVE METHODS.

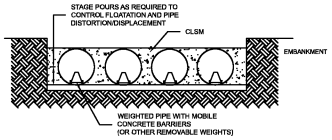


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE LEVEL OF COMPACTION.

FOR LARGE SYSTEMS, CONVEYOR SYSTEMS, BACKHOES WITH LONG REACHES OR DRAGLINES WITH STONE BUCKETS MAY BE USED TO PLACE BACKFILL. ONCE MINIMUM COVER FOR CONSTRUCTION LOADING ACROSS THE ENTIRE WIDTH OF THE SYSTEM IS REACHED, ADVANCE THE EQUIPMENT TO THE END OF THE RECENTLY PLACED FILL, AND BEGIN THE SEQUENCE AGAIN UNTIL THE SYSTEM IS COMPLETELY BACKFILLED. THIS TYPE OF CONSTRUCTION SEQUENCE PROVIDES ROOM FOR STOCKPILED BACKFILL DIRECTLY BEHIND THE BACKHOE, AS WELL AS THE MOVEMENT OF CONSTRUCTION TRAFFIC. MATERIAL STOCKPILES ON TOP OF THE BACKFILLED DETENTION SYSTEM SHOULD BE LIMITED TO 8- TO 10-FEET HIGH AND MUST PROVIDE BALANCED LOADING ACROSS ALL BARRELS. TO DETERMINE THE PROPER COVER OVER THE PIPES TO ALLOW THE MOVEMENT OF CONSTRUCTION EQUIPMENT SEE TABLE 1, OR CONTACT YOUR LOCAL CONTECH SALES ENGINEER.



WHEN FLOWABLE FILL IS USED, YOU MUST PREVENT PIPE FLOATATION. TYPICALLY, SMALL LIFTS ARE PLACED BETWEEN THE PIPES AND THEN ALLOWED TO SET-UP PRIOR TO THE PLACEMENT OF THE NEXT LIFT. THE ALLOWABLE THICKNESS OF THE CLSM LIFT IS A FUNCTION OF A PROPER BALANCE BETWEEN THE UPLIFT FORCE OF THE CLSM, THE OPPOSING WEIGHT OF THE PIPE, AND THE EFFECT OF OTHER RESTRAINING MEASURES. THE PIPE CAN CARRY LIMITED FLUID PRESSURE WITHOUT PIPE DISTORTION OR DISPLACEMENT, WHICH ALSO AFFECTS THE CLSM LIFT THICKNESS. YOUR LOCAL CONTECH SALES ENGINEER CAN HELP DETERMINE THE PROPER LIFT THICKNESS.

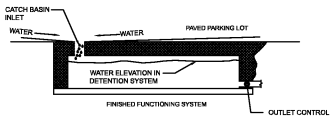


CONSTRUCTION LOADING

TYPICALLY, THE MINIMUM COVER SPECIFIED FOR A PROJECT ASSUMES H-20 LIVE LOAD. BECAUSE CONSTRUCTION LOADS OFTEN EXCEED DESIGN LIVE LOADS, INCREASED TEMPORARY MINIMUM COVER REQUIREMENTS ARE NECESSARY. SINCE CONSTRUCTION EQUIPMENT VARIES FROM JOB TO JOB, IT IS BEST TO ADDRESS EQUIPMENT SPECIFIC MINIMUM COVER REQUIREMENTS WITH YOUR LOCAL CONTECH SALES ENGINEER DURING YOUR PRE-CONSTRUCTION MEETING.

ADDITIONAL CONSIDERATIONS

BECAUSE MOST SYSTEMS ARE CONSTRUCTED BELOW-GRADE, RAINFALL CAN RAPIDLY FILL THE EXCAVATION; POTENTIALLY CAUSING FLOATATION AND MOVEMENT OF THE PREVIOUSLY PLACED PIPES. TO HELP MITIGATE POTENTIAL PROBLEMS, IT IS BEST TO START THE INSTALLATION AT THE DOWNSTREAM END WITH THE OUTLET ALREADY CONSTRUCTED TO ALLOW A ROUTE FOR THE WATER TO ESCAPE. TEMPORARY DIVERSION MEASURES MAY BE REQUIRED FOR HIGH FLOWS DUE TO THE RESTRICTED NATURE OF THE OUTLET PIPE.



CMP DETENTION SYSTEM INSPECTION AND MAINTENANCE

UNDERGROUND STORMWATER DETENTION AND INFILTRATION SYSTEMS MUST BE INSPECTED AND MAINTAINED AT REGULAR INTERVALS FOR PURPOSES OF PERFORMANCE AND LONGEVITY.

INSPECTION

INSPECTION IS THE KEY TO EFFECTIVE MAINTENANCE OF CMP DETENTION SYSTEMS AND IS EASILY PERFORMED. CONTECH RECOMMENDS ONGOING, ANNUAL INSPECTIONS. SITES WITH HIGH TRASH LOAD OR SMALL OUTLET CONTROL ORIFICES MAY NEED MORE FREQUENT INSPECTIONS. THE RATE AT WHICH THE SYSTEM COLLECTS POLLUTANTS WILL DEPEND MORE ON SITE SPECIFIC ACTIVITIES RATHER THAN THE SIZE OR CONFIGURATION OF THE SYSTEM.

INSPECTIONS SHOULD BE PERFORMED MORE OFTEN IN EQUIPMENT WASHDOWN AREAS, IN CLIMATES WHERE SANDING AND/OR SALTING OPERATIONS TAKE PLACE, AND IN OTHER VARIOUS INSTANCES IN WHICH ONE WOULD EXPECT HIGHER ACCUMULATIONS OF SEDIMENT OR ABRASIVE/CORROSIVE CONDITIONS. A RECORD OF EACH INSPECTION IS TO BE MAINTAINED FOR THE LIFE OF THE SYSTEM

MAINTENANCE

CMP DETENTION SYSTEMS SHOULD BE CLEANED WHEN AN INSPECTION REVEALS ACCUMULATED SEDIMENT OR TRASH IS CLOGGING THE DISCHARGE ORIFICE.

ACCUMULATED SEDIMENT AND TRASH CAN TYPICALLY BE EVACUATED THROUGH THE MANHOLE OVER THE OUTLET ORIFICE. IF MAINTENANCE IS NOT PERFORMED AS RECOMMENDED, SEDIMENT AND TRASH MAY ACCUMULATE IN FRONT OF THE OUTLET ORIFICE. MANHOLE COVERS SHOULD BE SECURELY SEATED FOLLOWING CLEANING ACTIVITIES. CONTECH SUGGESTS THAT ALL SYSTEMS BE DESIGNED WITH AN ACCESS/INSPECTION MANHOLE SITUATED AT OR NEAR THE INLET AND THE OUTLET ORIFICE. SHOULD IT BE NECESSARY TO GET INSIDE THE SYSTEM TO PERFORM MAINTENANCE ACTIVITIES, ALL APPROPRIATE PRECAUTIONS REGARDING CONFINED SPACE ENTRY AND OSHA REGULATIONS SHOULD BE FOLLOWED.

ANNUAL INSPECTIONS ARE BEST PRACTICE FOR ALL UNDERGROUND SYSTEMS. DURING THIS INSPECTION, IF EVIDENCE OF SALTING/DE-ICING AGENTS IS OBSERVED WITHIN THE SYSTEM, IT IS BEST PRACTICE FOR THE SYSTEM TO BE RINSED, INCLUDING ABOVE THE SPRING LINE SOON AFTER THE SPRING THAW AS PART OF THE MAINTENANCE PROGRAM FOR THE SYSTEM.

MAINTAINING AN UNDERGROUND DETENTION OR INFILTRATION SYSTEM IS EASIEST WHEN THERE IS NO FLOW ENTERING THE SYSTEM. FOR THIS REASON, IT IS A GOOD IDEA TO SCHEDULE THE CLEANOUT DURING DRY WEATHER.

THE FOREGOING INSPECTION AND MAINTENANCE EFFORTS HELP ENSURE UNDERGROUND PIPE SYSTEMS USED FOR STORMWATER STORAGE CONTINUE TO FUNCTION AS INTENDED BY IDENTIFYING RECOMMENDED REGULAR INSPECTION AND MAINTENANCE PRACTICES. INSPECTION AND MAINTENANCE RELATED TO THE STRUCTURAL INTEGRITY OF THE PIPE OR THE SOUNDNESS OF PIPE JOINT CONNECTIONS IS BEYOND THE SCOPE OF THIS GUIDE.

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DATE	REVISION DESCRIPTION	BY

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO97148 Conco Construction-Quarry
CMP-1
Apple Valley, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
70998	97148	1/14/2026
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.:	1	

C:\CONTECH\TEMP_ATEDC.MP_V1\.DWG, 10/18/2019 10:02 AM

Infiltration Drawdown Time Calculation: Contech CMP-1

Infiltration Surface Area Provided:	5,868	SF	
Infiltration Rate per Soil Report	2.05	in/hr	Avg Site Inf. rate per Geotechnical Report
	0.17	ft/hr	
Facor of Safety	2.2		
Design Infiltration Rate	0.078	ft/hr	
Volume needed to be Infiltrated	18251	cu.ft	
Infiltration Volume per hour	455.66	cu.ft/hr	(5868 sft * 0.078 ft/hr)
Infiltration Draw Down Time	40.05	Hours	(18251 cu.ft / 455.66 cu.ft/hr)
	40 hr	48 hr draw down time. OK	

FloGard Pre-treatment System Detail

Oldcastle Precast®

FLOGARD® CATCH BASIN INSERT FILTER

Catch basin insert designed to capture sediment, gross solids, trash and petroleum hydrocarbons from first-flush flows, even during the most extreme weather conditions

Example Types, Sizes and Capacities

Additional sizes, including regional and custom options are available

FloGard Combination Inlet SPECIFIER CHART								
MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-1633FGO	16 X 33	18 X 36	7.0	2.5	1.7	FGP-1633FGO8	1.4	1.1
FGP-1836FGO	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836FGO8	1.3	.9
FGP-2234FGO	22 X 34	24 X 36	8.1	3.6	2.1	FGP-2234FGO8	2.1	1.4
FGP-2436FGO	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436FGO8	1.95	1.15



Combination Inlet

FloGard Flat Grated Inlet SPECIFIER CHART								
MODEL NO. STANDARD DEPTH	STANDARD & SHALLOW DEPTH (Data in these columns is the same for both STANDARD & SHALLOW versions)			STANDARD DEPTH -20 Inches-		MODEL NO. SHALLOW DEPTH	SHALLOW DEPTH -12 Inches-	
	INLET ID Inside Dimension (inch x inch)	GRADE OD Outside Dimension (inch x inch)	TOTAL BYPASS CAPACITY (cu. ft. / sec.)	SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)		SOLIDS STORAGE CAPACITY (cu. ft.)	FILTERED FLOW (cu. ft. / sec.)
FGP-12F	12 X 12	12 X 14	2.8	0.3	0.4	FGP-12F8	.15	.25
FGP-16F	16 X 16	16 X 19	4.7	0.8	0.7	FGP-16F8	.45	.4
FGP-18F	18 X 18	18 X 20	4.7	0.8	0.7	FGP-18F8	.45	.4
FGP-1836F	18 X 36	18 X 40	6.9	2.3	1.6	FGP-1836F8	1.3	.9
FGP-21F	22 X 22	22 X 24	6.1	2.2	1.5	FGP-21F8	1.25	.85
FGP-24F	24 X 24	24 X 27	6.1	2.2	1.5	FGP-24F8	1.25	.85
FGP-2436F	24 X 36	24 X 40	8.0	3.4	2.0	FGP-2436F8	1.95	1.15
FGP-2448F	24 X 48	24 X 48	9.3	4.4	2.4	FGP-2448F8	2.5	1.35
FGP-32F-TN	28 X 28	32 X 32	6.3	2.2	1.5	FGP-32F8-TN	1.25	.85
FGP-30F	30 X 30	30 X 34	8.1	3.6	2.0	FGP-30F8	2.05	1.15
FGP-36F	36 X 36	36 X 40	9.1	4.6	2.4	FGP-36F8	2.65	1.35
FGP-3648F	36 X 48	40 X 48	11.5	6.8	3.2	FGP-3648F8	3.9	1.85
FGP-48F	48 X 48	48 X 54	13.2	9.5	3.9	FGP-48F8	5.45	2.25
FGP-1633F	16 X 34	18 X 36	6.9	2.3	1.6	FGP-1633F8	1.3	.9
FGP-2234F	22 X 34	24 X 36	8.0	3.4	2.0	FGP-2234F8	1.95	1.15



Flat-Grated Inlet

FloGard Circular Grated Inlet SPECIFIER CHART					
MODEL NUMBER	INLET ID (inches)	GRADE OD (inches)	SOLIDS STORAGE CAPACITY (CU FT)	FILTERED FLOW (CSF)	TOTAL BYPASS CAPACITY (CFS)
FGP-RF15F	15	18	0.3	0.4	2.8
FGP-RF18F	18	20	0.8	0.7	4.7
FGP-RF20F	20	23	0.8	0.7	4.7
FGP-RF21F	21	23.5	0.8	0.7	4.7
FGP-RF22F	22	24	0.8	0.7	4.7
FGP-RF24F	24	26	0.8	0.7	4.7
FGP-RF30F	30	32	2.2	1.5	6.1
FGP-RF36F	36	39	3.6	2.0	8.1



Circular Frame Catch Basin

Oldcastle Precast®

FLOGARD+PLUS®
CATCH BASIN INSERT FILTER

Inspection and Maintenance Guide

DRAINAGE PROTECTION SYSTEMS
DPS
A division of Oldcastle Precast

Stormwater

SCOPE:

Federal, State and Local Clean Water Act regulations and those of insurance carriers require that stormwater filtration systems be maintained and serviced on a recurring basis. The intent of the regulations is to ensure that the systems, on a continuing basis, efficiently remove pollutants from stormwater runoff thereby preventing pollution of the nation's water resources. These specifications apply to the FloGard+Plus® Catch Basin Insert Filter.

RECOMMENDED FREQUENCY OF SERVICE:

Drainage Protection Systems (DPS) recommends that installed FloGard+Plus Catch Basin Insert Filters be serviced on a recurring basis. Ultimately, the frequency depends on the amount of runoff, pollutant loading and interference from debris (leaves, vegetation, cans, paper, etc.); however, it is recommended that each installation be serviced a minimum of three times per year, with a change of filter medium once per year. DPS technicians are available to do an onsite evaluation, upon request.

RECOMMENDED TIMING OF SERVICE:

DPS guidelines for the timing of service are as follows:

1. For areas with a definite rainy season: Prior to, during and following the rainy season.
2. For areas subject to year-round rainfall: On a recurring basis (at least three times per year).
3. For areas with winter snow and summer rain: Prior to and just after the snow season and during the summer rain season.
4. For installed devices not subject to the elements (washracks, parking garages, etc.): On a recurring basis (no less than three times per year).

SERVICE PROCEDURES:

1. The catch basin grate shall be removed and set to one side. The catch basin shall be visually inspected for defects and possible illegal dumping. If illegal dumping has occurred, the proper authorities and property owner representative shall be notified as soon as practicable.
2. Using an industrial vacuum, the collected materials shall be removed from the liner. (Note: DPS uses a truck-mounted vacuum for servicing FloGard+Plus catch basin inserts.)
3. When all of the collected materials have been removed, the filter medium pouches shall be removed by unsnapping the tether from the D-ring and set to one side. The filter liner, gaskets, stainless steel frame and mounting brackets, etc., shall be inspected for continued serviceability. Minor damage or defects found shall be corrected on-the-spot and a notation made on the Maintenance Record. More extensive deficiencies that affect the efficiency of the filter (torn liner, etc.), if approved by the customer representative, will be corrected and an invoice submitted to the representative along with the Maintenance Record.
4. The filter medium pouches shall be inspected for defects and continued serviceability and replaced as necessary and the pouch tethers re-attached to the liner's D-ring. See below.
5. The grate shall be replaced.

REPLACEMENT AND DISPOSAL OF EXPOSED FILTER MEDIUM AND COLLECTED DEBRIS

The frequency of filter medium exchange will be in accordance with the existing DPS-Customer Maintenance Contract. DPS recommends that the medium be changed at least once per year. During the appropriate service, or if so determined by the service technician during a non-scheduled service, the filter medium will be replaced with new material. Once the exposed pouches and debris have been removed, DPS has possession and must dispose of it in accordance with local, state and federal agency requirements.

DPS also has the capability of servicing all manner of storm drain filters, catch basin inserts and catch basins without inserts, underground oil/water separators, stormwater interceptors and other such devices. All DPS personnel are highly qualified technicians and are confined space trained and certified. Call us at (888) 950-8826 for further information and assistance.

FLOGARD+PLUS®
CATCH BASIN INSERT FILTER

OUR MARKETS



BUILDING STRUCTURES



COMMUNICATIONS



WATER



ENERGY



TRANSPORTATION

BMP Fact Sheets

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.

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.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

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

Storm Drain Signage SD-13



Design Objectives

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

Description

Waste materials dumped into storm drain inlets can have severe impacts on receiving and ground waters. Posting notices regarding discharge prohibitions at storm drain inlets can prevent waste dumping. Storm drain signs and stencils are highly visible source controls that are typically placed directly adjacent to storm drain inlets.

Approach

The stencil or affixed sign contains a brief statement that prohibits dumping of improper materials into the urban runoff conveyance system. Storm drain messages have become a popular method of alerting the public about the effects of and the prohibitions against waste disposal.

Suitable Applications

Stencils and signs alert the public to the destination of pollutants discharged to the storm drain. Signs are appropriate in residential, commercial, and industrial areas, as well as any other area where contributions or dumping to storm drains is likely.

Design Considerations

Storm drain message markers or placards are recommended at all storm drain inlets within the boundary of a development project. The marker should be placed in clear sight facing toward anyone approaching the inlet from either side. All storm drain inlet locations should be identified on the development site map.

Designing New Installations

The following methods should be considered for inclusion in the project design and show on project plans:

- Provide stenciling or labeling of all storm drain inlets and catch basins, constructed or modified, within the project area with prohibitive language. Examples include "NO DUMPING

– DRAINS TO OCEAN" and/or other graphical icons to discourage illegal dumping.

- Post signs with prohibitive language and/or graphical icons, which prohibit illegal dumping at public access points along channels and creeks within the project area.

Note - Some local agencies have approved specific signage and/or storm drain message placards for use. Consult local agency stormwater staff to determine specific requirements for placard types and methods of application.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. If the project meets the definition of "redevelopment", then the requirements stated under " designing new installations" above should be included in all project design plans.

Additional Information

Maintenance Considerations

- Legibility of markers and signs should be maintained. If required by the agency with jurisdiction over the project, the owner/operator or homeowner's association should enter into a maintenance agreement with the agency or record a deed restriction upon the property title to maintain the legibility of placards or signs.

Placement

- Signage on top of curbs tends to weather and fade.
- Signage on face of curbs tends to be worn by contact with vehicle tires and sweeper brooms.

Supplemental Information

Examples

- Most MS4 programs have storm drain signage programs. Some MS4 programs will provide stencils, or arrange for volunteers to stencil storm drains as part of their outreach program.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

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

Infiltration Report
Geotechnical Report

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	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.50
		Depth to groundwater / impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \Sigma p$			1.25
B	Design	Tributary area size	0.25	2	0.50
		Level of pretreatment/ expected sediment loads	0.25	1	0.25
		Redundancy	0.25	3	0.75
		Compaction during construction	0.25	1	0.25
		Design Safety Factor, $S_B = \Sigma p$			1.75
Combined Safety Factor, $S_{TOT} = S_A \times S_B$					2.20
Measured Infiltration Rate, inch/hr, K_M (corrected for test-specific bias)					2.05
Design Infiltration Rate, in/hr, $K_{DESIGN} = K_M / S_{TOT}$					0.93

Supporting Data

Briefly describe infiltration test and provide reference to test forms:

Average Inf. Rate : 2.05 in/hr average rate from 4-tested pits
(P-1: 3.3"/hr, P-2:1.4"/hr, P3:1.9"/hr, P4:1.6"/hr)
Geotechnical & Infiltration feasibility investigation, March 14, 2025.
Design Inf Rate: 2.05/2.2 = 0.93"/hr

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

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PRELIMINARY GEOTECHNICAL AND INFILTRATION FEASIBILITY INVESTIGATION THREE PROPOSED COMMERCIAL BUILDINGS APN 0463-441-07 APPLE VALLEY, CALIFORNIA

PROJECT NO. 14053.1
MARCH 14, 2025

Prepared For:

Conco Construction
P.O. Box 1582
22276 Ottawa Road, Suite 3
Apple Valley, California 92308

Attention: Cindy Watson

March 14, 2025

Conco Construction
P.O. Box 1582
22276 Ottawa Road, Suite 3
Apple Valley, California 92308

Project No. 14053.1

Attention: Cindy Watson

Subject: Preliminary Geotechnical and Infiltration Feasibility Investigation, Three Proposed Commercial Buildings, APN 0463-441-07, Apple Valley, California.

LOR Geotechnical Group, Inc., is pleased to present this report of our geotechnical investigation for the subject project. In summary, it is our opinion that the proposed development is feasible from a geotechnical perspective, provided the recommendations presented in the attached report are incorporated into design and construction.

To provide adequate support for the proposed structures and structural improvements, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils. All existing loose alluvial materials and any undocumented fill material should be removed from structural areas and areas to receive engineered compacted fills. The data developed during this investigation indicates that removals of approximately 2 to 3 feet will be required from currently planned development areas. The given removal depth is preliminary and the actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Low expansion potential, high soluble sulfate content, and fair R-value quality generally characterize the upper onsite materials tested. Near completion and/or at the completion of site grading, additional foundation and subgrade soils should be tested, as necessary, to verify their expansion potential, R-value quality, and soluble sulfate content.

Marginal infiltration rates were obtained for the soils tested.

LOR Geotechnical Group, Inc.

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INTRODUCTION

During February and March of 2025, a Preliminary Geotechnical and Infiltration Feasibility Investigation was performed by LOR Geotechnical Group, Inc., for three proposed commercial buildings within Assessor's Parcel Number (APN) 0463-441-074, Apple Valley, California. The purpose of this investigation was to provide a technical evaluation of the geologic setting of the site and to provide geotechnical design recommendations for the proposed development. The scope of our services included:

- Review of available geotechnical literature, reports, maps, and agency information pertinent to the study area;
- Interpretation of aerial photographs of the site and surrounding regions dated 1952 through 2024;
- Geologic field reconnaissance mapping to verify the areal distribution of earth units and significance of surficial features as compiled from documents, literature, and reports reviewed;
- A subsurface field investigation to determine the physical soil conditions pertinent to the proposed development;
- Laboratory testing of selected soil samples obtained during the field investigation;
- Development of geotechnical recommendations for site grading and foundation design; and
- Preparation of this report summarizing our findings, and providing conclusions and recommendations for site development.

The approximate location of the site is shown on the attached Index Map, Enclosure A-1, within Appendix A.

PROJECT CONSIDERATIONS

To orient our investigation at the site, a Site Plan prepared by Joshua Grading Development, dated December 2024, was furnished for our use. The current site conditions and proposed building configuration were indicated on this plan. The Site Plan was utilized as a base map for our field investigation and is presented as Enclosure A-2, within Appendix A.

As noted on the site plan, development of the site will include two single story and one double story, 10,000 square foot commercial buildings. Light to moderate foundation loads are anticipated with this type of structure.

Grading plans were not provided. However, based on the current topography of the site and adjacent areas, very minor cuts and fills are anticipated to create level surfaces for the proposed improvements.

AERIAL PHOTO ANALYSIS

The aerial photographs reviewed consisted of vertical aerial photograph images of varying scales. We reviewed imagery available from Google Earth Pro (2025) computer software and from online Historic Aerials (2025).

To summarize briefly, the site has remained vacant, natural land from prior to 1952 to present. Grading of the surrounding dirt roads occurred between 1984 and 1994. Aside from this, the site has remained in a relatively natural state. No evidence for the presence of faults traversing the site area or mass movement features was noted during our review of the photographs covering the site and nearby vicinity.

EXISTING SITE CONDITIONS

The approximately 10-acre site is located in the Town of Apple Valley, California, approximately 0.40 miles east of Dale Evans Parkway and along the south side of Quarry Road. The property consists of vacant desert land with sparse vegetation. The site slopes gently to the southwest. A wire fence runs along the northern portion, separating the site from Quarry Road. Trash and debris are abundant locally. Similar vacant desert land borders the site to the east, west, and south, with more vacant land beyond.

SUBSURFACE FIELD INVESTIGATION

Our subsurface field exploration program was conducted on February 11, 2025. The work consisted of advancing a total of 5 exploratory borings using a truck-mounted drill rig equipped with 8-inch diameter hollow stem augers. In addition, 4 borehole percolation tests were conducted in general accordance with the Shallow Percolation Test procedure as outlined in the Technical Guidance Document for Water Quality Management Plans (CDM Smith, 2013). The approximate locations of our exploratory borings and percolation tests are presented on Enclosure A-2, within Appendix A.

.

The subsurface conditions encountered in the exploratory borings were logged by a geologist from this firm. The borings were drilled to depths ranging from approximately 15.42 to a refusal depth of approximately 40.42 feet below the existing ground surface. Relatively undisturbed and bulk samples were obtained at a maximum depth interval of 5 feet, and returned to our geotechnical laboratory in sealed containers for further testing and evaluation.

A detailed description of the subsurface field exploration program and the boring logs are presented in Appendix B.

LABORATORY TESTING PROGRAM

Selected soil samples obtained during the field investigation were subjected to geotechnical laboratory testing to evaluate their physical and engineering properties. Laboratory testing included in-place moisture content and dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, expansion index, and corrosion screening. Physical testing was conducted in our geotechnical laboratory and chemical testing was conducted by our subconsultant, Project X Corrosion Engineering. A detailed description of the geotechnical laboratory testing program and the test results are presented in Appendix D.

GEOLOGIC CONDITIONS

Regional Geologic Setting

The site is situated along the southern edge of the Mojave Desert on a series of coalescing alluvial fans and terraces collectively referred to as the Cajon Fan. These fans and terraces have formed from sediment eroded from the San Gabriel and San Bernardino Mountains in Pleistocene and Recent times. The subject site is generally located on a large, wide fan region within the Cajon Fan series, referred to as the Baldy Mesa Fan. The Baldy Mesa Fan slopes to the northeast and is composed predominantly of silty sand and poorly graded to well graded sand, with lesser amounts of clayey sand and sandy clay. These fans lie on a very thick sequence of terrestrial sedimentary rocks, which in turn overlie crystalline bedrock (Dibblee, 1960).

This area north of the San Gabriel Mountains lies along the southeastern portion of a larger geomorphic province in southern California known as the Mojave Desert. The Mojave Desert geomorphic province is essentially a very large, wedge shaped, alluviated plain of comparatively low relief, containing irregularly trending bedrock hills and low mountains.

The Mojave Desert province is bounded on the southwest by the San Andreas fault zone and on the north by the Garlock fault zone. The eastern boundary of the Mojave Desert geomorphic province is not distinct, but gradually converges with the Basin and Range geomorphic province east of Death Valley and into Arizona and Nevada. The province is broken by many internal, major but discontinuous faults, predominately trending to the northwest showing rough parallelism with the trend of the San Andreas. Most of these faults have been active within the last 1.6 million years and many are still considered to be active or potentially active.

The closest known active fault to the subject site noted in the documents reviewed during our study is the Helendale fault located approximately 4.3 kilometers (2.7 miles) northeast of the site. A complete listing of the distances to known active faults in relation to the site is given in the Faulting section of this report.

The site and the regional geologic setting are shown on Enclosure A-3 within Appendix A.

Site Geologic Conditions

Alluvium: Alluvial materials were encountered within all of our exploratory borings to a depth of approximately 10 to 15 feet. These units were noted to mainly consist of silty sand with minor clayey sand and well graded sand with silt. These materials were typically light brown to reddish brown in color and were noted to contain abundant secondary calcite and trace pinhole porosity. The alluvial materials were in a relatively medium dense/very stiff to dense state at the surface becoming dense to very dense with depth based on our equivalent Standard Penetration Test (SPT) data and in-place density testing. Expansion index testing indicates a low expansion of the materials tested.

Bedrock: Igneous bedrock was encountered within all of our exploratory borings underlying the alluvial materials above to the maximum depths explored. These units were encountered at depths of approximately 10 to 15 feet and were noted to mainly consist of dry, light brown, coarse to medium grained granitic rock. The bedrock was in a very hard state based on our equivalent Standard Penetration Test (SPT) data and in-place density testing. Refusal was experienced within these materials at a depth of approximately 40 feet.

A detailed description of the subsurface soil and bedrock conditions as encountered within our exploratory borings is presented on the Boring Logs within Appendix B.

Groundwater Hydrology

Groundwater was not encountered within any of exploratory borings as advanced to a maximum depth of approximately 40.42 feet below the existing ground surface elevation of approximately 3,074 feet.

In order to estimate the approximate depth to groundwater in the site area, a search was conducted for local groundwater (well) level measurements within the State of California Department of Water Resources online database (CDWR, 2025). There were abundant wells within a one mile radius of the site however, groundwater measurements were limited within these wells. Most wells had one questionable recorded groundwater reading from the 1950's.

The well with the most readings within a one mile radius of the site is Local Well 06N03W17B001S located approximately 0.80 miles to the west of the site with 7 measurements from 1953 to 1957. The referenced ground surface elevation is 3,052 feet and depth to ground water is referenced at approximately 2,980 feet suggesting that the ground water elevation at the site is greater than 90 feet.

Additionally, since the site is underlain by bedrock at relatively shallow depths, groundwater may be present only as groundwater seeps within bedrock fractures at the site. Groundwater may seep into the bedrock beneath the site region along fractures and joints within the bedrock, the presence of bedrock beneath the site generally precludes the development of groundwater conditions or a groundwater table in these areas. Any groundwater that might be encountered during site development would likely be the result of infiltration of surface waters/irrigation waters traveling downward into the bedrock along these joints and fractures.

Based on this information, groundwater is not anticipated to be an adverse factor in site development.

Mass Movement

The site lies on a relatively flat surface. The occurrence of mass movement failures such as landslides, rockfalls, or debris flows within such areas is generally not considered common, and no evidence of mass movement was observed on the site.

Faulting

No active or potentially active faults are known to exist at the subject site. In addition, the subject site does not lie within a current State of California Earthquake Fault Zone (Hart and Bryant, 2010) nor does the site lie within a County of San Bernardino fault zone. No evidence of faulting projecting into or crossing the site was noted during our aerial photograph review or our review of published geologic maps.

As previously mentioned, the closest known active fault is the Helendale fault, located approximately 4.3 kilometers (2.7 miles) to the northeast. In addition, other relatively close active faults include the North Frontal fault located approximately 20.0 kilometers (12.4 miles) to the south, the Cleghorn fault located approximately 36.0 kilometers (22.4 miles) to the southwest, and the San Andreas fault located about 45 kilometers (28 miles) to the southwest.

The Helendale fault is a right-lateral strike slip fault. This fault has been active very recently. It is believed that the Helendale fault is capable of producing an earthquake magnitude on the order of 6.5 to 7.3.

The North Frontal fault zone of the San Bernardino Mountains is a zone consisting of numerous fault segments, many of which have their own names. The primary sense of slip is south dipping thrust. This fault seems to be offset (right-laterally) by the Helendale fault. It is believed that the North Frontal fault zone is capable of producing an earthquake magnitude on the order of 6.0 to 7.1.

The Cleghorn fault of the San Bernardino Mountains is a left-lateral strike-slip fault. The exact nature of the activity of this fault is questionable. The local landscape does not seem to express the reported slip rate (0.3 mm/yr) and some have dismissed Holocene displacement and rupture surfaces as caused by landsliding, not faulting. However, it is believed that the Cleghorn fault is capable of producing an earthquake magnitude on the order of 6.5.

The San Andreas fault is considered to be the major tectonic feature of California, separating the Pacific Plate and the North American Plate. While estimates vary, the San Andreas fault is generally thought to have an average slip rate on the order of 24mm/yr and capable of generating large magnitude events on the order of 7.5.

Current standards of practice included a discussion of all potential earthquake sources within a 100 kilometer (62 mile) radius. However, while there are other large earthquake faults within a 100 kilometer (62-mile) radius of the site, none of these are considered as relevant to the site as the faults described above, due to their greater distance and/or smaller anticipated magnitudes.

Historical Seismicity

In order to obtain a general perspective of the historical seismicity of the site and surrounding region a search was conducted for seismic events at and around the area within various radii. This search was conducted utilizing the historical seismic search website of the U.S.G.S. (2025). This website conducts a search of a user selected cataloged seismic events database, within a specified radius and selected magnitudes, and then plots the events onto a map. At the time of our search, the database contained data from January 1, 1932 through March 6, 2025.

In our first search, the general seismicity of the region was analyzed by selecting an epicenter map listing all events of magnitude 4.0 and greater, recorded since 1932, within a 100 kilometer (62 mile) radius of the site, in accordance with guidelines of the California Division of Mines and Geology. This map illustrates the regional seismic history of moderate to large events. As depicted on Enclosure A-4, within Appendix A, the site lies within a relatively active region associated with the San Andreas fault and various Mojave Desert faults to the east.

In the second search, the micro seismicity of the area lying within a 15 kilometer (9.2 mile) radius of the site was examined by selecting an epicenter map listing events on the order of 1.0 and greater since 1978. The results of this search is a map that presents the seismic history around the area of the site with much greater detail, not permitted on the larger map. The reason for limiting the time period for the events on the detail map is to enhance the accuracy of the map. Events recorded prior to the mid to late1970's are generally considered to be less accurate due to advancements in technology. As depicted on this map, Enclosure A-5, the Helendale fault appears to be the source of numerous events.

In summary, the historical seismicity of the site entails numerous small to medium magnitude earthquake events occurring in the region around the subject site. Any future developments at the subject site should anticipate that moderate to large seismic events could occur very near the site.

Secondary Seismic Hazards

Other secondary seismic hazards generally associated with severe ground shaking during an earthquake include liquefaction, seismic-induced settlement, seiches and tsunamis, earthquake induced flooding, landsliding, and rockfalls.

Liquefaction: The potential for liquefaction generally occurs during strong ground shaking within granular loose sediments where the groundwater is usually less than 50 feet below the ground surface. As groundwater is anticipated to lie greater than 50 feet beneath the site and the site is underlain by igneous bedrock at relatively shallow depths, the possibility of liquefaction at the site is considered nil.

Seiches/Tsunamis: The potential for the site to be affected by a seiche or tsunami (earthquake generated wave) is considered nil due to absence of any large bodies of water near the site.

Flooding (Water Storage Facility Failure): There are no large water storage facilities located on or near the site which could possibly rupture during in earthquake and affect the site by flooding.

Seismically-Induced Landsliding: Due to the low relief of the site and surrounding region, the potential for landslides to occur at the site is considered nil.

Rockfalls: No large, exposed, loose or unrooted boulders are present above the site that could affect the integrity of the site.

Seismically-Induced Settlement: Settlement generally occurs within areas of loose, granular soils with relatively low density. Since the site is underlain by relatively dense alluvial materials and igneous bedrock, the potential for settlement is considered very low. In addition, the recommended earthwork operations to be conducted during the development of the site should mitigate any near surface loose soil conditions.

SOILS AND SEISMIC DESIGN CRITERIA (California Building Code 2022)

Design requirements for structures can be found within Chapter 16 of the 2022 California Building Code (CBC) based on building type, use, and/or occupancy. The classification of use and occupancy of all proposed structures at the site, shall be the responsibility of the building official.

Site Classification

Chapter 20 of the ASCE 7-16 defines six possible site classes for earth materials that underlie any given site. Our investigation, mapping by others, and our experience in the site region indicates that the materials beneath the site are considered Site Class C very dense soil and soft rock.

CBC Earthquake Design Summary

Earthquake design criteria have been formulated in accordance with the 2022 CBC and ASCE 7-16 for the site based on the results of our investigation to determine the Site Class and an assumed Risk Category II. However, these values should be reviewed and the final design should be performed by a qualified structural engineer familiar with the region. In addition, the building official should confirm the Risk Category utilized in our design (Risk Category II). Our design values are provided below:

CBC 2022/ASCE 7-16 SEISMIC DESIGN SUMMARY* Site Location (USGS WGS84) 34.6146, -117.1989, Risk Category II	
Site Class Definition Chapter 20 ASCE 7	C
$\mathbf{S_s}$ Mapped Spectral Response Acceleration at 0.2s Period	1.015
$\mathbf{S_1}$ Mapped Spectral Response Acceleration at 1s Period	0.391
$\mathbf{S_{MS}}$ Adjusted Spectral Response Acceleration at 0.2s Period	1.218
$\mathbf{S_{M1}}$Adjusted Spectral Response Acceleration at 1s Period	0.586
$\mathbf{S_{DS}}$ Design Spectral Response Acceleration at 0.2s Period	0.812
$\mathbf{S_{D1}}$ Design Spectral Response Acceleration at 1s Period	0.391
$\mathbf{F_a}$ Short Period Site Coefficient at 0.2s Period	1.2
$\mathbf{F_v}$ Long Period Site Coefficient at 1s Period	1.5
$\mathbf{PGA_M}$ Site Modified Peak Ground Acceleration	0.524
Seismic Design Category	C
*Values obtained from OSHPD Seismic Design Maps Tool	

CONCLUSIONS

This investigation provides a broad overview of the geotechnical and geologic factors which are expected to influence future site planning and development. On the basis of our field investigation and testing program, it is the opinion of LOR Geotechnical Group, Inc., that the proposed development of the site for the proposed use is feasible from a geotechnical standpoint, provided the recommendations presented in this report are incorporated into design and implemented during grading and construction.

It should be noted that the subsurface conditions encountered in our exploratory borings are indicative of the locations explored and the subsurface conditions may vary. If conditions are encountered during the construction of the project that differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided.

Foundation Support

To provide adequate support for the proposed structures, we recommend that a compacted fill mat be constructed beneath footings and slabs. The compacted fill mat will provide a dense, high-strength soil layer to uniformly distribute the anticipated foundation loads over the underlying soils.

Conventional foundation systems utilizing either individual spread footings and/or continuous wall footings will provide adequate support for the anticipated downward and lateral loads when utilized in conjunction with the recommended fill mat.

Soil Expansiveness

The upper materials encountered during this investigation were tested and found to have a low expansion potential. Specialized construction procedures to specifically resist expansive soil activity for this type of soil are required and are provided within.

Corrosion Screening

A select representative sample from our borings was taken to Project X Corrosion Engineering for full corrosion series testing. Results from soil corrosivity testing completed by Project X Corrosion Engineering are presented within Appendix D.

The corrosivity test results indicate that soluble sulfate concentrations in the samples were 0.06 to 0.23 percent by weight. These concentrations indicate an exposure class of S0 to S2 for sulfate (ACI 318). Special mitigation methods are considered necessary.

The corrosivity test results indicate that chloride concentrations were below 500 ppm. This concentration indicates an exposure class C1 for chloride (ACI 318). Special mitigation measures are not considered necessary.

Soil pH for the sample was 7.6 and 8.5, neutral to slightly basic. Therefore, the need for specialized design is not anticipated.

Concentrations of ammonium and nitrate indicate the soil may be aggressive towards copper.

Resistivity result for the sample indicates the soil is severely corrosive to ferrous metals.

LOR Geotechnical does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer should be consulted.

Infiltration

The results of our field investigation and test data indicate marginal infiltration characteristics for the soils tested with clear water results ranging from 1.4 to 3.3 inches per hour.

Geologic Mitigations

No special mitigation methods are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

Seismicity

Seismic ground rupture is generally considered most likely to occur along pre-existing active faults. Since no known faults are known to exist at, or project into the site, the probability of ground surface rupture occurring at the site is considered nil.

Due to the site's close proximity to the faults described above, it is reasonable to expect a relatively strong ground motion seismic event to occur during the lifetime of the proposed

development on the site. Large earthquakes could occur on other faults in the general area, but because of their lesser anticipated magnitude and/or greater distance, they are considered less significant than the faults described above from a ground motion standpoint.

The effects of ground shaking anticipated at the subject site should be mitigated by the seismic design requirements and procedures outlined in Chapter 16 of the California Building Code. However, it should be noted that the current building code requires the minimum design to allow a structure to remain standing after a seismic event, in order to allow for safe evacuation. A structure built to code may still sustain damage which might ultimately result in the demolishing of the structure (Larson and Slosson, 1992).

No secondary seismic hazards are anticipated to impact the proposed development.

RECOMMENDATIONS

Geologic Recommendations

No special geologic recommendations are deemed necessary at this time, other than the geotechnical recommendations provided in the following sections.

General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer. An onsite, pre-job meeting with the developer, the contractor, the jurisdictional agency, and the geotechnical engineer should occur prior to all grading related operations. Operations undertaken at the site without the geotechnical engineer present may result in exclusions of affected areas from the final compaction report for the project.

Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the California Building Code, and/or applicable local ordinances.

All areas to be graded should be stripped of significant vegetation and other deleterious materials. Any undocumented fill encountered during grading should be completely removed, cleaned of significant deleterious materials and may then be reused as compacted fill. It is our recommendation that any existing fills under any proposed flatwork and paved areas be removed and replaced with engineered compacted fill. If this is not

done, premature structural distress (settlement) of the flatwork and pavement may occur. Cavities created by the removal of any subsurface obstructions that could be encountered, such as foundations, utilities, and septic systems associated with the previous on-site development should be thoroughly cleaned of loose soil, organic matter and other deleterious materials, shaped to provide access for construction equipment, and backfilled as recommended in the following Engineered Compacted Fill section of this report.

Initial Site Preparation

The existing loose alluvial soils and any existing fill materials (if encountered) should be removed from all proposed structural and/or fill areas. The data developed during this investigation indicates that removals on the order of 2 to 3 feet deep will be required from proposed development areas in order to encounter competent alluvium upon which engineered compacted fill can be placed. The given removal depths are preliminary. Deeper removals may be required locally. Removals should expose alluvial materials with an in-situ relative compaction of at least 85 percent (ASTM D 1557). The actual depths of the removals should be determined during the grading operation by observation and/or in-place density testing.

Preparation of Fill Areas

Prior to placing fill, the surfaces of all areas to receive fill should be scarified to a minimum depth of 12 inches. The scarified soil should be brought to near optimum moisture content and compacted to a relative compaction of at least 90 percent (ASTM D 1557).

Engineered Compacted Fill

The onsite soils should provide adequate quality fill material, provided they are free from oversized and/or organic matter and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 6 inches should not be buried or placed in fills.

If required, import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6 inches in maximum dimension. Sources for import fill should be approved by the geotechnical engineer prior to their use. Fill should be spread in maximum 8-inch uniform, loose lifts, each lift brought to near optimum moisture content, and compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Preparation of Foundation Areas

All footings should rest upon at least 24 inches of properly compacted fill material placed over competent alluvium. In areas where the required fill thickness is not accomplished by the recommended removals or by site rough grading, the footing areas should be further subexcavated to a depth of at least 24 inches below the proposed footing base grade, with the subexcavation extending at least 5 feet beyond the footing lines. The bottom of all excavations should be scarified to a depth of 12 inches, brought to near optimum moisture content, and recompacted to at least 90 percent relative compaction (ASTM D 1557) prior to the placement of compacted fill.

Concrete floor slabs should bear on a minimum of 24 inches of compacted soil. This should be accomplished by the recommendations provided above. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Short-Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations 5 feet deep and greater should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements. Short-term excavations of 5 feet deep and greater will conform to Title 8 of the California Code of Regulations, Construction Safety Orders, Section 1504 and 1539 through 1547. Based on the findings from our exploratory borings, it appears that Type C soils are the predominant type of soil on the project and all short-term excavations should be based on this type of soil.

Deviation from the standard short-term slopes are permitted using option four, Design by a Registered Professional Engineer (Section 1541.1).

Short-term excavation construction and maintenance are the responsibility of the contractor and should be a consideration of his methods of operation and the actual soil conditions encountered.

Slope Construction

Preliminary data indicates that cut and fill slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Slope Protection

Since the site soil materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after the completion of grading. The use of succulent ground covers such as iceplant or sedum is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Soil Expansiveness

The upper materials encountered during this investigation were tested and found to have a low expansion potential. Specialized construction procedures to specifically resist expansive soil activity are required and are provided within.

Additional evaluation of on-site and any imported soils for their expansion potential should be conducted following completion of the grading operation.

Foundation Design

If the site is prepared as recommended, the proposed structures may be safely supported on conventional shallow foundations, either individual spread footings and/or continuous wall footings, bearing entirely on a minimum of 24 inches of engineered compacted fill placed over competent alluvial materials. All foundations should have a minimum width of 12 inches. Footings placed upon low expansive soils should be established a minimum of 18 inches below lowest adjacent grade.

For the minimum width and depth, spread foundations may be designed using an allowable bearing pressure of 2,000 psf. This bearing pressure may be increased by 200 psf for each additional foot of width, and by 500 psf for each additional foot of depth, up to a maximum of 4,000 psf. For example, a footing 2 feet wide and embedded 2 feet will have an allowable bearing pressure of 2,700 psf.

The above values are net pressures; therefore, the weight of the foundations and the backfill over the foundations may be neglected when computing dead loads. The values apply to the maximum edge pressure for foundations subjected to eccentric loads or overturning. The recommended pressures apply for the total of dead plus frequently

applied live loads, and incorporate a factor of safety of at least 3.0. The allowable bearing pressures may be increased by one-third for temporary wind or seismic loading.

The resultant of the combined vertical and lateral seismic loads should act within the middle one-third of the footing width. The maximum calculated edge pressure under the toe of foundations subjected to eccentric loads or overturning should not exceed the increased allowable pressure.

Resistance to lateral loads will be provided by passive earth pressure and base friction. For footings bearing against compacted fill, passive earth pressure may be considered to be developed at a rate of 400 pounds per square foot per foot of depth. Base friction may be computed at 0.35 times the normal load. Base friction and passive earth pressure may be combined without reduction. These values are for dead load plus live load and may be increased by one-third for wind or seismic loading.

Due to the presence of low expansive soils at the site, footings should be reinforced with a minimum of two #4 rebars, one near the top and one near the bottom of the footings. More stringent parameters may be given by the structural engineer.

Settlement

Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Maximum settlement of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be on the order of 0.5 inch. Differential settlements between adjacent footings should be about one-half of the total settlement. Settlement of all foundations is expected to occur rapidly, primarily as a result of elastic compression of supporting soils as the loads are applied, and should be essentially completed shortly after initial application of the loads.

Building Area Slab-on-Grade

To provide adequate support, concrete floor slabs-on-grade should bear on a minimum of 24 inches of engineered fill compacted soil placed over competent alluvium. The final pad surfaces should be rolled to provide smooth, dense surfaces.

Due to the presence of low expansive soils at the site, minimum slab reinforcement should consist of # 3 rebars placed at a maximum spacing of 18 inches on center, each way. Unless more stringent parameters are given by the structural engineer, the slab thickness should be a minimum of 4 inches.

Slabs to receive moisture-sensitive coverings should be provided with a moisture vapor retarder/barrier. We recommend that a vapor retarder/barrier be designed and constructed according to the American Concrete Institute 302.1R, Concrete Floor and Slab Construction, which addresses moisture vapor retarder/barrier construction. At a minimum, the vapor retarder/barrier should comply with ASTM E1745 and have a nominal thickness of at least 10 mils. The vapor retarder/barrier should be properly sealed, per the manufacturer's recommendations, and protected from punctures and other damage.

Per the Portland Cement Association, floor slabs with vapor-sensitive coverings, a layer of dry, granular material (sand) should be placed under the vapor retarder/barrier.

For slabs in humidity-controlled areas, a layer of dry, granular material (sand) should be placed above the vapor retarder/barrier.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

The recommendations to counteract generally low expansive soil activity should be considered preliminary and should be revised upon the completion of the site grading. The given parameters are also subject to review of the project structural engineer experienced in expansive soil issues.

Exterior Flatwork

To provide adequate support, exterior flatwork improvements should rest on a minimum of 12 inches of soil compacted to at least 90 percent (ASTM D 1557).

Due to the presence of low expansive soils at the site, sidewalks, patio slabs, and driveways with a minimum dimension greater than 5 feet should be reinforced with # 3 rebars placed at a maximum spacing of 18 inches on center, each way. Reinforcement for curbing should be one continuous # 4 rebar at top and bottom. In addition, it is recommended that sidewalks, patio slabs, curbs, etc., have thickness of at least 4 inches, with saw cuts every 10 feet or less. Driveways should be at least 6-inch thick, with saw cuts every 15 feet or less.

Flatwork areas should be pre-saturated to 2 to 4 percent over optimum prior to placing concrete.

Again these recommendations to mitigate generally expansive soil activity should be considered preliminary and should be revised upon completion of the site grading.

The given parameters are also subject to review of the project structural engineer experienced in expansive soil issues.

Flatwork surface should be sloped a minimum of 1 percent away from buildings and slopes, to approved drainage structures.

Wall Pressures

The design of footings for retaining walls should be performed in accordance with the recommendations described earlier under Preparation of Foundation Areas and Foundation Design. For design of retaining wall footings, the resultant of the applied loads should act in the middle one-third of the footing, and the maximum edge pressure should not exceed the basic allowable value without increase.

For design of retaining walls unrestrained against movement at the top, we recommend an active pressure of 40 pounds per square foot (psf) per foot of depth be used. This assumes level backfill consisting of compacted, non-expansive, on-site soils placed against the structures and within the back cut slope extending upward from the base of the stem at 35 degrees from the vertical or flatter.

Retaining structures subject to uniform surcharge loads within a horizontal distance behind the structures equal to the structural height should be designed to resist additional lateral loads equal to 0.40 times the surcharge load. Any isolated or line loads from adjacent foundations or vehicular loading will impose additional wall loads and should be considered individually.

As noted before, low expansive soils are present at the site. Since these materials have a very low permeability, very uncertain behavior, and exert much higher lateral earth pressures on retaining structures, they should not be used as wall backfills. Select grading or import is anticipated.

To avoid over stressing or excessive tilting during placement of backfill behind walls, heavy compaction equipment should not be allowed within the zone delineated by a 45-degree line extending from the base of the wall to the fill surface. The backfill directly behind the walls should be compacted using light equipment such as hand operated vibrating plates

and rollers. No material larger than three inches in diameter should be placed in direct contact with the wall.

Wall pressures should be verified prior to construction, when the actual backfill materials and conditions have been determined. Recommended pressures are applicable only to level, non-expansive, properly drained backfill with no additional surcharge loadings. If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters.

Preliminary Pavement Design

Testing and design for preliminary onsite pavement was conducted in accordance with California Highway Design Manual and the Guild for the Design and Construction of Concrete Parking Lot (ACI33OR).

Based upon our preliminary sampling and testing, and upon an assumed Traffic Index generally used for similar projects, it appears that the structural section tabulated below should provide satisfactory pavements for the subject on-site pavement improvements:

AREA	T.I.	DESIGN R-VALUE	PRELIMINARY SECTION
On site vehicular parking	5.0	30	0.25’ AC / 0.45 AB
On site vehicular drive isles with occasional truck traffic (ADTT=10)	6.0	30	0.25’ AC / 0.70' AB or 5" JPCP / 4" AB
Light to moderate truck traffic (ADTT=25)	7.0	30	0.30’ AC / 0.85' AB or 6" JPCP / 4" AB
Moderate to heavy truck traffic (ADTT=100)	--	30	6.5" JPCP / 4" AB
AC - Asphalt Concrete AB - Class 2 Aggregate Base JPCP - Jointed Plain Concrete Pavement with MR ≥550 psi			

The above structural sections are predicated upon 90 percent relative compaction (ASTM D 1557) of all utility trench backfills and 95 percent relative compaction (ASTM D 1557) of the upper 12 inches of pavement subgrade soils and of any aggregate base utilized. In addition, the aggregate base should meet Caltrans specifications for Class 2 Aggregate Base.

The recommended concrete pavement sections should have a minimum modulus of rupture (MR) of 550 pounds per square inch (psi). Traverse joints should be sawcut in the pavement at approximately 12 to 15-foot intervals within 4 to 6 hours of concrete placement, or preferably sooner. Sawcut depth should be equal to approximately one quarter of slab thickness. Construction joints should be constructed such that adjacent sections butt directly against each other and are keyed into each other. Parallel pavement sections should also be keyed into each other.

In areas of the pavement which will receive high abrasion loads due to start-ups and stops or where trucks will move on a tight turning radius, consideration should be given to installing concrete pads. Such pads should be a minimum of 5-inch thick concrete over 4-inches of aggregate base. Concrete pads are also recommended in areas adjacent to trash storage areas where heavier loads occur due to operation of trucks lifting trash dumpsters.

It should be noted that all of the above pavement design was based upon results of preliminary sampling and testing, and should be verified by additional sampling and testing during construction when the actual subgrade soils are exposed.

Infiltration

Based upon our field investigation and infiltration test data, an average clear water absorption rate of approximately 2.0 inches per hour for the proposed water retention systems in the western and southern portions of the site was obtained. It is our opinion that a design clear water rate of 2.0 inches per hour is appropriate for the planned infiltration in the area and at the depths tested.

A factor of safety should be applied as indicated by the Technical Guidance Document for Water Quality Management Plans (CDM Smith, 2013). The design infiltration rate should be adjusted using Worksheet H, using the following factor values in determination of the suitability assessment, S_A:

Factor Category		Factor Description	Assigned Weight (w)	Factor Value (v)	Product (p) p = w x v
A	Suitability Assessment	Soil assessment method	0.25	1	0.25
		Predominant soil texture	0.25	1	0.25
		Site soil variability	0.25	2	0.50
		Depth to groundwater/impervious layer	0.25	1	0.25
		Suitability Assessment Safety Factor, $S_A = \sum p$			1.25

The project design engineer should determine the suitability assessment S_B.

To ensure continued infiltration capability of the infiltration area, a program to maintain the facility should be considered. This program should include periodic removal of accumulated materials, which can slow the infiltration considerably and decrease the water quality. Materials to be removed from the catch basin areas typically consist of litter, dead plant matter, and soil fines (silts and clays). Proper maintenance of the system is critical. A maintenance program should be prepared and properly executed. At a minimum, the program should be as outlined in the Technical Guidance Document for Water Quality Management Plans (CDM Smith, 2013).

The program should also incorporate the recommendations contained within this report and any other jurisdictional agency requirements.

- Systems should be set back at least 10 feet from foundations or as required by the design engineer.

- Any geotextile filter fabric utilized should consist of such that it prevents soil piping but has greater permeability than the existing soil.

During site development, care should be taken to not disturb the area(s) proposed for infiltration as changes in the soil structure could occur resulting in a change of the soil infiltration characteristics.

Corrosion Protection

Based on the test results, this soil is classified as severely corrosive to ferrous metals and potentially aggressive towards copper. In addition, the soils are considered exposure class S2 per ACI 310 and special mitigation measures are recommended. The laboratory data above should be reviewed and corrosion design should be completed by a qualified corrosion engineer.

In lieu of corrosion design for metal piping, ABS/PVC may be used. Soil corrosion is not considered a factor with ABS/PVC materials. ABS/PVC is considered suitable for use due to the corrosion potential of the on-site soils with respect to metals.

LOR Geotechnical does not practice corrosion engineering. If further information concerning the corrosion characteristics, or interpretation of the results submitted herein, is required, then a competent corrosion engineer should be consulted.

Construction Monitoring

Post investigative services are an important and necessary continuation of this investigation. Project plans and specifications should be reviewed by the project geotechnical consultant prior to construction to confirm that the intent of the recommendations presented in this report have been incorporated into the design.

Additional R-value, expansion, and soluble sulfate content testing should be conducted after/during site rough grading.

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this investigation with the actual subsurface conditions exposed during construction. Items requiring observation and testing include, but are not necessarily limited to, the following:

1. Site preparation-stripping and removals.

2. Excavations, including approval of the bottom of excavations prior to the processing and preparation of the bottom areas for fill placement.

3. Scarifying and compacting prior to fill placement.

4. Foundation excavations.

5. Subgrade preparation for slabs-on-grade, flatwork, pavement, etc., including pre-saturation.

6. Placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by Conco Construction, and their design consultants, for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. If conditions are encountered during the construction of the project, which differ significantly from those presented in this report, this firm should be notified immediately so we may assess the impact to the recommendations provided. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc., provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report.

Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc., verifying the suitability of the conclusions and recommendations.

CLOSURE

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please do not hesitate to contact our office at your convenience.

Respectfully submitted,
LOR Geotechnical Group, Inc.

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Staff Geologist

Andrew A. Tardie, CEG 2794
Vice President

John P. Leuer, GE 2030
President

CC:AAT:JPL:ss





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REFERENCES

American Concrete Institute, 2008, Guide for Design and Construction of Concrete Parking Lots, ACI 3030R-08, June 2008.

American Society of Civil Engineers, 2016, Minimum Design Load for Buildings and Other Structures, ASCE 7-16.

Building Code Requirements for Structural Concrete (ACI 318-19): An ACI Standard; Commentary on Building Code Requirements for Structural Concrete (ACI 318R-19), 2022 American Concrete Institute.

California Building Standards Commission and International Conference of Building Officials, 2022, California Building Code, 2022 Edition.

California Department of Water Resources, 2025, Online Water Data Library (WDL), https://wdl.water.ca.gov/waterdatalibrary/Map.aspx.

CDM Smith, 2013, Technical Guidance Document for Water Quality Management Plans, dated June 2013.

Dibblee, T.W., 1960, Preliminary Geologic Map of the Victorville Quadrangle, California, Mineral Investigations Field Studies Map MF-229.

Dibblee, T.W., 1965, Geologic Map of the Hesperia 15-Minute Quadrangle, San Bernardino County, California, Open-File Report OF-65-43.

Google Earth, 2025, Imagery from various years, www.google.com/earth.

Hart, E.W. and W.A. Bryant, 2010, Fault-Rupture Hazard Zones in California, California Dept. of Conservation Division of Mines and Geology Special Publication 42.

Historic Aerials (Nationwide Environmental Title Research, LLC), 2025, Imagery from Various Years, https://www.historicaerials.com/.

Larson, R., and Slosson, J., 1992, The Role of Seismic Hazard Evaluation in Engineering Reports, in Engineering Geology Practice in Southern California, AEG Special Publication Number 4, pp 191-194.

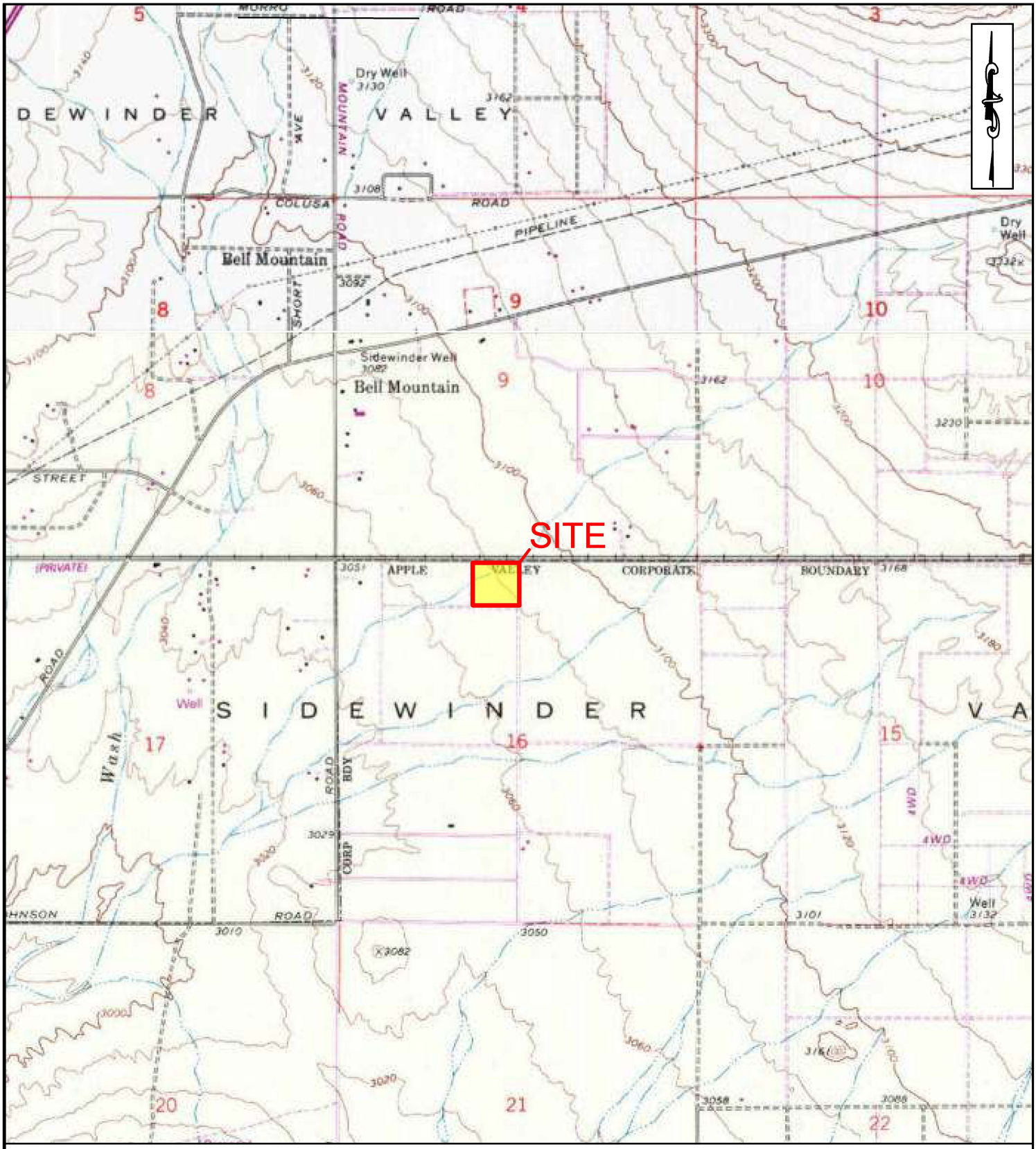
OSHPD Seismic Design Maps, 2025, https://www.seismicmaps.org/.

San Bernardino County, 2025 Land Use Services Hazard Overlay Maps; https://lus.sbcounty.gov/planning-home/zoning-and-overlay-maps/geologic-hazard-maps.

USGS, 2025, https://earthquake.usgs.gov/earthquakes/map.

APPENDIX A

Index Map, Site Plan, Regional Geologic Map, and Historical Seismicity Maps

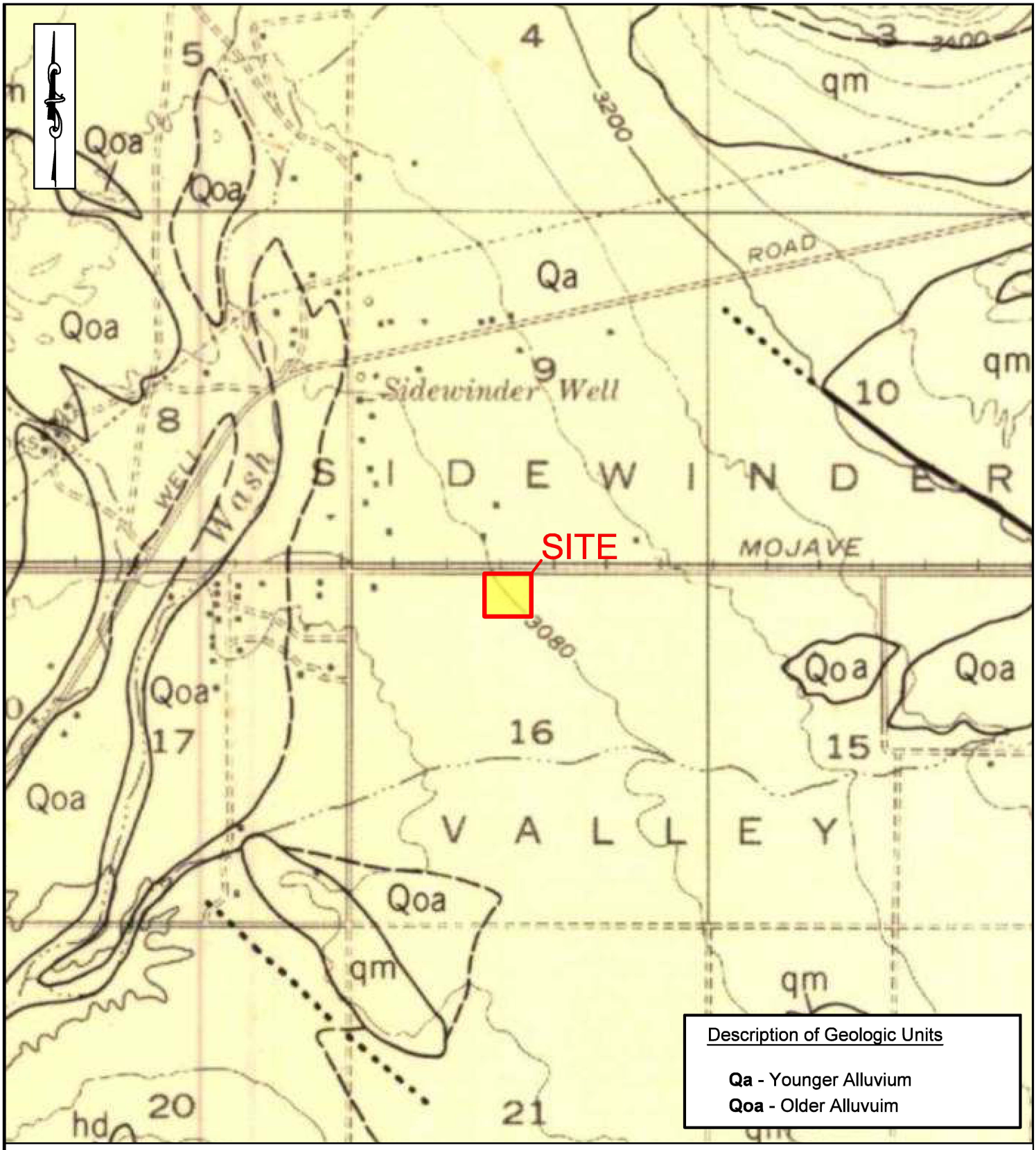


INDEX MAP

PROJECT:	Commercial Development, APN 0463-441-07, Apple Valley, California	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ENCLOSURE:**	A-1
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025
		SCALE:	1" ≈ 2,000'

SITE PLAN

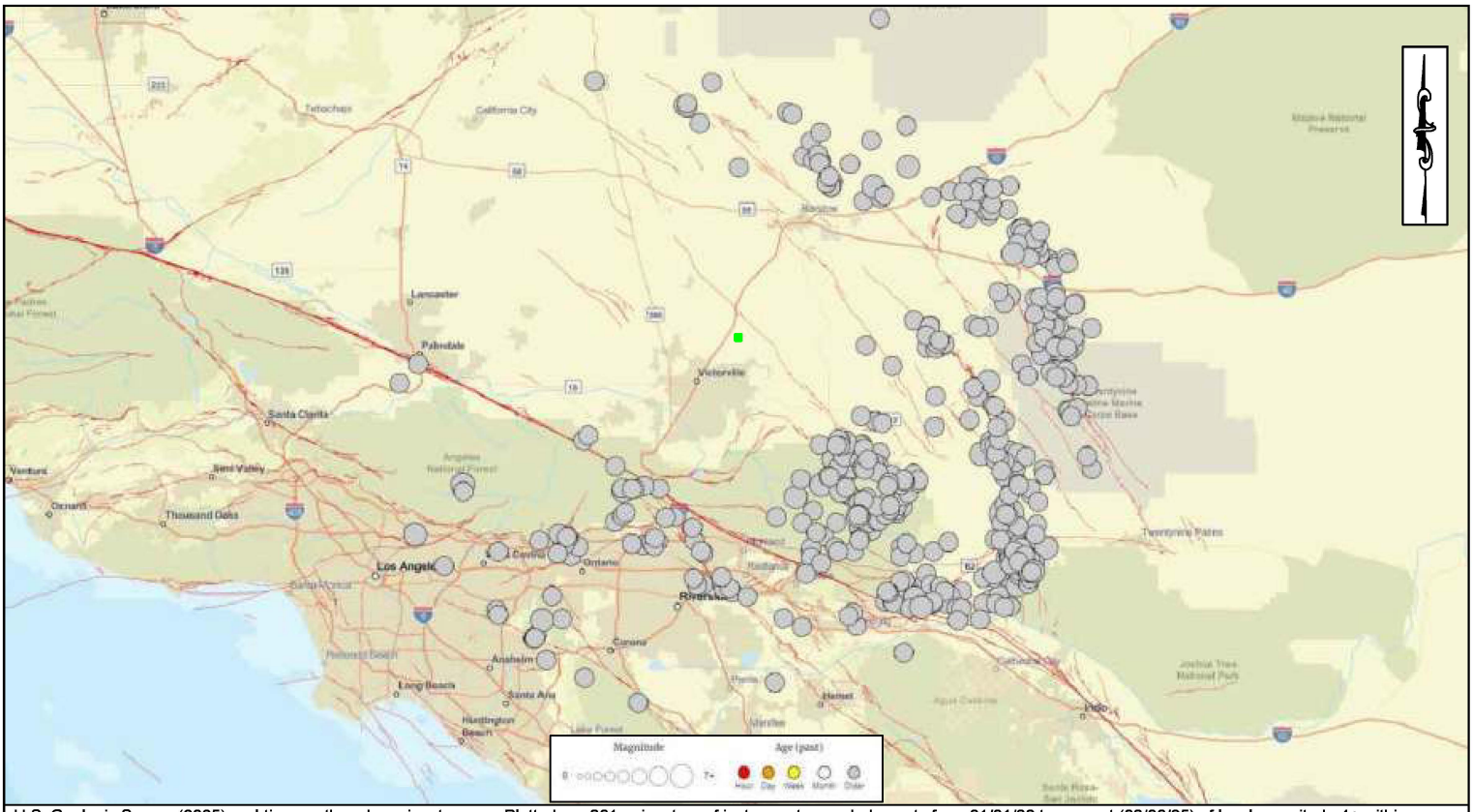
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CLIENT:	Conco Construction	**ENCLOSURE:**	A-2
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025
		SCALE:	1" ≈ 90'



REGIONAL GEOLOGIC MAP

(Dibblee Jr., 1960)

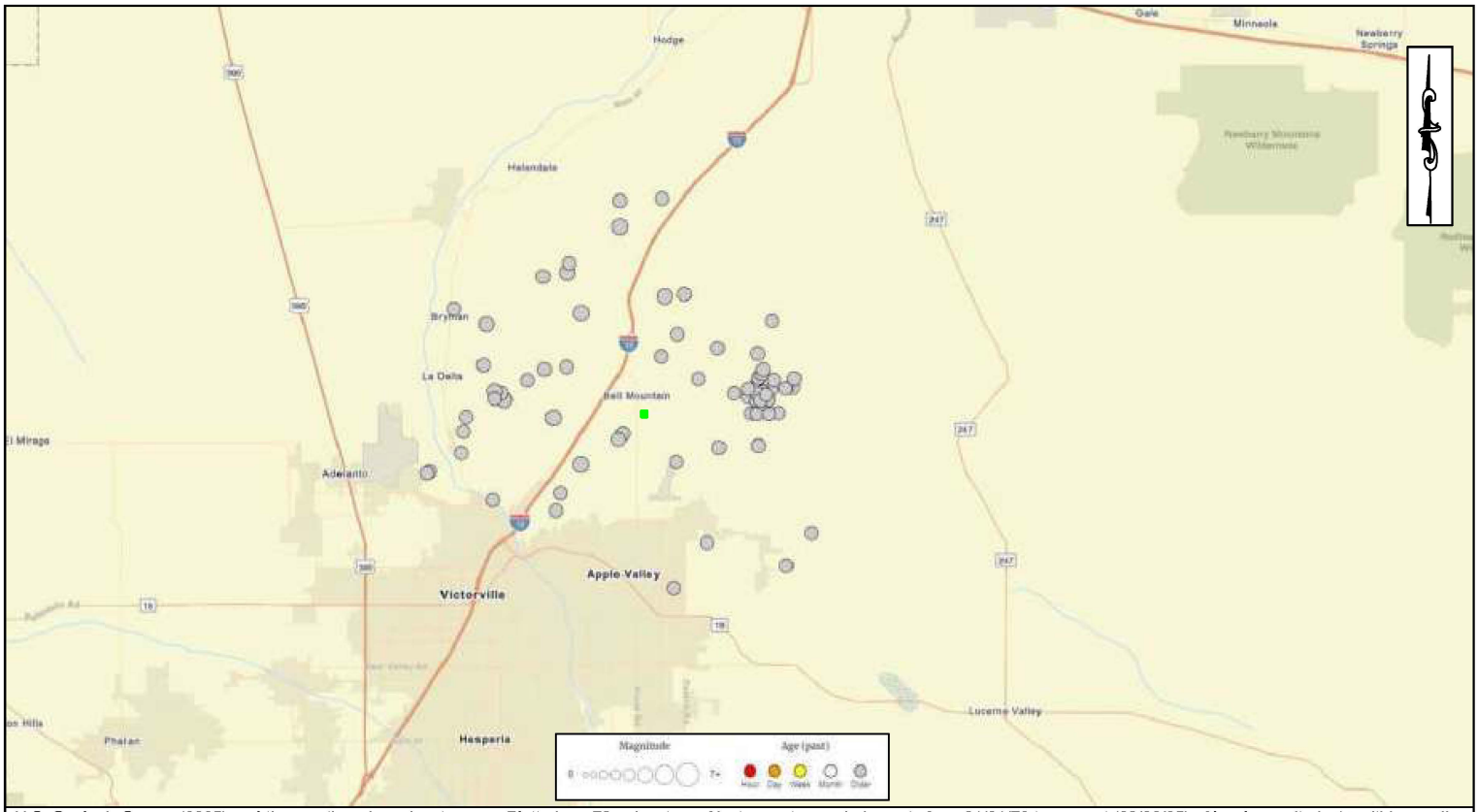
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CLIENT:	Conco Construction	**ENCLOSURE:**	A-3
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025
		SCALE:	1" ≈ 2,000'



U.S. Geologic Survey (2025) real-time earthquake epicenter map. Plotted are 361 epicenters of instrument-recorded events from 01/01/32 to present (03/06/25) of local magnitude 4+ within a radius of ~62 miles (100 kilometers) of the site. Location accuracy varies. The site is indicated by the green square (■). The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 100km Radius

PROJECT:	Commercial Development, APN 0463-441-07, Apple Valley, California	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ENCLOSURE:**	A-4
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025
		SCALE:	1" ≈ 20km



U.S. Geologic Survey (2025) real-time earthquake epicenter map. Plotted are 73 epicenters of instrument-recorded events from 01/01/78 to present (03/06/25) of local magnitude 1+ within a radius of ~9.3 miles (15 kilometers) of the site. Location accuracy varies. The site is indicated by the green square (■). The selected magnitude corresponds to a threshold intensity value where very light damage potential begins. These events are also generally widely felt by persons. Red lines mark the surface traces of known Quaternary-age faults.

HISTORICAL SEISMICITY MAP - 15km Radius

PROJECT:	Commercial Development, APN 0463-441-07, Apple Valley, California	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ENCLOSURE:**	A-5
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025
		SCALE:	1" ≈ 5km

APPENDIX B

Field Investigation Program and Boring Logs

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

Our subsurface exploration of the site consisted of drilling 5 exploratory borings to depths of approximately 15.42 feet, and a refusal depth of approximately 40.42 feet below the existing ground surface using a Mobile B-61 drill rig on February 11, 2025. The approximate locations of the borings are shown on Enclosure A-2 within Appendix A.

The drilling exploration was conducted using a Mobile B-61 drill rig equipped with 8-inch diameter hollow stem augers. The soils were continuously logged by a geologist from this firm who inspected the site, created detailed logs of the borings, obtained undisturbed, as well as disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System.

Relatively undisturbed samples of the subsoils were obtained at a maximum interval of 5 feet. The samples were recovered by using a California split barrel sampler of 2.50 inch inside diameter and 3.25 inch outside diameter or a Standard Penetration Sampler (SPT) from the ground surface to the total depth explored. The samplers were driven by a 140 pound automatic trip hammer dropped from a height of 30 inches. The number of hammer blows required to drive the sampler into the ground the final 12 inches were recorded and further converted to an equivalent SPT N-value. Factors such as efficiency of the automatic trip hammer used during this investigation (80%), borehole diameter (8"), and rod length at the test depth were considered for further computing of equivalent SPT N-values corrected for field procedures (N60) which are included in the boring logs, Enclosures B-1 through B-5.

The undisturbed soil samples were retained in brass sample rings of 2.42 inches in diameter and 1.00 inch in height, and placed in sealed plastic containers. Disturbed soil samples were obtained at selected levels within the borings and placed in sealed containers for transport to our geotechnical laboratory.

All samples obtained were taken to our geotechnical laboratory for storage and testing. Detailed logs of the borings are presented on the enclosed Boring Logs, Enclosures B-1 through B-5. A Boring Log Legend is presented on Enclosure B-i. A Soil Classification Chart is presented as Enclosure B-ii.

CONSISTENCY OF SOIL

SANDS

SPT BLOWS	CONSISTENCY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very Stiff
30-60	Hard
Over 60	Very Hard

SAMPLE KEY

Symbol	Description
	INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE
	INDICATES BULK SAMPLE
	INDICATES SAND CONE OR NUCLEAR DENSITY TEST
	INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

TYPES OF LABORATORY TESTS

1	Atterberg Limits
2	Consolidation
3	Direct Shear (undisturbed or remolded)
4	Expansion Index
5	Hydrometer
6	Organic Content
7	Proctor (4", 6", or Cal216)
8	R-value
9	Sand Equivalent
10	Sieve Analysis
11	Soluble Sulfate Content
12	Swell
13	Wash 200 Sieve

BORING LOG LEGEND

PROJECT:	Proposed Commercial Development, Apple Valley, California	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ENCLOSURE:**	B-i
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" No. 4 No. 10 No. 40 No. 200

(U.S. STANDARD SIEVE SIZE)

SOIL CLASSIFICATION CHART

PROJECT:	Proposed Commercial Development, Apple Valley, California	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ENCLOSURE:**	B-ii
LOR GEOTECHNICAL GROUP, INC.		**DATE:**	March 2025

LOG OF BORING B-1

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	27		14.0		91.8			SM	@ 0 feet, ALLUVIUM: SILTY SAND, trace gravel to 2" approximately 15% coarse grained sand, 35% medium grained sand, 25% fine grained sand, 25% silty fines, light brown, dry, disturbed in the upper 0.5'.
								SC	@ 2 feet, CLAYEY SAND, approximately 15% coarse grained sand, 35% medium grained sand, 25% fine grained sand, 25% clayey fines of low plasticity, light brown, damp.
5	61		7.1		108.1			SM	@ 5 feet, SILTY SAND, approximately 25% coarse grained sand, 25% medium grained sand, 35% fine grained sand, 15% silty fines, trace clay, white, abundant calcite coating.
	36		4.9		116.7			SW	@ 7 feet, WELL GRADED SAND, approximately, 30% coarse grained sand, 30% medium grained sand, 35% fine grained sand, 5% silty fines, light brown, damp, trace pinhole porosity, trace calcite.
10	38		7.6		107.9				
15	46 for 1"		3.0		109.4				@ 15 feet, IGNEOUS BEDROCK, slightly weathered granitics, dry, light brown, collected as well graded sand.
20	51 for 5"		2.4		115.1				
25	73 for 6"		2.4						@ 25 feet, IGNEOUS BEDROCK, slightly weathered granitics, dry, light brown, collected as well graded sand.
30	77 for 5"		2.4						
35	77 for 4"		4.1						@ 35 feet, damp.
40	77 for 5"		7.4						END OF BORING @ 40.42' due to refusal No fill No groundwater Bedrock @ 15'
45									

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ELEVATION:**	3,074
		DATE DRILLED:	February 11, 2025
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-1

LOG OF BORING B-2

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0	52		9.8		113.4			SM	@ 0 feet, ALLUVIUM: SILTY SAND, trace gravel to 2" approximately 25% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 20% silty fines, light brown, dry, disturbed in the upper 0.5'. @ 2 feet, SILTY SAND, trace gravel to 2 1/2" approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, trace clay, light brown, damp, abundant calcite coating, trace pinhole porosity.
5	37		8.3						@ 5 feet, decrease in silt, rings disturbed.
10	46 for 6"		3.9		107.5				@ 10 feet, IGNEOUS BEDROCK, slightly weathered granitics, dry, light brown, collected as well graded sand with silt, slight calcite coating.
15	46 for 6"		2.8		109.4				@ 15 feet, IGNEOUS BEDROCK, slightly weathered granitics, dry, brown, collected as well graded sand.
20	51 for 6"		3.0		112.8				END OF BORING @ 20.5' No fill No groundwater Bedrock @ 10'
25									

TEST DATA

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ELEVATION:**	3,076
		DATE DRILLED:	February 11, 2025
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-2

LOG OF BORING B-3

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0								SM	@ 0 feet, ALLUVIUM SILTY SAND, trace gravel to 1" approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, light brown, dry, disturbed in the upper 0.5'.
	64		4.4		112.3			SC	@ 2 feet, CLAYEY SAND, approximately 25% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 25% clayey fines of low plasticity, light reddish brown, trace pinhole porosity, abundant calcite, dry.
5	54		7.7					SM	@ 5 feet, SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, trace clay, light brown, calcite coating, rings disturbed.
10	70		4.2		103.2			SW SM	@ 10 feet, WELL GRADED SAND with SILT, approximately, 20% coarse grained sand, 30% medium grained sand, 35% fine grained sand , 10% silty fines, light brown, slight calcite coating, trace pinhole porosity.
15	46 for 5"		3.2		104.6				@ 15 feet, IGNEOUS BEDROCK, slightly weathered granitics, dry, pink, collected as well graded sand.
20	51 for 3"								@ 20 feet, no recovery.
									END OF BORING @ 20.25'
25									No fill No groundwater Bedrock @ 15'

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ELEVATION:**	3,079
		DATE DRILLED:	February 11, 2025
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-3

LOG OF BORING B-4

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0								SM	@ 0 feet, ALLUVIUM SILTY SAND, approximately 5% gravel to 3", 20% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 20% silty fines, light brown, dry, disturbed in the upper 0.5'.
	27		7.8		96.0			SC	@ 2 feet, CLAYEY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% clayey fines of low plasticity, light brown, dry, trace pinhole porosity, calcite coating.
5	28		5.2		101.0				@ 5 feet, abundant calcite coating, white.
10	56		6.4		107.8				@ 10 feet, IGNEOUS BEDROCK, very weathered granitics, dry, light brown, collected as well graded sand.
15	46 for 5"		3.8		105.0				@ 15 feet, less weathered bedrock. END OF BORING @ 15.42' No fill No groundwater Bedrock @ 10'
20									
25									

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ELEVATION:**	3,076
		DATE DRILLED:	February 11, 2025
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-4

LOG OF BORING B-5

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	40 for 6		3.4		113.8			SM	@ 0 feet, ALLUVIUM: SILTY SAND, approximately 15% coarse grained sand, 25% medium grained sand, 30% fine grained sand, 30% silty fines, light brown, dry, disturbed in the upper 0.5'. @ 2 feet, SILTY SAND, approximately 20% coarse grained sand, 25% medium grained sand, 25% fine grained sand, 30% silty fines, light reddish brown, calcite, trace pinhole porosity.
5	76		9.2						@ 5 feet, rings disturbed.
10	46 for 5"		3.7		97.8				@ 10 feet, IGNEOUS BEDROCK, weathered granitics, dry, light brown, collected as well graded sand.
15	46 for 6"		3.8		110.8				@ 15 feet, less weathered bedrock
20	51 for 4"		8.1		119.6				@ 20 feet, iron oxide staining. END OF BORING @ 20.33' No fill No groundwater Bedrock @ 10'
25									

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**ELEVATION:**	3,079
		DATE DRILLED:	February 11, 2025
LOR GEOTECHNICAL GROUP, INC.		**EQUIPMENT:**	Mobile B-61
		HOLE DIA.: 8"	**ENCLOSURE:** B-5

APPENDIX C

Borehole Percolation Testing Program and Infiltration Rate Test Results

APPENDIX C
BOREHOLE PERCOLATION TESTING PROGRAM AND INFILTRATION RATE TEST RESULTS

Four borehole percolation tests were conducted in general accordance with the Shallow Percolation Test procedure as outlined in the Technical Guidance Document for Water Quality Management Plans (CDM Smith, 2013). The general locations of our tests are illustrated on Enclosure A-2 and were conducted at the requested locations and depth. Subsequent to drilling, a 3-inch diameter, perforated PVC pipe wrapped in filter fabric was placed within each test hole and 3/4-inch gravel was placed between the outside of the pipe and the hole wall. Test holes were pre-soaked the same day as drilling. Testing took place the next day, February 12, 2025, within 26 hours but not before 15 hours, of the pre-soak. The holes were filled using water from a 200 gallon water tank. Test periods consisted of allowing the water to drop in approximately 30-minute intervals. After each reading, the hole was refilled. Testing was terminated after a total of 12 readings were recorded. The percolation test data was converted to an infiltration rate using the Porchet Method as outlined by the Technical Guidance Document (CDM Smith, 2013).

Infiltration test results are summarized in the following table:

Test No.	Depth* (ft)	Infiltration Rate** (in/hr)
P-1	5.0	3.3
P-2	5.0	1.4
P-3	5.0	1.9
P-4	5.0	1.6

* depth measured below existing ground surface
** Porchet Method determined clear water rate

The results of this testing are presented as Enclosures C-1 through C-4.

Avg Inf Rate: 2.05"/hr

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	APN 0463-441-07, Apple Valley, California	Test Date:	February 12, 2025
Project No.:	14053.1	Test Hole No.:	P-1
Soil Classificaiton:	(SM) Silty sand	Hole Diameter:	8.0 in.
Depth of Test Hole:	5.0 ft.	Date Excavated:	February 11, 2025
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	9:50 AM	10:20 AM	30	0.50	0.50	24.00	48.50	60.00	60.00	24.50	23.75	57.1
2	10:21 AM	10:51 AM	30	0.50	1.00	24.00	47.00	60.00	60.00	23.00	24.50	52.1
3	10:52 AM	11:22 AM	30	0.50	1.50	24.00	47.00	60.00	60.00	23.00	24.50	52.1
4	11:23 AM	11:53 AM	30	0.50	2.00	24.00	46.75	60.00	60.00	22.75	24.63	51.3
5	11:54 AM	12:24 PM	30	0.50	2.50	24.00	46.50	60.00	60.00	22.50	24.75	50.5
6	12:25 PM	12:55 PM	30	0.50	3.00	24.00	46.25	60.00	60.00	22.25	24.88	49.7
7	12:56 PM	1:26 PM	30	0.50	3.50	24.00	46.00	60.00	60.00	22.00	25.00	48.9
8	1:27 PM	1:57 PM	30	0.50	4.00	24.00	46.25	60.00	60.00	22.25	24.88	49.7
9	1:58 PM	2:28 PM	30	0.50	4.50	24.00	46.00	60.00	60.00	22.00	25.00	48.9
10	2:29 PM	2:59 PM	30	0.50	5.00	24.00	46.00	60.00	60.00	22.00	25.00	48.9
11	3:00 PM	3:30 PM	30	0.50	5.50	24.00	46.00	60.00	60.00	22.00	25.00	48.9
12	3:31 PM	4:01 PM	30	0.50	6.00	24.00	46.00	60.00	60.00	22.00	25.00	48.9

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	36.00	
H_f	14.00	
ΔH	22.00	
H_{avg}	25.00	
I_t	**3.3**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	APN 0463-441-07, Apple Valley, California	Test Date:	February 12, 2025
Project No.:	14053.1	Test Hole No.:	P-2
Soil Classificaiton:	(SM) Silty sand	Hole Diameter:	8.0 in.
Depth of Test Hole:	5.0 ft.	Date Excavated:	February 11, 2025
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	9:53 AM	10:23 AM	30	0.50	0.50	24.00	37.00	60.00	60.00	13.00	29.50	24.8
2	10:24 AM	10:54 AM	30	0.50	1.00	24.00	36.00	60.00	60.00	12.00	30.00	22.5
3	10:55 AM	11:25 AM	30	0.50	1.50	24.00	36.00	60.00	60.00	12.00	30.00	22.5
4	11:26 AM	11:56 AM	30	0.50	2.00	24.00	35.75	60.00	60.00	11.75	30.13	21.9
5	11:57 AM	12:27 PM	30	0.50	2.50	24.00	35.50	60.00	60.00	11.50	30.25	21.4
6	12:28 PM	12:58 PM	30	0.50	3.00	24.00	35.50	60.00	60.00	11.50	30.25	21.4
7	12:59 PM	1:29 PM	30	0.50	3.50	24.00	35.25	60.00	60.00	11.25	30.38	20.8
8	1:30 PM	2:00 PM	30	0.50	4.00	24.00	35.25	60.00	60.00	11.25	30.38	20.8
9	2:01 PM	2:31 PM	30	0.50	4.50	24.00	35.00	60.00	60.00	11.00	30.50	20.3
10	2:32 PM	3:02 PM	30	0.50	5.00	24.00	35.00	60.00	60.00	11.00	30.50	20.3
11	3:03 PM	3:33 PM	30	0.50	5.50	24.00	35.00	60.00	60.00	11.00	30.50	20.3
12	3:34 PM	4:04 PM	30	0.50	6.00	24.00	35.25	60.00	60.00	11.25	30.38	20.8

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	36.00	
H_f	24.75	
ΔH	11.25	
H_{avg}	30.38	
I_t	**1.4**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	APN 0463-441-07, Apple Valley, California	Test Date:	February 12, 2025
Project No.:	14053.1	Test Hole No.:	P-3
Soil Classificaiton:	(SM) Silty sand	Hole Diameter:	8.0 in.
Depth of Test Hole:	5.0 ft.	Date Excavated:	February 11, 2025
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	9:56 AM	10:26 AM	30	0.50	0.50	24.00	42.00	60.00	60.00	18.00	27.00	37.2
2	10:27 AM	10:57 AM	30	0.50	1.00	24.00	40.00	60.00	60.00	16.00	28.00	32.0
3	10:58 AM	11:28 AM	30	0.50	1.50	24.00	39.25	60.00	60.00	15.25	28.38	30.1
4	11:29 AM	11:59 AM	30	0.50	2.00	24.00	39.50	60.00	60.00	15.50	28.25	30.7
5	12:00 PM	12:30 PM	30	0.50	2.50	24.00	39.00	60.00	60.00	15.00	28.50	29.5
6	12:31 PM	1:01 PM	30	0.50	3.00	24.00	39.00	60.00	60.00	15.00	28.50	29.5
7	1:02 PM	1:32 PM	30	0.50	3.50	24.00	39.25	60.00	60.00	15.25	28.38	30.1
8	1:33 PM	2:03 PM	30	0.50	4.00	24.00	38.75	60.00	60.00	14.75	28.63	28.9
9	2:04 PM	2:34 PM	30	0.50	4.50	24.00	38.75	60.00	60.00	14.75	28.63	28.9
10	2:35 PM	3:05 PM	30	0.50	5.00	24.00	39.00	60.00	60.00	15.00	28.50	29.5
11	3:06 PM	3:36 PM	30	0.50	5.50	24.00	38.50	60.00	60.00	14.50	28.75	28.3
12	3:37 PM	4:07 PM	30	0.50	6.00	24.00	38.50	60.00	60.00	14.50	28.75	28.3

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	36.00	
H_f	21.50	
ΔH	14.50	
H_{avg}	28.75	
I_t	**1.9**	in/hr (clear water rate)

BOREHOLE METHOD PERCOLATION TEST RESULTS

Project:	APN 0463-441-07, Apple Valley, California	Test Date:	February 12, 2025
Project No.:	14053.1	Test Hole No.:	P-4
Soil Classificaiton:	(SM) Silty sand	Hole Diameter:	8.0 in.
Depth of Test Hole:	5.0 ft.	Date Excavated:	February 11, 2025
Tested By:	A.L.		

READING	TIME START	TIME STOP	TIME INTERVAL		TOTAL TIME	INITIAL WATER LEVEL	FINAL WATER LEVEL	INITIAL HOLE DEPTH	FINAL HOLE DEPTH	CHANGE IN WATER LEVEL	AVERAGE WETTED DEPTH	PERCOLATION RATE
			min	hr.	hr.	in.	in.	in.	in.	in.	in.	(gal/sf/day)
1	10:00 AM	10:30 AM	30	0.50	0.50	24.00	40.75	60.00	60.00	16.75	27.63	33.9
2	10:31 AM	11:01 AM	30	0.50	1.00	24.00	38.00	60.00	60.00	14.00	29.00	27.1
3	11:02 AM	11:32 AM	30	0.50	1.50	24.00	37.50	60.00	60.00	13.50	29.25	25.9
4	11:33 AM	12:03 PM	30	0.50	2.00	24.00	37.75	60.00	60.00	13.75	29.13	26.5
5	12:04 PM	12:34 PM	30	0.50	2.50	24.00	37.25	60.00	60.00	13.25	29.38	25.3
6	12:35 PM	1:05 PM	30	0.50	3.00	24.00	37.00	60.00	60.00	13.00	29.50	24.8
7	1:06 PM	1:36 PM	30	0.50	3.50	24.00	37.00	60.00	60.00	13.00	29.50	24.8
8	1:37 PM	2:07 PM	30	0.50	4.00	24.00	37.00	60.00	60.00	13.00	29.50	24.8
9	2:08 PM	2:38 PM	30	0.50	4.50	24.00	36.50	60.00	60.00	12.50	29.75	23.6
10	2:39 PM	3:09 PM	30	0.50	5.00	24.00	36.75	60.00	60.00	12.75	29.63	24.2
11	3:10 PM	3:40 PM	30	0.50	5.50	24.00	36.25	60.00	60.00	12.25	29.88	23.1
12	3:41 PM	4:11 PM	30	0.50	6.00	24.00	36.50	60.00	60.00	12.50	29.75	23.6

PERCOLATION RATE CONVERSION (Porchet Method):

H_O	36.00	
H_f	23.50	
ΔH	12.50	
H_{avg}	29.75	
I_t	**1.6**	in/hr (clear water rate)

APPENDIX D

Laboratory Testing Program and Test Results

APPENDIX D
LABORATORY TESTING

General

Selected soil samples obtained from the borings were tested in our geotechnical laboratory to evaluate the physical properties of the soils affecting foundation design and construction procedures. Laboratory testing included in-place moisture content and dry density, laboratory compaction characteristics, direct shear, sieve analysis, sand equivalent, R-value, expansion index, and corrosion screening. Descriptions of the laboratory tests are presented in the following paragraphs:

Moisture Density Tests

The moisture content and dry density information provides an indirect measure of soil consistency for each stratum, and can also provide a correlation between soils on this site. The dry unit weight and field moisture content were determined for selected undisturbed samples, in accordance with ASTM D 2921 and ASTM D 2216, respectively, and the results are shown on the boring logs, Enclosures B-1 and B-2 for convenient correlation with the soil profile.

Laboratory Compaction

A selected soil sample was tested in the laboratory to determine compaction characteristics using the ASTM D 1557 compaction test method. The results are presented in the following table:

LABORATORY COMPACTION				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (percent)**
B-5	0-3	(SM) Silty Sand	131.0	6.5

Direct Shear Test

Shear tests are performed in general accordance with ASTM D 3080 with a direct shear machine at a constant rate-of-strain (0.04 inches/minute). The machine is designed to test

a sample partially extruded from a sample ring in a single shear. Samples are tested at varying normal loads in order to evaluate the shear strength parameters, angle of internal friction and cohesion. Samples are tested in remolded condition (90 percent relative compaction per ASTM D 1557) and soaked, to represent the worst case conditions expected in the field.

The results of the shear test on a selected soil sample is presented in the following table:

DIRECT SHEAR TEST				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Apparent Cohesion (psf)**	**Angle of Internal Friction (degrees)**
B-5	0-3	(SM) Silty Sand	500	26

Sieve Analysis

A quantitative determination of the grain size distribution was performed for selected samples in accordance with the ASTM D 422 laboratory test procedure. The determination is performed by passing the soil through a series of sieves, and recording the weights of retained particles on each screen. The results of the grain size distribution analyses are presented graphically on Enclosure D-1.

Sand Equivalent

The sand equivalent of selected soils were evaluated using the California Sand Equivalent Test Method, Caltrans Number 217. The results of the sand equivalent tests are presented with the grain size distribution analyses on Enclosure D-1.

R-Value Test

Based on the indicator testing above, a soil sample was selected and tested to determine its R-value using the California R-Value Test Method, Caltrans Number 301. The results of the R-value test are presented on Enclosure D-1.

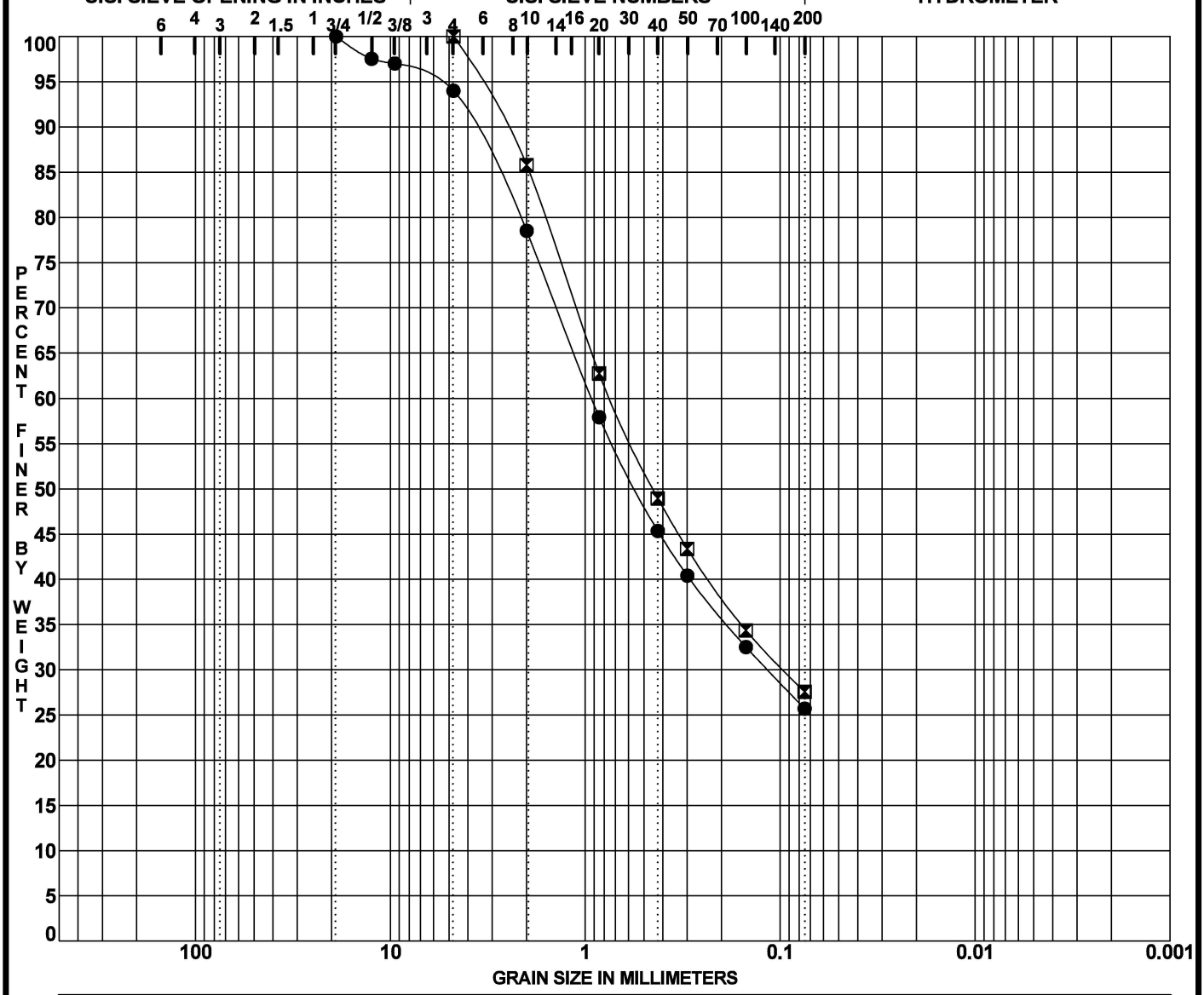
Expansion Index Test

Remolded samples are tested to determine their expansion potential in accordance with the Expansion Index (EI) test. The test is performed in accordance with the Uniform Building Code Standard 18-2. The test result for a select soil sample is presented in the following table:

EXPANSION INDEX TEST				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Expansion Index (EI)**	**Expansion Potential**
B-4	2-5	(SC) Clayey Sand	25	Low
B-5	0-3	(SM) Silty Sand	20	Very Low to Low
Expansion Index:		0-20 Very low	21-50 Low	51-90 Medium	91-130 High

Corrosion

Corrosion testing was conducted by our subconsultant, Project X Corrosion Engineering. Test results are enclosed.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Soil Classification	SE	RV	PL	PI	Cc	Cu
●	B-1	@ 0-3'	(SM) Silty Sand	20	--				
⊠	B-5	@ 0-3'	(SM) Silty Sand	19	34				

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	@ 0-3'	19.00	0.93	0.116		6.0	68.3	25.7	
⊠	B-5	@ 0-3'	4.75	0.74	0.096		0.0	72.5	27.5	

PROJECT:	Proposed Commercial Development	**PROJECT NO.:**	14053.1
CLIENT:	Conco Construction	**DATE:**	March 2025

GRADATION CURVES

LOR GEOTECHNICAL GROUP, INC.

ENCLOSURE: D-1

Results Only Soil Testing for APN 0463-441-07 Apple Valley, California

February 14, 2025

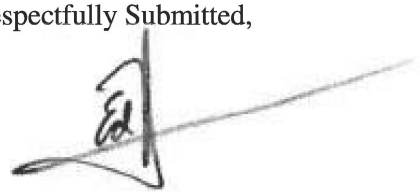
Prepared for:

Cristina Carranza
LOR Geotechnical Group, Inc.
6121 Quail Valley Ct
Riverside, CA 92507
ccarranza@lorgeo.com

Project X Job#: S250213G
Client Job or PO#: 14053.1

Prepared by:
D. Bobrova

Respectfully Submitted,





Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

Soil Analysis Lab Results

Client: LOR Geotechnical Group, Inc.
Job Name: APN 0463-441-07 AppleValley, California
Client Job Number: 14053.1
Project X Job Number: S250213G
February 14, 2025

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-D	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd	Minimum	**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{2-}	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ω-cm)	(Ω-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
RV-1 - B-1 Silty Sand (SM)	0-3	640.5	0.0641	388.3	0.0388	33,500	871	8.5	210	0.06	9.6	11.7	ND	547.7	10.5	11.7	71.0	12.7	5.2
RV-2 - B-5 Silty Sand (SM)	0-3	2,388.3	0.2388	18.2	0.0018	64,320	804	7.6	209	ND	3.7	6.8	ND	255.6	13.1	59.7	454.7	11.2	166.7

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

For AWWA 105C: 0-3mg/kg sulfide = Negative; 3-6mg/kg = trace; >6mg/kg = Positive

Note: Sometimes a bad sulfate hit is a contaminated spot. Typical fertilizers are Potassium chloride, ammonium sulfate or ammonium sulfate nitrate (ASN). So this is another reason why testing full corrosion series is good because we then have the data to see if those other ingredients are present meaning the soil sample is just fertilizer-contaminated soil. This can happen often when the soil samples collected are simply surface scoops. This is why it's best to dig in a foot, throw away the top and test the deeper stuff. Dairy farms are also notorious for these items.

If one sample pops up much more corrosive than all others, we would recommend collecting more samples surrounding the problem sample location to determine if the peak is isolated to it. This allows us to conclude it was a contaminated sample and able to declare it an outlier.

Try out our new online forms: SOIL CORROSIVITY & THERMAL RESISTIVITY LAB REQUEST FORM & IN-SITU WENNER 4 PIN QUOTE REQUEST FORM

Project X
Corrosion Engineering

Lab Request Sheet Chain of Custody
Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com

Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number
S250213G LOR 14053.1 APPLEVALLEY 2FULL

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	LOR Geotechnical Group, Inc.	Contact Name:	Cristina Carranza
Phone No:	951-653-1760		
Mailing Address:	6121 Quail Valley	Contact Email:	ccarranza@lorgeo.com
Accounting Contact:	John Leuer	Invoice Email:	atardie@lorgeo.com
Client Project No:	14053.1	Project Name:	APN 0463-441-07 Apple Valley, California
P.O. #:	--		

3-5 Day Standard | **3 Day Guarantee** 50% mark-up | **24 Hour RUSH** 100% mark-up

(Business Days) Turn Around Time: 3-5 Day Standard

METHOD ANALYSIS REQUESTED (Please circle)

For Corrosion Control Recommendations (350g soil sample):
NEED (1) Groundwater depth and
(2) Soil Sample Locations Map

FOR THERMAL RESISTIVITY PROVIDE (1,500g soil sample):
(1) Optimal Moisture %
(2) Dry Density{PCF}
(3) Desired Compaction
Date & Received By:

Default Method

350g Sample

*Req: Min. 3 Samples, site map, and groundwater info

1,500g Sample

Full Corrosion Series

Geo Quad: Soil Resistivity; pH; Sulfate; Chloride

Redox Potential; Sulfide; Ammonia; Nitrate; Fluoride; Phosphate; Lithium; Sodium; Potassium; Magnesium; Calcium

Full Corrosion Series

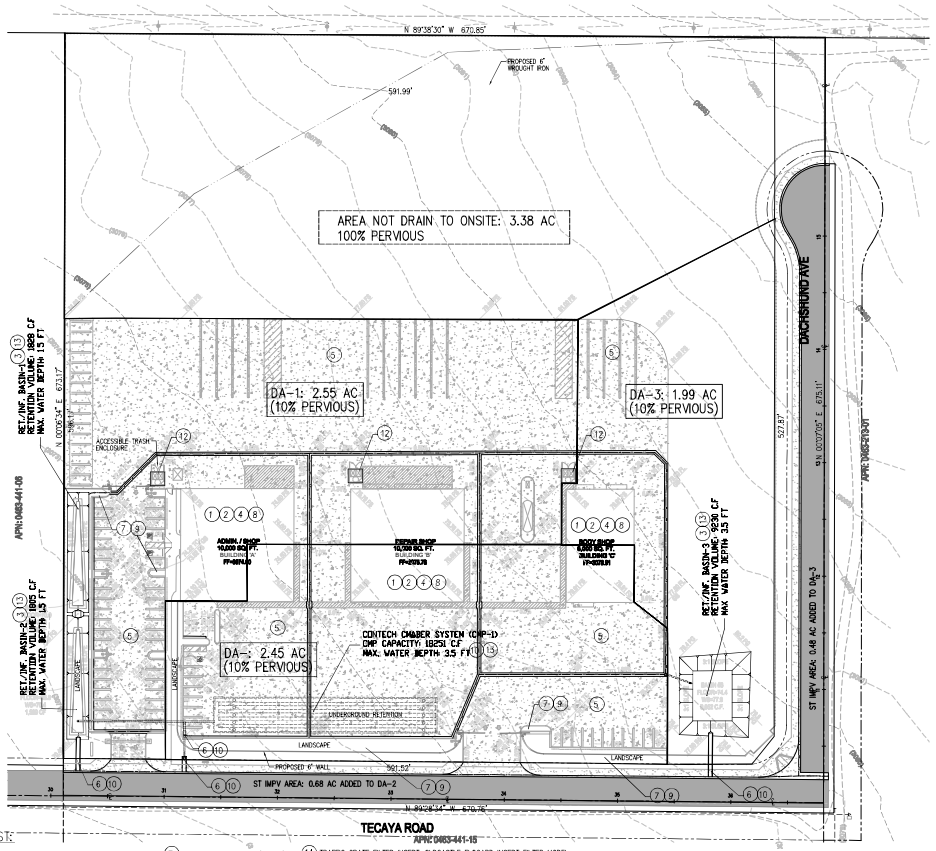
Reports: Soil Corrosivity Evaluation Report; Water Corrosivity Mini Report

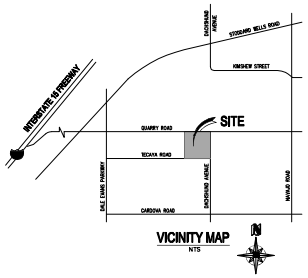
Moisture Content; Total Alkalinity; Soil Remolding; Thermal Resistivity; (ANC) Alk Neutr Cap; (SR18) Sulfate Reducing; Puckorius Index; XRF Elemental Analysis; Water Hardness

	SAMPLE ID - BORE # - Description	DEPTH (ft)	DATE COLLECTED	Full Corrosion Series
154	RV-1 - B-1 - Silty Sand (SM)	0-3	2/11/2025	●
155	RV-2 - B-5 - Silty Sand (SM)	0-3	2/11/2025	●
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Site Plan

(WQMP Exhibit)





DRAINAGE AREA	PROPOSED BMP	AREA (AC)	DESIGN CAPTURE VOL. (CF)	PROVIDED VOL. (CF)
DA-1	INF BASIN 1, 2 & CMP-1	2.55	6898	6898
DA-2	CMP-1	2.45	6627	14985
DA-3	BASIN-3	1.99	1660	9230
SITE		10.37 AC	15,185 CF	31,143 CF

DCV ACHIEVED WITH PROPOSED BMPs: 204%

GRAPHIC SCALE
20 0 10 20 40 80
(IN FEET)
1 INCH = 20 FT.

N

BMP LIST:

1. EDUCATION OF PROPERTY OWNERS
2. ACTIVITY RESTRICTIONS
3. INF/RET. BASIN FOR WQ MITIGATION (BASIN-1,2,3)
4. TRAINING/EDUCATION PROGRAM
5. PARKING LOT SWEEPING/VACUUMING
6. COMMON AREA CATCH BASIN INSPECTION
7. LANDSCAPE PLANNING (SD-10)
8. ROOF RUNOFF CONTROLS (SD-11)
9. EFFICIENT IRRIGAION (SD-12)
10. STORM DRAIN SIGNAGE (SD-13)
11. NOT USED
12. TRASH STORAGE AREAS (SD-32)
13. BELOW SURFACE CONTECH INF/RET CHAMBER SYSTEM (CMP-1) FOR WQ/ AND HIGH FLOW RETENTION VOL. INFILTRATION
14. TRAFFIC GRATE FILTER INSERT-OLDCASTLE FLOGARD INSERT FILTER MODEL NUMBER FGP-36F OR APPROVED EQUAL , ALSO USED FOR TRASH PICKUP.
15. OVERFLOW RISER GRATE

NO DUMPING
DRAINS TO WATER TABLE
CATCH BASIN STENCIL

LATITUDE & LONGITUDE
34.67481 N, -117.19930 W

Prepared By:
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AND EXCAVATING, INC
P.O. BOX 292329
PHELAN, CA 92329
PH: (760) 559-5845

TOWN OF APPLE VALLEY, CALIFORNIA
WQMP EXHIBIT
SITE MAP
APN: 0463-441-07

Filename: I:\Conco Construction\QUARRY\DWG's\FINAL DESIGN\EXHIBITS\WQ EXHIBIT 3-5-26.dwg