Appendix H

Water Quality Management Plans

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

COVINGTON - MIP - BUILDING 21

PERMIT NUMBERS: TBD

Prepared for:

Mojave 80 Gray, LLC,

c/o Covington Development Partners, LLC

3 Corporate Plaza, Suite 230

Newport Beach, Ca 92660

949-514-0274

Prepared by:

Huitt-Zollars, Inc

3990 Concours, Suite 330

Ontario, CA 91764

909-941-7799

Project: R315712.01

Submittal Date: 05/08/2023

Revision No. and Date: 05/08/2023 using Mojave Template

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Covington Development Partners, LLC by Huitt-Zollars, Inc.. The WQMP is intended to comply with the requirements of the County of San Bernardino 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):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-03

Owner's Signature		
Owner Name: Dana Whitmer		
Title	Partner	
Company	Mojave 80 Gray, LLC c/o Covington Development Partners, LLC	
Address	3 Corporate Development Plaza, Suite 230	
Email	dwhitmer@covingtongroupinc.com	
Telephone #	949-514-0274	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-03

"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: Johnny Murad, PE		PE Stamp Below
Title	Project Manager	
Company	Huitt-Zollars, Inc	
Address	3990 Concours, Suite 330 Ontario, CA 91764	
Email	jmurad@huitt-zollars.com	
Telephone #	909-941-7799	
Signature		
Date	05/19/2023	

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Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Covington - MIP - Building 1				
Project Owner Contact Name:	Dana Whitmer				
Mailing Address:	3 Corporate Plaza, Suite 230 Newport Beach, ca 92660	E-mail Address:	dwhitmer@covingtongroupinc.com	Telephone:	949-514-0274
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	APN 3128-631-03	
Additional Information/ Comments:	N/A				
Description of Project:	The project is a new development of an industrial warehouse facility located on the northwest corner of Mojave Drive and Topaz Road in the City of Victorville, California. The proposed building is approximately 91,000 square feet on approximately 6.21 acres of land.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	All on-site runoff will be collected by catch basins along the north end of the property and conveyed to the infiltration/detention basin north of the truck dock area for treatment. The design captured volume will infiltrate through the bottom of the basins. Once WQMP DCV (Design Capture Volume) is reached then the water will outlet to the proposed off-site storm drain system in Topaz Road. Refer to the Hydrology Study for more calculations and details.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 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):	270,675	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	TBD

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:

The property is being developed by Covington Development Partners, LLC. Covinton Development Partners, LLC, will be the entity responsible for long term maintenance of WQMP Storm Water Facilities throughout the site.

Name: Mojave 80 Gray, LLC, c/o Covington Development Partners, LLC
Address: 3 Corporate Plaza, Suite 230, Newport Beach, CA 92660
Contact Person: Dana Whitmer/ Partner
Phone: 949-514-0274

2.3 Potential Stormwater Pollutants

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

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Pathogens are typically caused by the transport of animal or human fecal wastes from the watershed.
Nutrients - Phosphorous	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Noxious aquatic plants are typically from animals or vehicle transport that grow aggressively, multiply quickly without natural controls (native herbivores, soil chemistry, etc.), and adversely affect native habitats.
Sediment	E ☒	N ☐	Sediments are solid materials that are eroded from the land surface.
Metals	E ☒	N ☐	The primary source of metal pollution in stormwater is typically commercially available metals and metal products, as well as emissions from brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste from human or animals.
Pesticides / Herbicides	E ☒	N ☐	Pesticides and herbicides can be washed off urban landscapes during storm events.
Organic Compounds	E ☒	N ☐	Sources of organic compounds may include waste handling areas and vehicle or landscape maintenance areas.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°31'53.96"N	Longitude 117°23'02.03"W	Thomas Bros Map page 4295

1 San Bernardino County climatic region: ☒ Desert

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

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	Runoff from the project site will be directed to the proposed infiltration/ detention basin on the north side of the project site. After the DCV WQMP volume is reached water will be outleted to the proposed storm drain system in Topaz Road.
DA1 DMA B to Outlet 1	N/A
DA2 to Outlet 2	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	270,675	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	0	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC II	N/A	N/A	N/A
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	C	N/A	N/A	N/A
5 Longest flowpath length (ft)	649	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	~0.0145	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	N/A	N/A	N/A
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	N/A	N/A	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)	N/A	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	N/A	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	N/A	N/A	N/A	N/A
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	N/A	N/A	N/A	N/A
5 Longest flowpath length (ft)	N/A	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	N/A	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	N/A	N/A	N/A	N/A
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*	N/A	N/A	N/A	N/A

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	City Storm Drain Line T, City Master Plan Facility E-01, Mojave River, Silver Lake and Soda Lake
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Per 2010 303(d) list, Mojave River: TMDLs still required. Soda Lake: TMDLs still required.
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	The project expects to generate Pathogens, Nutrients (Soda Lake), metals and Other Inorganics (fluoride & sulfate) (Mojave River) which are listed for downstream receiving waters on the latest CWA 303(d) list.
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	NO
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	☒	☐	Property owners shall review and become familiar with the site specific WQMP. Additional educational materials for day to day operations are contained in Attachment C. Additional materials can be obtained from the local water pollution prevention program. Education of property owners begin with the review/preparation of the site specific WQMP and continues through the review of additional educational material as it applies to their project.
N2	Activity Restrictions	☒	☐	Activity restriction shall be stated in the owners lease terms prior to occupancy; • Fuelling areas, air/water supply areas, maintenance bays, vehicle washing areas, outdoor material storage areas, outdoor work areas, outdoor processing areas, wash water from food preparation areas within the project site will not be allowed on the project site. • Storage of hazardous materials will not be allowed on the project site. • All pesticide applications shall be performed by a licensed contractor certified by the California Department of Pesticide Regulation. • All dumpster lids shall be kept closed at all times. • Blowing, Sweeping or hosing of debris (leaf, litter, grass clippings, trash or debris) into the streets, underground stormdrain facilities or other storm water conveyance areas shall be strictly prohibited
N3	Landscape Management BMPs	☒	☐	A landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate the use of native and drought tolerant trees and shrubs throughout the project site.
N4	BMP Maintenance	☒	☐	Property owners shall maintain the designated on-site BMP areas, see Section 5 for self inspection and maintenance form
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Industrial purposed warehouse does not apply to Title 22 CCR (California Code of Regulations). CCR licensing in child care, residential and family child care.

Form 4.1-1 Non-Structural Source Control BMPs				
N6	Local Water Quality Ordinances	☒	☐	Local Water Quality Ordinances will be addressed by implementation of this WQMP
N7	Spill Contingency Plan	☒	☐	Industrial Warehouse buildings and truck dock areas have potential for spills and therefore each tenant shall be required to prepare a spill contingency plan and it shall be implemented in accordance with section 6.95 of the California Health and Safety Code. The spill contingency plan shall identify responsible persons in the event of a spill, an action item list identifying how the spill should be contained, cleaned up and who should be contacted in the event of a spill. Documentation of any spill event and cleanup process shall be kept on site in perpetuity.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed for this site
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials are planned to be stored on this site.

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	☒	☐	Underground fire protection service and fire sprinklers will be provided per the uniform fire code and the requirements of the County of San Bernardino Fire Department.
N11	Litter/Debris Control Program	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
N12	Employee Training	☒	☐	The following shall be provided to the tentant by the onwer; an Employee Training/Education program shall be provided annually to help educate employees about storm water quality management and practices that help prevent storm water pollution. Documentation of such training/education program implementation shall be kept by the owner for a minimum of ten years. Sample education materials have been provided in Attachment D. Additional educational materials can be obtained from the County of San Bernardino storm water program.
N13	Housekeeping of Loading Docks	☒	☐	The project site will have truck docks. The truck docks shall be inspected on a weekly basis to help ensure that any trash and debris are collected prior to being washed into the underground storm drain system. All storm water runoff from the loading dock areas will be discharged into infiltration basins and/or underground infiltration chambers prior to conveyance to the public storm drain system. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected on a quarterly basis. Inspection of the on-site catch basins shall consist of visual inspection of any sediment, trash or debris collected in the bottom of each catch basin. Any sediment, trash or debris found shall be removed from the catch basins and disposed of in a legal manner. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The on-site parking lots, drive aisles, and loading dock areas shall be hand swept on a monthly basis. Documentation of such sweeping shall be kept by the owner in perpetuity. Frequency of sweeping shall be adjusted as needed to maintain a clean site.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	None, proposed BMP's satisfy requirements
N17	Comply with all other applicable NPDES permits	☒	☐	General construction permit "SWRCB Orders No. 2009-009-DWQ as amended by Order 2010-0014-DWQ"

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)	☒	☐	The on-site storm drain catch basins shall be stenciled with the phrase "Drains to River" or other approved language. The signage shall be inspected on an annual basis. Missing or faded signage shall be replaced. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas are proposed for this site
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	The landscape architect will follow CASQA SD-12 for design and provide design plans for the on-site irrigation system. The irrigation system shall be inspected on a monthly basis to ensure proper operation. Any broken sprinkler heads shall be repaired immediately to ensure that the system continues to operate efficiently. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	The landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate that finish grade of landsapced areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement throughout the project site.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Perimeter slopes and slopes to catch grade will have a maximum slope of 2:1. The slopes will be landscaped appropriately to also help ensure that erosion of the slopes does not occur. Slopes will be inspected and maintained bi-annually. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Docks are not covered
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are planned for this site.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash area are planned for this site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas are planned for this site.

Form 4.1-2 Structural Source Control BMPs

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

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: The developer has chosen to maximize the building and parking footprint. However, the infiltration was oversized to accommodate more pervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: The entire site drains to the infiltration/ detention basin thereby maximizing the natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: The existing drainage pattern, south to north, will be preserved. The flood routing and controlled outlet in the infiltration/ detention Basin will lengthen the time of concentration thus mimicking the existing conditions.
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: The site layout does not allow for roof drains to discharge to previous areas.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement will not be used and is not practical for developments with heavy trucks.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The site has no existing vegetation to protect. Planting of new vegetation will occur throughout the site.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: All landscape areas will be vegetated for stablization using drought tolerant plants and trees.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The soils in the proposed infiltration system area will be uncompacted in-place native material.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: No rock-lined drainage swales are proposed, except for the pipe discharge areas in the basin.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: All landscaped areas will be staked by designation of curb throughout the project site.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: No rain barrels or cisterns are planned for this site.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: There are no streams within or adjacent to the project.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
1 Project area DA 1 (ft^2): 270,675	**2** Imperviousness after applying preventative site design practices (Imp%): 0.80	**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): 0.361 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
5 Compute P_6, Mean 6-hr Precipitation (inches): 0.41 *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): 1/12*[270,675* 0.73* 0.41 * 1.963] = 13,252 CF *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	**1** SEE CALCS *Form 4.2-3 Item 12*	**2** N/A *Form 4.2-4 Item 13*	**3** N/A *Form 4.2-5 Item 10*
Post-developed	**4** N/A *Form 4.2-3 Item 13*	**5** N/A *Form 4.2-4 Item 14*	**6** N/A *Form 4.2-5 Item 14*
Difference	**7** *N/A* *Item 4 – Item 1*	**8** *N/A* *Item 2 – Item 5*	**9** *N/A* *Item 6 – Item 3*
Difference (as % of pre-developed)	**10** *N/A%* *Item 7 / Item 1*	**11** *N/A%* *Item 8 / Item 2*	**12** *N/A%* *Item 9 / Item 3*

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

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

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

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

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

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

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): SEE SEPARATE HYD CALCULATIONS IN APPENDIX B
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

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

13 Pre-developed time of concentration (min): N/A *Minimum of Item 12 pre-developed DMA*

14 Post-developed time of concentration (min): N/A *Minimum of Item 12 post-developed DMA*

15 Additional time of concentration needed to meet hydromodification requirement (min): N/A $T_{C\text{-}Hydro}$ *= (Item 13 * 0.95) – Item 14*

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

Compute peak runoff for pre- and post-developed conditions

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

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

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

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

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

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

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that

either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	N/A	N/A	N/A
3 Ratio of pervious area receiving runoff to impervious area	N/A	N/A	N/A
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*	N/A	N/A	N/A
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	N/A	N/A	N/A
8 Ponding depth (ft) (min. 0.5 ft.)	N/A	N/A	N/A
9 Surface area of amended soil/gravel (ft^2)	N/A	N/A	N/A
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	N/A	N/A	N/A
11 Average porosity of amended soil/gravel	N/A	N/A	N/A
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	N/A	N/A	N/A
13 Runoff volume retention from on-lot infiltration (ft^3): 0 *$V_{retention}$ =Sum of Item 12 for all BMPs*			

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

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

4.3.3 Infiltration BMPs

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

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 13,252 *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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	5.3	N/A	N/A
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	N/A	N/A
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.77	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	N/A	N/A
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	8	N/A	N/A
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	7.08	N/A	N/A
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*	7,339	N/A	N/A
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity	N/A	N/A	N/A
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0.5	N/A	N/A
12 Gravel porosity	0.4	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	N/A	N/A
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	0	N/A	N/A
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	14,043	N/A	N/A

16 Total Retention Volume from LID Infiltration BMPs: 14,043 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 106% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

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

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

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

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

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0, NA *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA 0 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A
2 Amended soil infiltration rate *Typical ~ 5.0*	N/A	N/A	N/A
3 Amended soil infiltration safety factor *Typical ~ 2.0*	N/A	N/A	N/A
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	N/A	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	N/A	N/A	N/A
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	N/A	N/A	N/A
8 Amended soil surface area (ft^2)	N/A	N/A	N/A
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity, *n*	N/A	N/A	N/A
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
12 Gravel porosity, *n*	N/A	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	N/A	N/A	N/A
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	N/A	N/A	N/A
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A	N/A
2 Bottom width (ft)	N/A	N/A	N/A	N/A
3 Bottom length (ft)	N/A	N/A	N/A	N/A
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*	N/A	N/A	N/A	N/A
5 Side slope (ft/ft)	N/A	N/A	N/A	N/A
6 Depth of storage (ft)	N/A	N/A	N/A	N/A
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*	N/A	N/A	N/A	N/A
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*	N/A	N/A	N/A	N/A
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*	N/A		N/A	
10 Outflow rate (cfs) Q_{BMP} = *(Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*	N/A		N/A	
11 Duration of design storm event (hrs)	N/A		N/A	
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*	N/A		N/A	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

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): 13,252 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 14,043 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 0 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 270,675 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☒
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☒

For the 10-year storm event, the total Q allowed to be released for all 3 Buildings is being limited to the existing 10-year storm event Q which is Tributary to Line T.

4.4 Alternative Compliance Plan (if applicable)

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

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Under-ground Infiltrati-on Basin/ Treatment Unit (FDHC)	Owner	- Inspect/maintain underground infiltration systems -Isolator row for collected trash, sediments and/or debris. Remove trash, sediments and debris by jet-vac and pump and dispose of trash, sediemnts and debris in a legal manner -Inspect system for standing water. If system has standing water. If system has standing water, peform re-inspection within 48 hours. If system still has standing water then the system shall be jet-vaccumed and pumped and removed debris shall be disposed of in a legal manner. -Inspect Treatment Unit for sediment, floating trash, and debris	Bi-monthly and prior to storm event and 48 hours after storm has passed
Loading Dock and Parking Lot Sweeping	Owner	Sweep loading dock and parking lot and truck courts.	Monthly / As needed.

Catch Basin Filter	Owner	- Inspect and maintain catch basin filters as required. - Inspect catch basin bottom for debris / remove debris and dispose as required.	Quarterly
Truck Dock	Owner	Inspect loading dock for trash debris and sediments. Inspect loading dock for evidence of spills and broken containers. Clean up spills and dispose of collected material in a legal manner.	Weekly
Planting	Owner	Inspect helth of planting and erosion of landscape area. Trimming trees and bushes when needed.	Monthly
Efficient Irrigation	Owner	- Inspect irrigation system general operation and durations. - Repair damaged sprinkler and drip irrigation lines as needed. - Reduce durations during the winter season to prevent over irrigation.	Monthly
Storm drain system signage	Owner	Inspect Catch basin signage for faded or lost signs / repair or replace as needed.	Annually
Trash Storage Areas and Litter Control (SD-32)	Owner	Inspect trash container, lids, screens and clean trash storage areas..	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

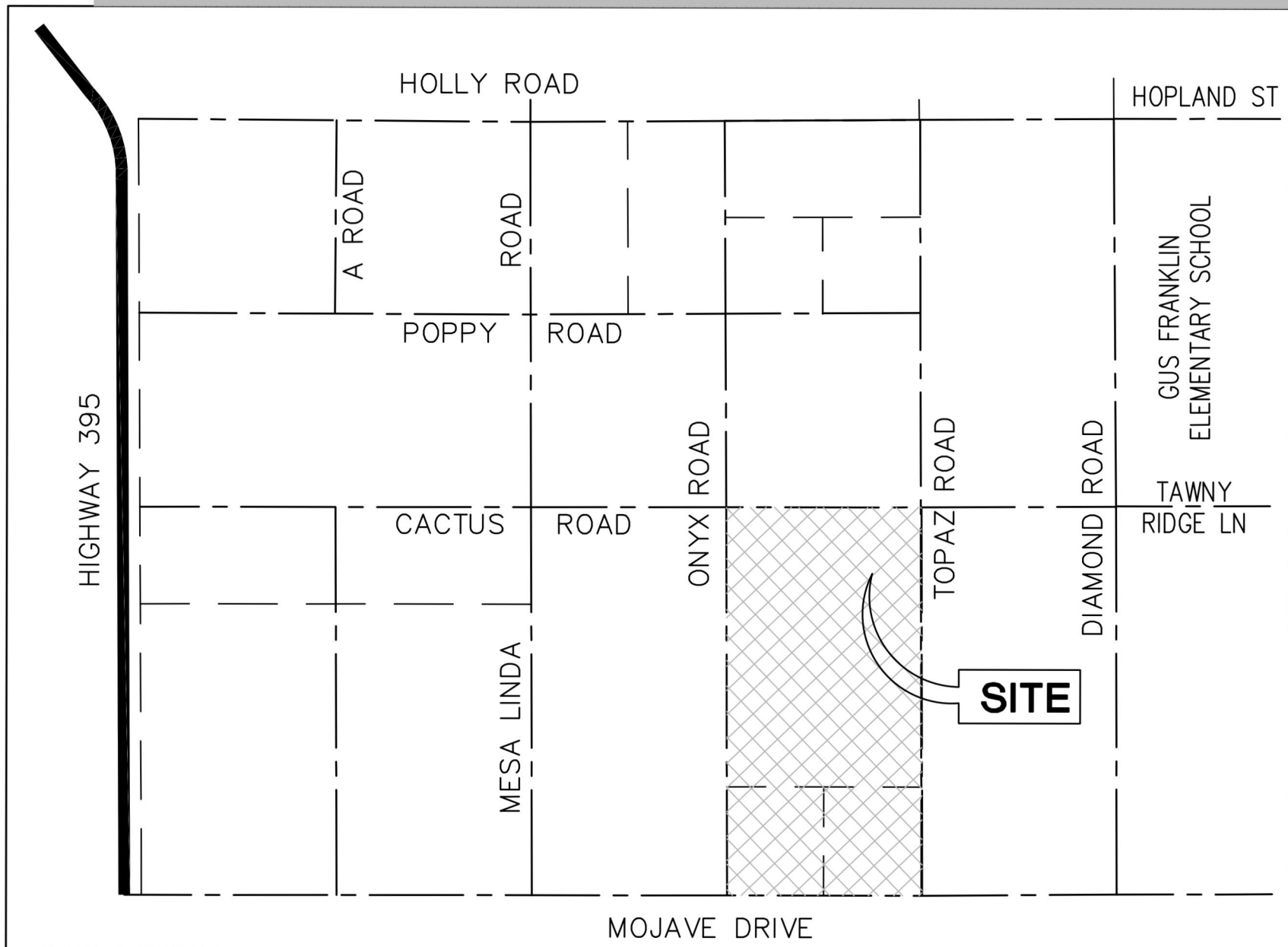
6.3 Post Construction

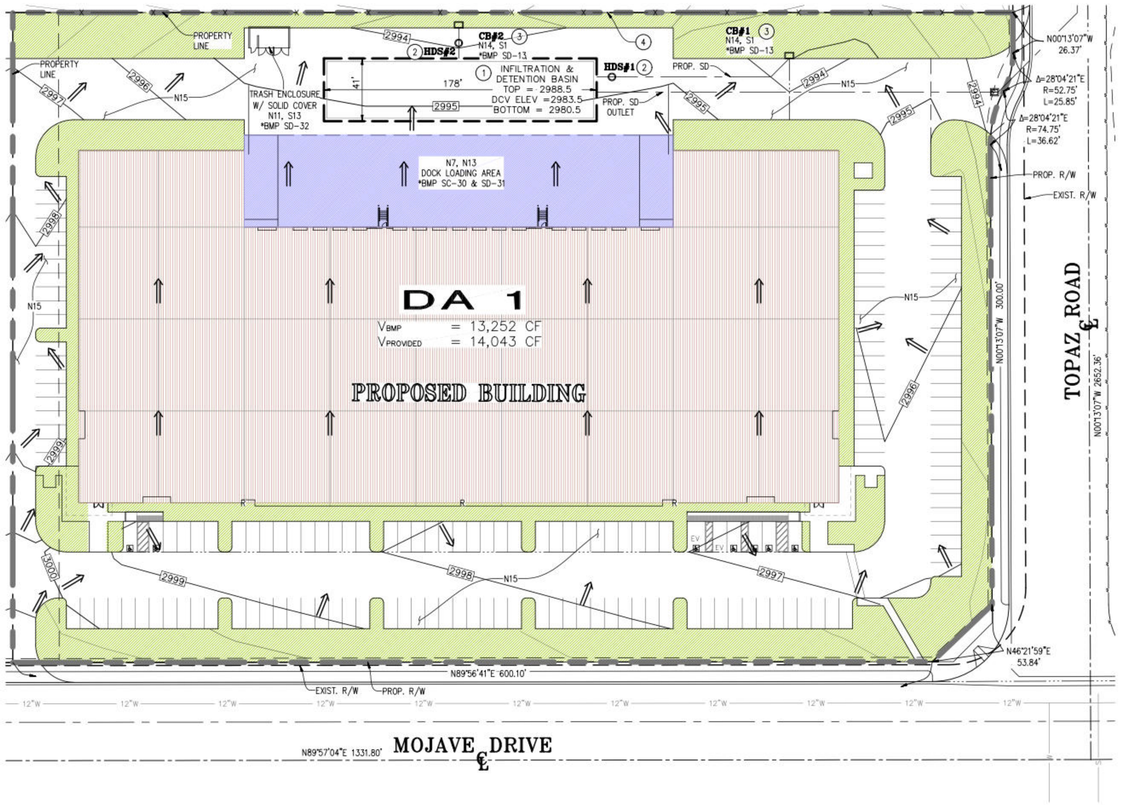
Attach all O&M Plans and Maintenance Agreements for BMP to the WQMP.

6.4 Other Supporting Documentation

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

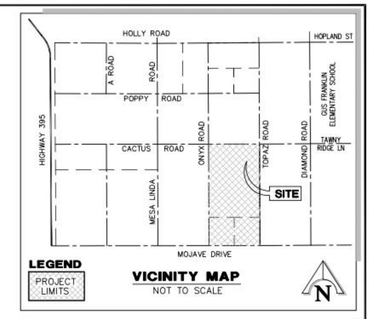
Attachment A
WQMP Site Plan


HOLLY ROAD
HOPLAND ST
A ROAD
ROAD
POPPY ROAD
HIGHWAY 395
GUS FRANKLIN ELEMENTARY SCHOOL
ONYX ROAD
TOPAZ ROAD
DIAMOND ROAD
TAWNY RIDGE LN
CACTUS ROAD
MESA LINDA
SITE
MOJAVE DRIVE
LEGEND
PROJECT LIMITS
VICINITY MAP
NOT TO SCALE
N



LEGEND

- PROPOSED STORM DRAIN
- WQMP & DA BOUNDARY
- PROPOSED CURB OPENING INLET W/ FILTER INSERT
- CB CATCH BASIN
- R BUILDING RIDGE LINE
- FLOW DIRECTION
- PROPOSED LANDSCAPING AREA – N3, S5, *BMP SD-10 & SD-12
- PROPOSED LOADING DOCK AREA – N7, N13, *BMP SC-30 & SC-31
- PROPOSED ROOF AREA
- PROPOSED IMPERVIOUS (PARKING, DRIVE LANE, SIDEWALKS, RAMPS)



BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

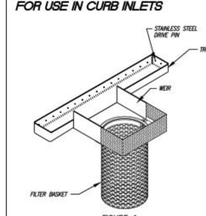


FIGURE 1: DETAIL OF PARTS

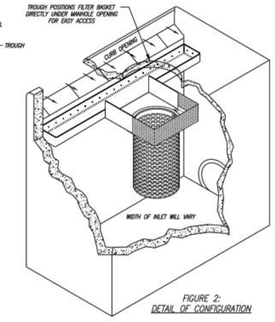


FIGURE 2: DETAIL OF CONFIGURATION

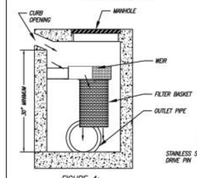


FIGURE 4: DETAIL OF PROFILE

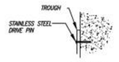


FIGURE 3: DETAIL OF MOUNTING

NOTES:
1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% 100lB STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGING SCREEN WITH 4.7 MM OPENINGS AND 50 PSI FOR FULL CAPTURE REQUIREMENTS.
6. FILTERS ARE RETROFITTED WITH HYDROCARBON ABSORBENT BOOM.
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS SAFETY FACTOR OF 2.
11. BYPASS IS REGULATED BY THE OVERFLOW OF THE TROUGH WHICH WAS DESIGNED TO THE CAPACITY OF THE CURB OPENING.
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS — MEETS FULL CAPTURE REQUIREMENTS
TREATMENT FLOW RATE: 2.85 cfs — MODEL #: BIO-CURB-FULL
WARRANTY: 1 YEAR MANUFACTURER'S — PROJECT:

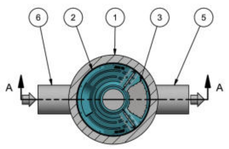
BIO CLEAN ENVIRONMENTAL SERVICES, INC.
398 VIA EL CENTRO, OCEANSIDE CA 92058
PHONE: 760-433-7640 FAX: 760-433-3176
DATE: 10/12/2017 SCALE: NTS
DRAWN BY: M.C.P. UNITS = INCHES

REVISIONS: DATE:

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com

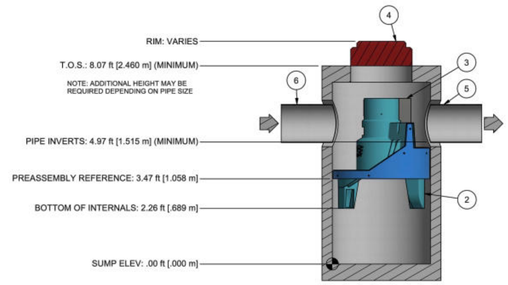
Page 1

3 CURB INLET SYSTEM
NOT TO SCALE



SECTION A-A
SCALE 1:40

HYDRO FRAME AND COVER (INCLUDED)
GRADE RINGS BY OTHERS AS REQUIRED



SECTION A-A
SCALE 1:30

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.
2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.
3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA. AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
3. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.

PARTS LIST				
ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1			5mm TRASH SCREEN (PRE-INSTALLED)
4	1	30	750	FRAME AND COVER (ROUND)
5	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
6	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION
IF IN DOUBT ASK
DATE: 12/13/2021 SCALE: 1:40
DRAWN BY: EHR CHECKED BY: APPROVED BY:
Title: 4-ft DIAMETER FDHC FULL TRASH CAPTURE GENERAL ARRANGEMENT

Hydro International
hydro-int.com
©2020 HYDRO INTERNATIONAL
WEIGHT: MATERIAL: Stainless Steel
STOCK NUMBER:
DRAWING NO.: FDHC-FTC
SHEET SIZE: B SHEET: 1 OF 1 Rev: -

2 HDS #1 AND #2
NOT TO SCALE

WQMP BMP NOTES

** (1) INSTALL CONTECH 84" CMP INFILTRATION/RETENTION SYSTEM OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION
** (2) INSTALL ADS HDS UNIT OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION
(3) INSTALL BIOCLEAN CURB INLET FILTER, SEE DETAIL HEREON
(4) INSTALL SILT FENCE PER CASQA BMP EC SE-1 (OR APPROVED EQUAL)
** DETAIL TO BE PROVIDED IN FINAL

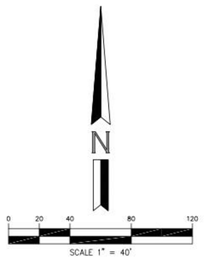
NAME	TOTAL AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	i	C	V_{BMP} (CF)	BMP	$V_{PROVIDED}$ (CF) (RETENTION)	V_{TOTAL} (CF) (DETENTION)
DA 1	270,675	215,362	55,313	0.80	0.73	13,252	INFILTRATION BASIN/ DETENTION BASIN	14,043	39,840

SOURCE CONTROL BMPs INCLUDED ONSITE		
IDENTIFIER	DESCRIPTION OF BMP	RESPONSIBLE PARTY
N3	LANDSCAPE MAINTENANCE BMP'S	OWNER
N7	PROVIDE SPILL PLAN	OWNER
N11	LITTER/DEBRIS CONTROL PROGRAM	OWNER
N13	HOUSEKEEPING OF LOADING DOCKS	OWNER
N14	CATCH BASIN INSPECTION PROGRAM	OWNER
N15	VACUUM SWEEPING OF PARKING LOTS	OWNER
N17	NPDES COMPLIANCE	OWNER
S1	STORM DRAIN STENCILING	OWNER
S3	REDUCED WASTE STORAGE POLLUTION	OWNER
S4	EFFICIENT IRRIGATION SYSTEM	OWNER
S5	LANDSCAPING MIN. 1–2" BELOW CURB	OWNER

*SEE WQMP REPORT ATTACHMENT C FOR BMP FACT SHEET

OWNER/DEVELOPER
MOJAVE 80 GRAY, LLC
C/O COVINGTON DEVELOPMENT PARTNERS, LLC
3 CORPORATE PLAZA, SUITE 230
NEWPORT BEACH, CA 92660
OFFICE: 949-514-0274
CONTACT: DANA WHITMER

ENGINEER
HUITT-ZOLLARS
3990 CONCOURS, SUITE 330
ONTARIO, CALIFORNIA 91764
PHONE: (909) 941-7799
CONTACT: JOHNNY MURAD



BASIS OF BEARINGS:
BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN SOPAC STATION P581 AND SOPAC STATION AVRY BEING N85°20'40"W

BENCH MARK
V-215
NAVD29, ELEVATION=2998.27'
MOJAVE DR. @ TOPAZ RD., TC OF CENTER ISLAND NOSE 48' E/O INT.

BY	MARK	DESCRIPTION	APPR.	DATE
ENGINEER		REVISIONS	CITY	

DESIGNED BY: M.M.
DRAWN BY: H-Z STAFF
CHECKED BY: J.M.
SCALE: AS SHOWN

CITY CASE NO. (to be assigned at plan submittal)

CITY OF VICTORVILLE
ENGINEERING DEPARTMENT
14343 Civic Drive, Victorville, CA 92392 (760) 955-5000
Approved By:
Brian W. Gengler, RCE C44730 — DATE
City Engineer

REGISTERED PROFESSIONAL ENGINEER — JOHNNY MURAD — NO. 67512 EXPIRATION 6-30-2025 — CIVIL — STATE OF CALIFORNIA

PREPARED BY:
REGISTERED CIVIL ENGINEER NO. 67512
EXPIRATION: 6-30-2025
DATE

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS • SUITE 330 • ONTARIO, CALIFORNIA 91764
PHONE (909) 941-7799 • FAX (909) 941-7789

CITY OF VICTORVILLE
MOJAVE INDUSTRIAL PARK
WQMP MAP - PRELIMINARY CONDITION
BUILDING 1
FOR COVINGTON GROUP
M.O.
CITY FILE NO. .
SHEET 1 OF 1 SHEETS

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Attachment B
BMP Details & Support Calc's

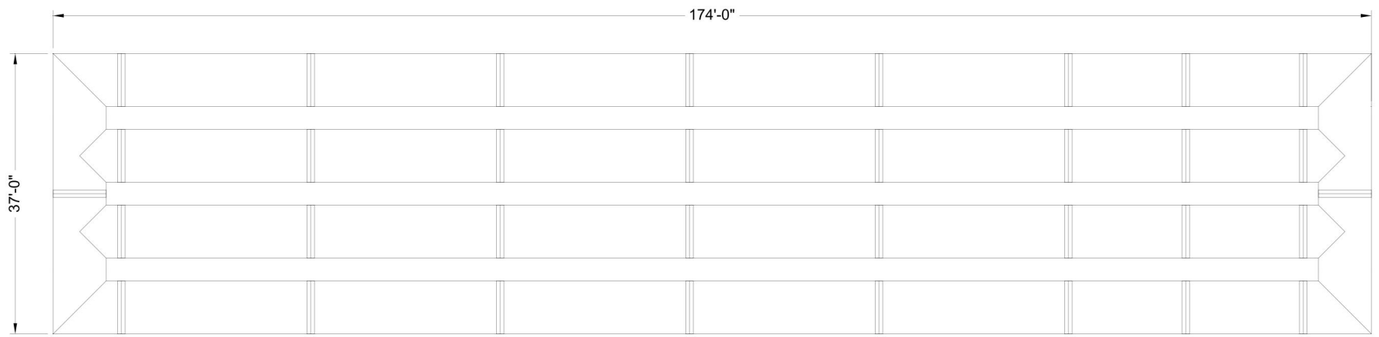
PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 714 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 39,756 CF
- PIPE STORAGE VOLUME = 27,478 CF
- BACKFILL STORAGE VOLUME = 12,362 CF
- TOTAL STORAGE PROVIDED = 39,840 CF

PIPE DETAILS
- DIAMETER = 84"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 24"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 24"
- 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 $2\frac{2}{3}$" x $\frac{1}{2}$" 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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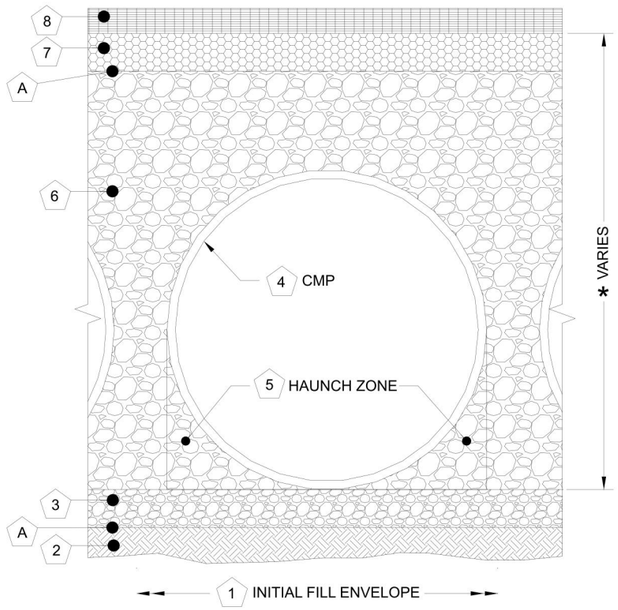
DATE	REVISION DESCRIPTION	BY

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

DYO30922 Covington - Mojave Industrial Park
Building 1
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30922	4/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (if applicable)			
7 Road Base (if applicable			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6 Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3 Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of Infiltration systems due to the propensity for geotextiles to clog over time.
* Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 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 BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

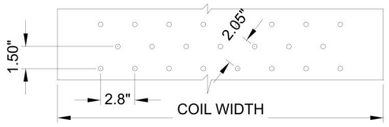
5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL
MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

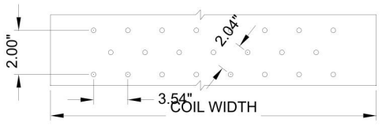
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2" CORRUGATION - STEEL AND ALUMINUM CMP EDGE SPACING EQUAL ON BOTH SIDES



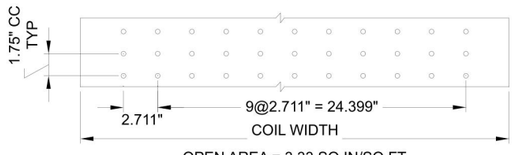
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION - STEEL AND ALUMINUM CMP (COIL PROVIDED FROM CONTECH LANTANA, FL PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY
EDGE SPACING EQUAL ON BOTH SIDES



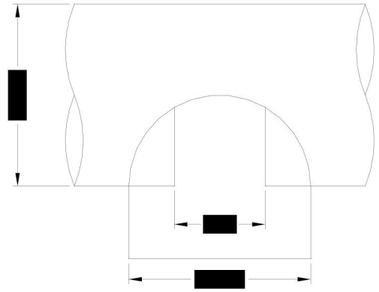
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

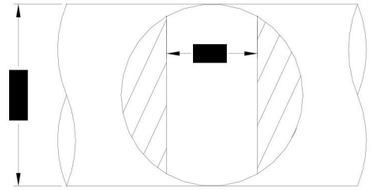
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ⌀3/8".

TYPICAL PERFORATION DETAIL

SCALE: N.T.S.



PLAN

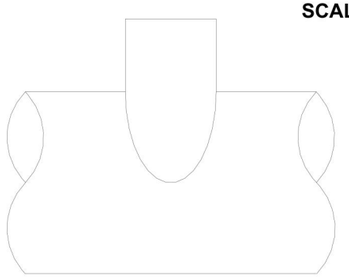


FRONT

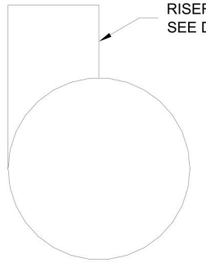
TYPICAL MANWAY DETAIL

SCALE: N.T.S.

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.



ELEVATION

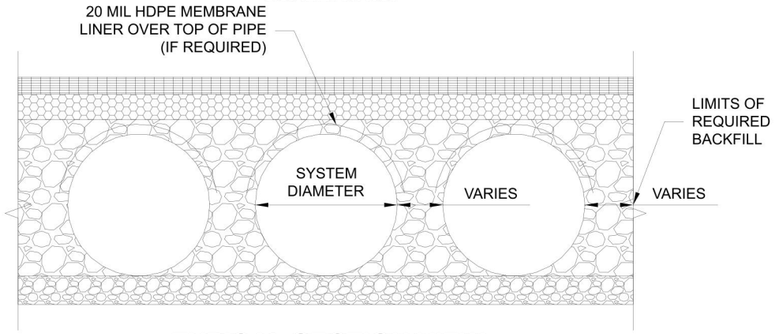


END

TYPICAL RISER DETAIL

SCALE: N.T.S.

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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DATE	REVISION DESCRIPTION	BY

CONTECH® ENGINEERED SOLUTIONS LLC
www.ContechES.com
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800-338-1122 513-645-7000 513-645-7993 FAX

CONTECH® CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO30922 Covington - Mojave Industrial Park
Building 1
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30922	4/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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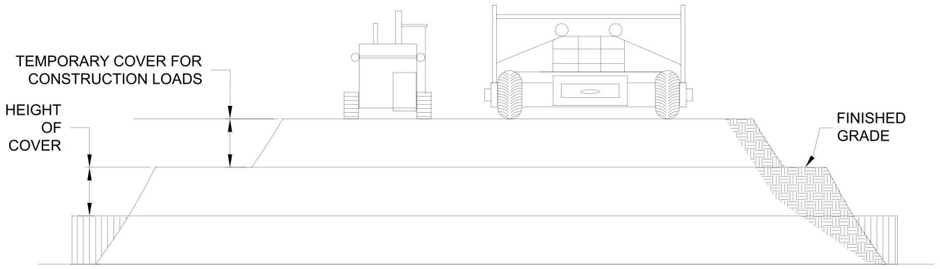


CONSTRUCTION LOADS

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.

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

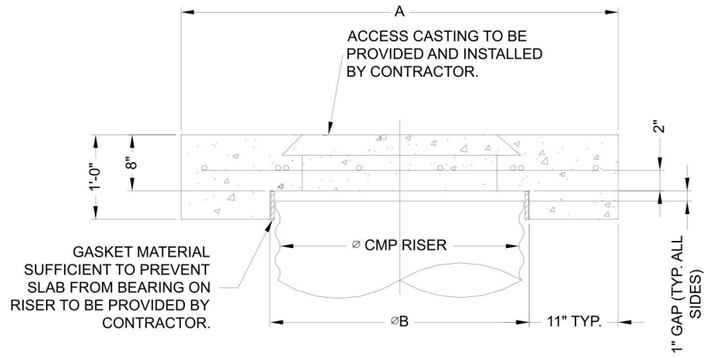
ALUMINUM: AASHTO M-196 OR ASTM B-745

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.

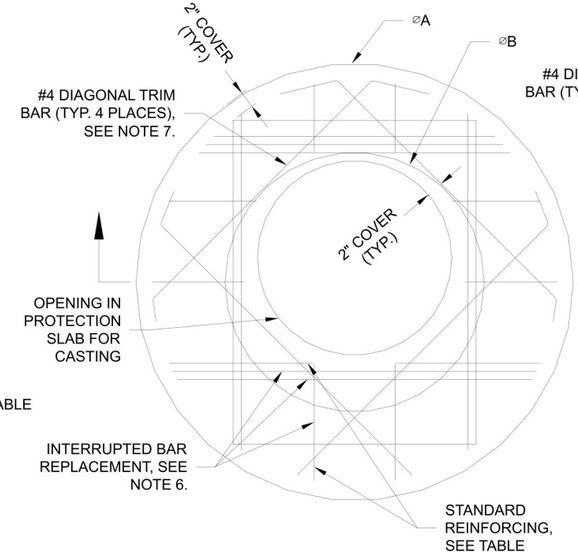
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



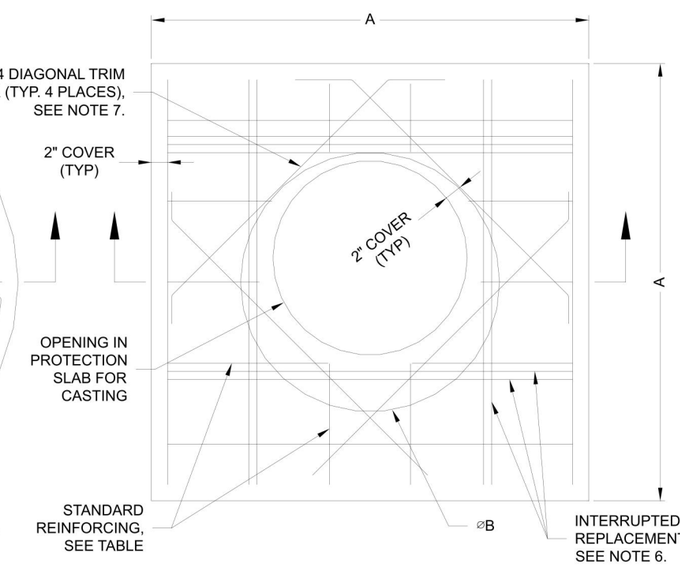
SECTION VIEW

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

DYO30922 Covington - Mojave Industrial Park
Building 1
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30922	4/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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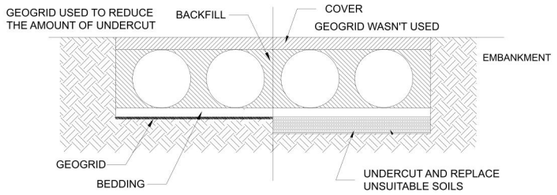
CMP DETENTION INSTALLATION GUIDE

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.

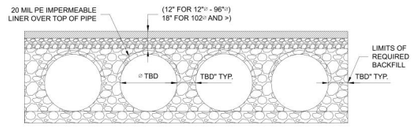


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING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

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

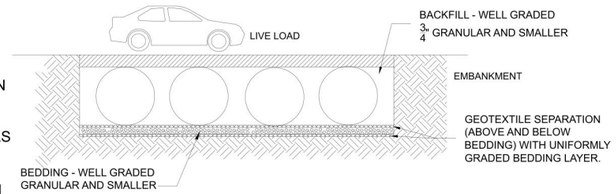
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

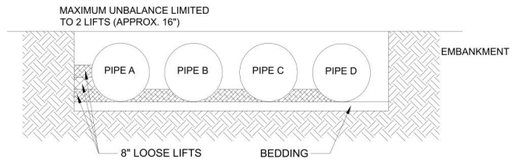
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION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



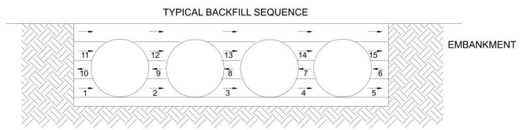
BACKFILL PLACEMENT

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

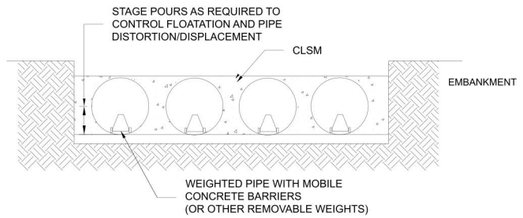


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE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

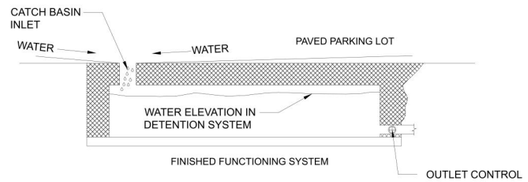


CONSTRUCTION LOADING

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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CONTECH **DYODS** DRAWING

DYO30922 Covington - Mojave Industrial Park Building 1 Victorville, CA DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30922	4/27/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 1
Location: HDS#1

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 2.4 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 0.4 $\frac{ft^3}{s}$	***(12)***

Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 1
Location: HDS#2

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 3.8 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 0.63 $\frac{ft^3}{s}$	***(12)***

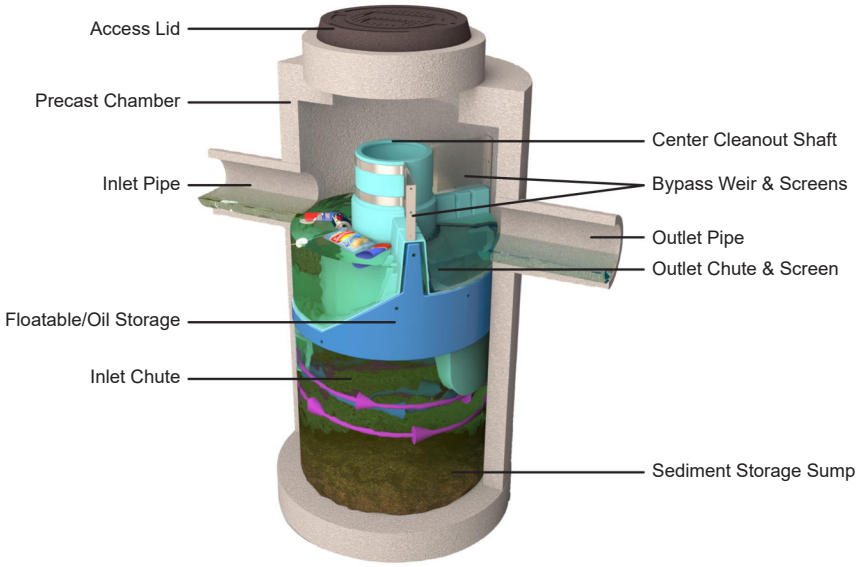
First Defense® FTC

Full Trash Capture Hydrodynamic Separator

Product Summary

First Defense Full Trash Capture (FTC) is an advanced hydrodynamic separator that combines enhanced vortex technology for total suspended solids (TSS) removal with a 5mm screen to meet full trash capture requirements set by the California Water Boards.*

Features



*One-hour, one-year design storm.

Applications

- Removal of Total Suspended Solids (TSS), floatable trash, and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pre-treatment for green infrastructure and ponds
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- LEED® development projects
- Retrofitting existing systems

How It Works

1. Stormwater enters the Inlet Chute, where water is directed downwards and into a rotational motion around the Sediment Storage Sump.
2. Free floating trash is retained in the Inlet Chute area. Sediment and other settleable solids are retained in the Sediment Storage Sump as water follows a rotational path to the screened Outlet Chute.
3. Water then exits upward in the Outlet Chute where a horizontal screen prevents the loss of any suspended debris larger than 5mm. High flows can bypass directly to the outlet via the Bypass Weirs.
4. Two Bypass Screens continue to treat and retain the free floating debris. In extreme events water can crest the bypass screen and go directly to the outlet to prevent upstream flooding.

Model Number	Diameter	Maximum Pipe Diameter[1]	Trash Storage Capacity[2]	Flow Rate (cfs) for Screen Blinding Percentage[3]				Bypass Capacity	Typical TSS Treatment Rates
Model	(ft / m)	(in / mm)	(yd^3 / m^3)	0%	25%	50%	75%	(cfs)	(cfs / L/s)
FD-4 FTC	4 / 1.2	24 / 600	0.83 / 0.63	7.94	7.10	5.27	3.43	18	1.88 / 53.2
FD-5 FTC	5 / 1.5	24 / 600	1.54 / 1.18	13.02	10.51	7.87	6.07	20	2.94 / 83.2
FD-6 FTC	6 / 1.8	30 / 750	2.22 / 1.70	25.60	21.50	16.01	10.66	32	4.23 / 119.8
FD-8 FTC	8 / 2.4	48 / 1219	5.28 / 4.00	34.16	33.75	26.29	16.88	50	7.52 / 212.9

[1]*Contact Hydro International when larger pipe sizes are required.*
[2]*Trash storage volume estimated as half the chamber volume from the base of the Inlet Chute to top of Bypass Weirs (not bypass screens). Actual volume of material stored will vary with size, density, and type. Larger volumes of trash may be retained.*
[3]*Calculated using HydroCAD modelling. A lower blinding factor can be applied to sites with lower anticipated loads.*

HDS #1 & #2

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200
Email: stormwaterinquiry@hydro-int.com
Web: www.hydro-int.com/firstdefense

FD-FTC_SS_E_2110

Download Drawings:

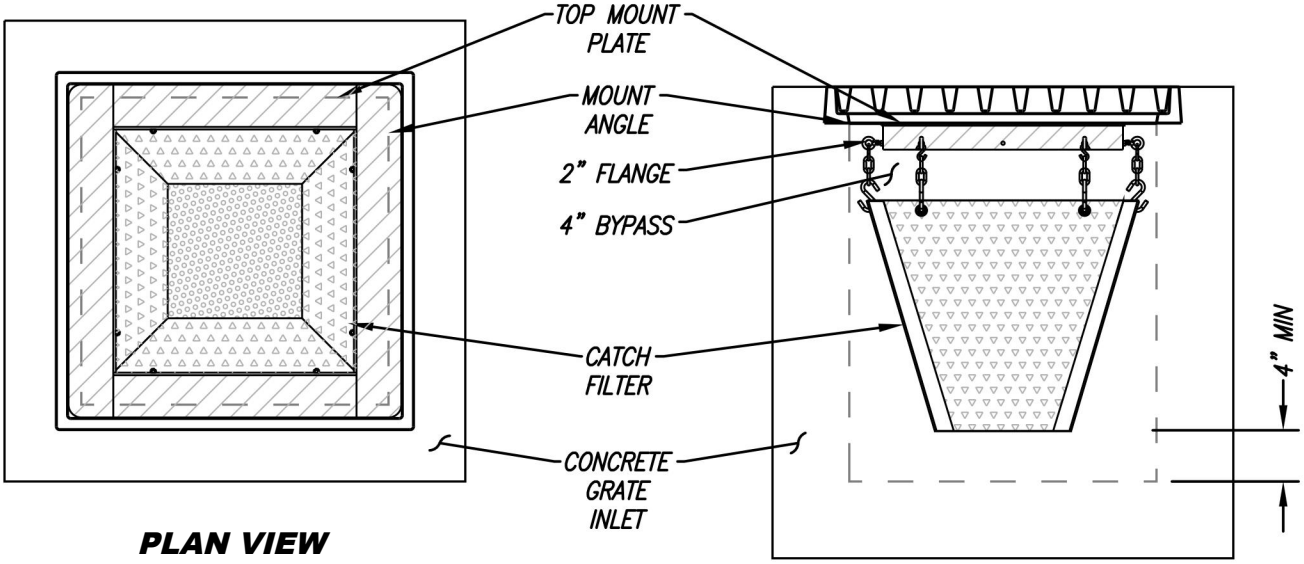
→ hydro-int.com/fddrawings

Operation & Maintenance Manual:

→ hydro-int.com/fd-om

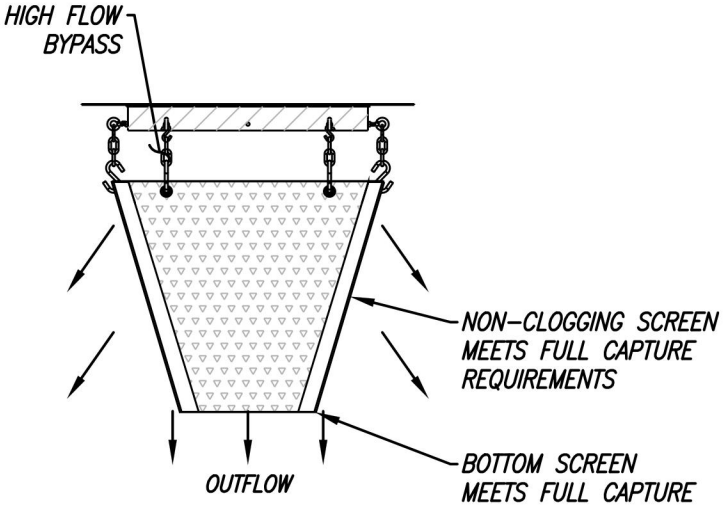
BIO CLEAN FULL CAPTURE FILTER

FOR USE IN GRATE INLETS



PLAN VIEW
(GRATE NOT SHOWN)

ELEVATION VIEW



FLOW DIAGRAM

MODEL #	TREATMENT FLOW RATE (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.04	1.24	0.15
BIO-GRATE-FULL 18-18-12	1.78	2.79	0.33
BIO-GRATE-FULL 24-24-12	2.70	4.96	0.59
BIO-GRATE-FULL 24-40-12	3.70	6.35	0.88
BIO-GRATE-FULL 24-24-24	7.31	4.96	1.22
BIO-GRATE-FULL 24-40-24	9.53	6.35	1.82
BIO-GRATE-FULL 36-36-24	11.93	7.74	2.73

INSTALLATION NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL.
2. OPTIONAL HYDROCARBON BOOM SHALL BE 2" DIAMETER.
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

NOT TO SCALE

PROPRIETARY AND CONFIDENTIAL:

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GRATE INLET FILTER
FULL CAPTURE
STANDARD DETAIL

9/23/22CSCHIPPER

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

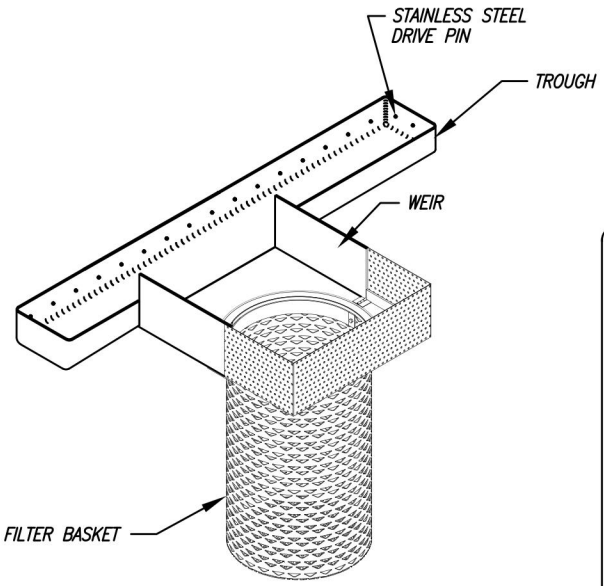

FIGURE 1:
DETAIL OF PARTS

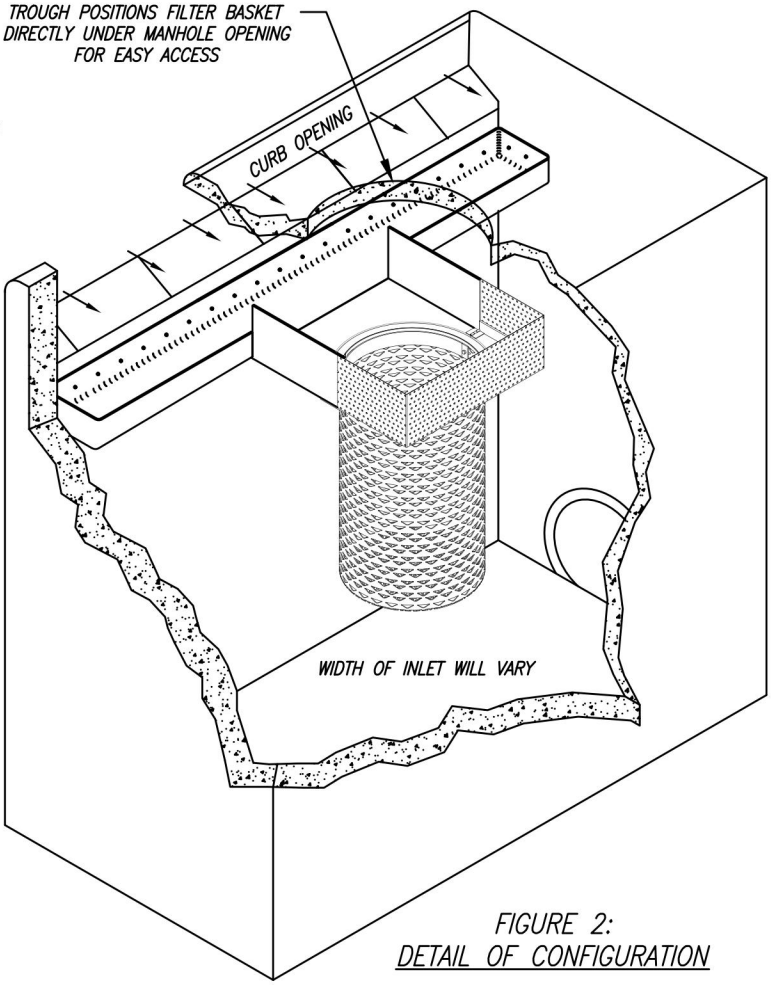

FIGURE 2:
DETAIL OF CONFIGURATION

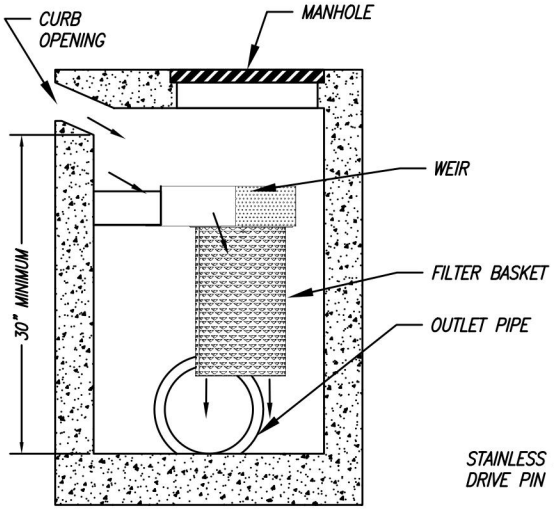

FIGURE 4:
DETAIL OF PROFILE

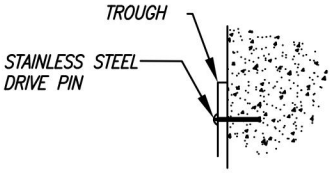

FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE - CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BIO-CURB-FULL	
WARRANTY: 1 YEAR MANUFACTURER'S		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

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MODEL # BIO-CURB-FULL FILTER

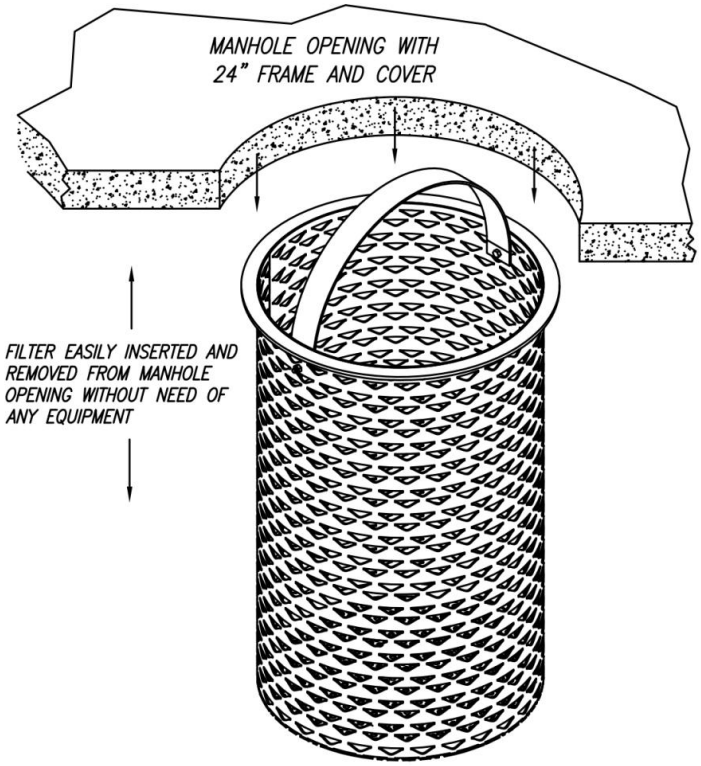

FIGURE 1:
DETAIL OF INSTALLATION

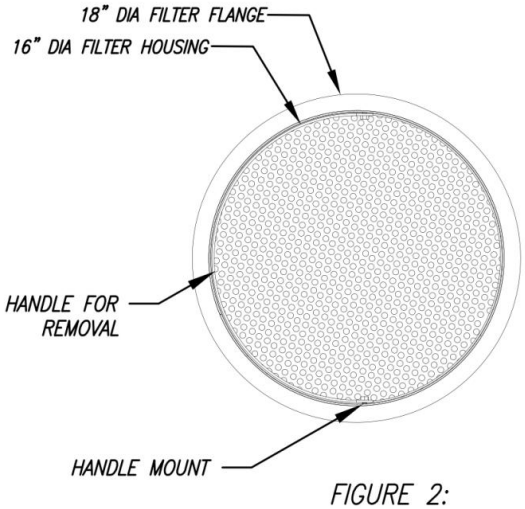

FIGURE 2:
DETAIL OF DIAMETERS

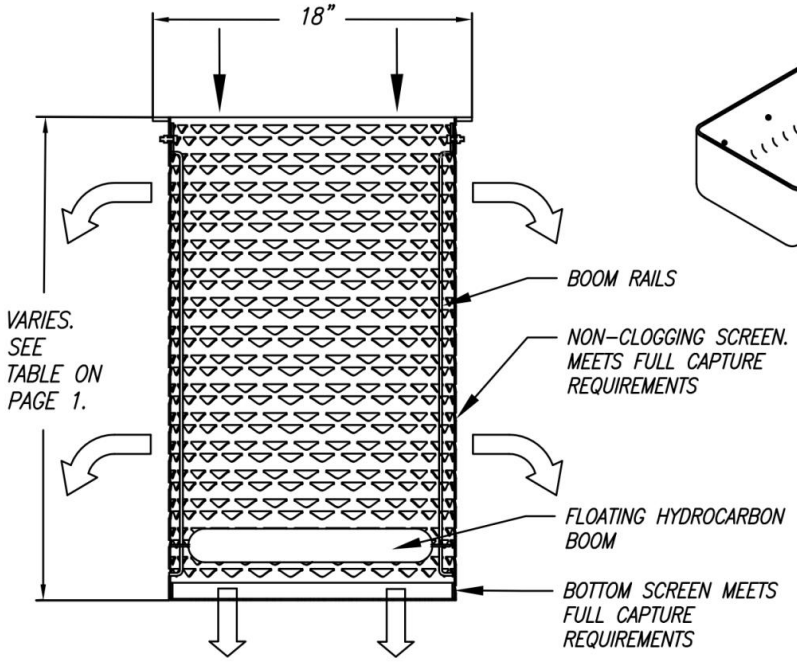

FIGURE 3:
DETAIL OF PARTS

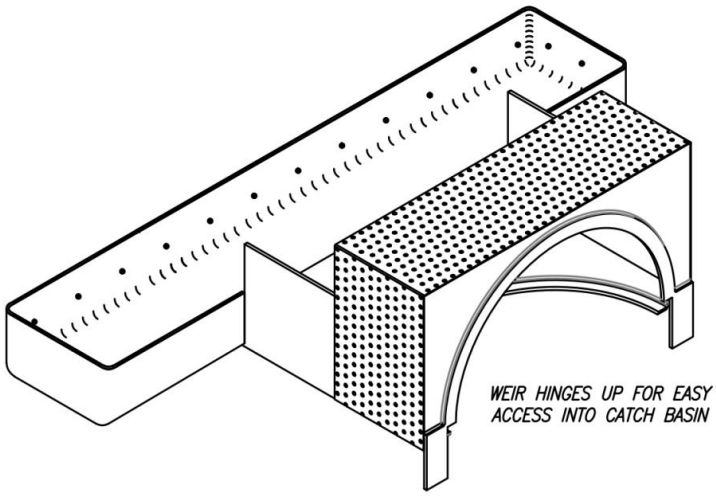

FIGURE 4:
DETAIL OF WEIR

FLOW RATES – CURB FILTER		
TREATMENT FLOW RATE	2.85 cfs	SAFETY FACTOR OF 2X
*TREATMENT FLOW RATE IS BASED ON THE CRITICAL POINT OF RESTRICTION, WHICH IS EITHER THE WEIR OR THE SCREEN CAPACITIES.		WEIR CAPACITY=2.85 CFS SCREEN CAPACITY=4.82 CFS
**FLOW RATES CALCULATED USING THE FOLLOWING EQUATION $Q=SO*c_d*A\sqrt{2*g*h}$ c_d = COEFFICIENT of DISCHARGE = .62		

DRAWING: BIO-CURB-FULL FILTER		MEETS FULL CAPTURE REQUIREMENTS		SEE PAGE 1 FOR NOTES
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BIO-CURB-FULL		CONTECH® ENGINEERED SOLUTIONS LLC www.ContechES.com
WARRANTY: 1 YEAR MANUFACTURER'S		PROJECT:		
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:	
		REVISIONS:	DATE:	
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:	
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:	PAGE 2

Attachment C
Educational Materials

Outdoor Loading/Unloading SC-30

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

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Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/unloading area to a drain that is connected to a deadend.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

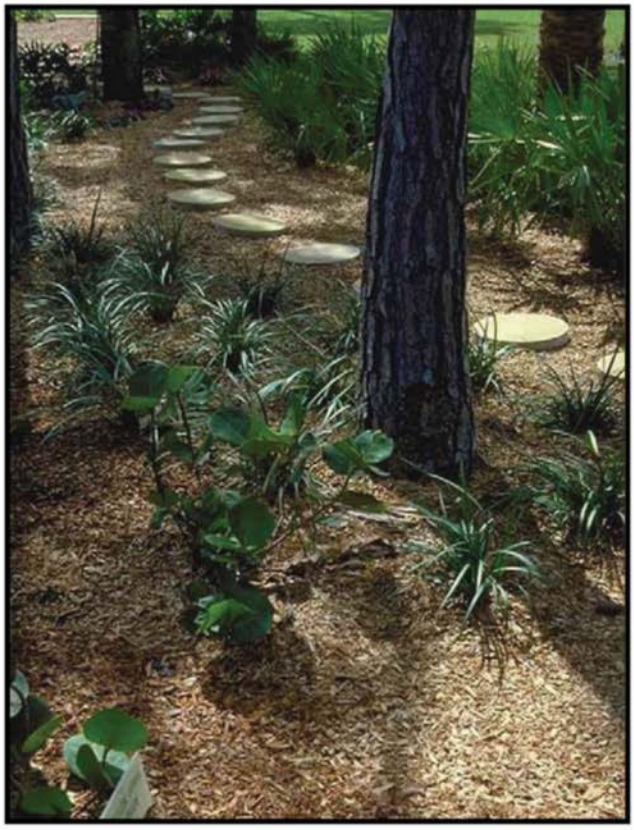
Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

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.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

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

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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

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– 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.

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be 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.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Design Objectives

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

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

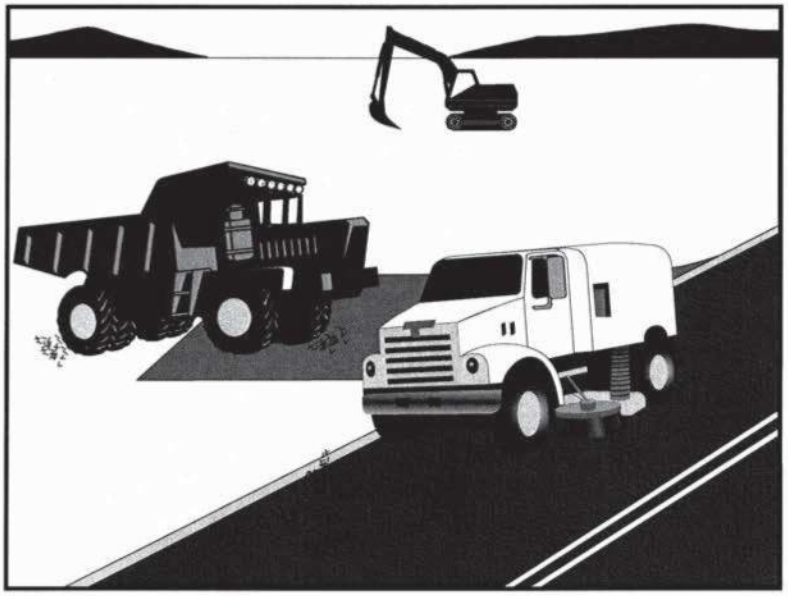
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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

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

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

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

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- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

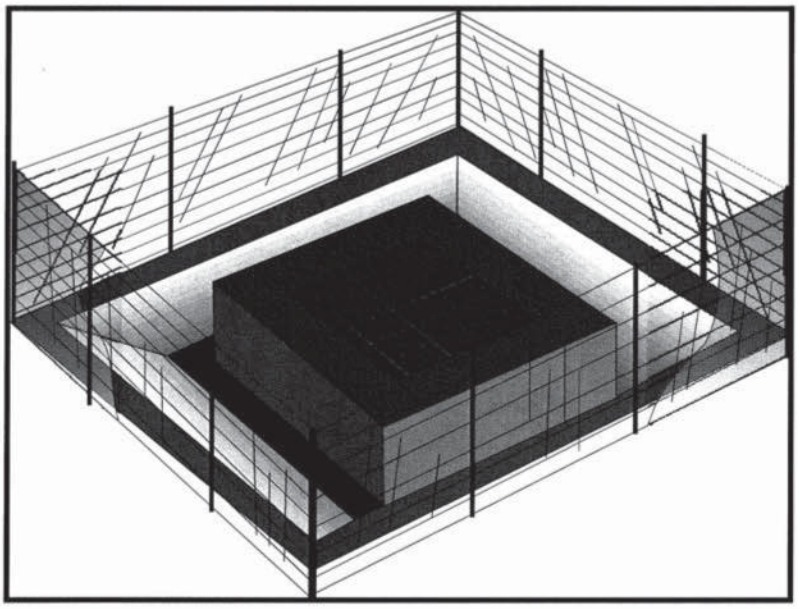
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.

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- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other onsite sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Six types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
  - Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag*** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.
  2. Leave room upstream of barrier for water to pond and sediment to settle.
  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.
  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.

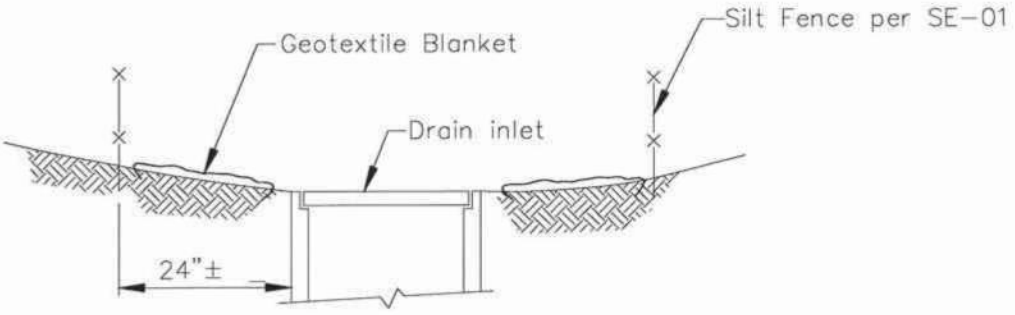
- Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

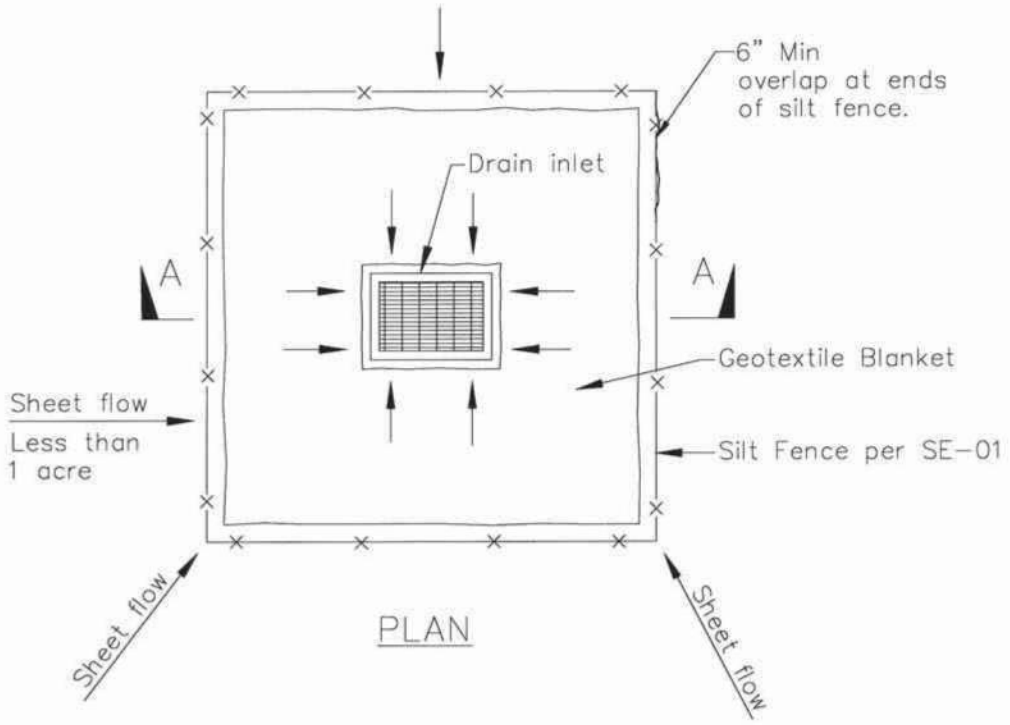
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

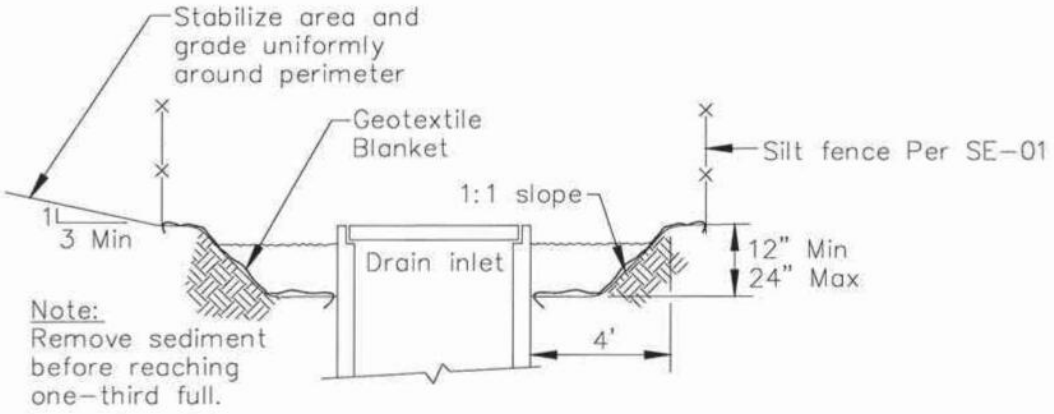


PLAN

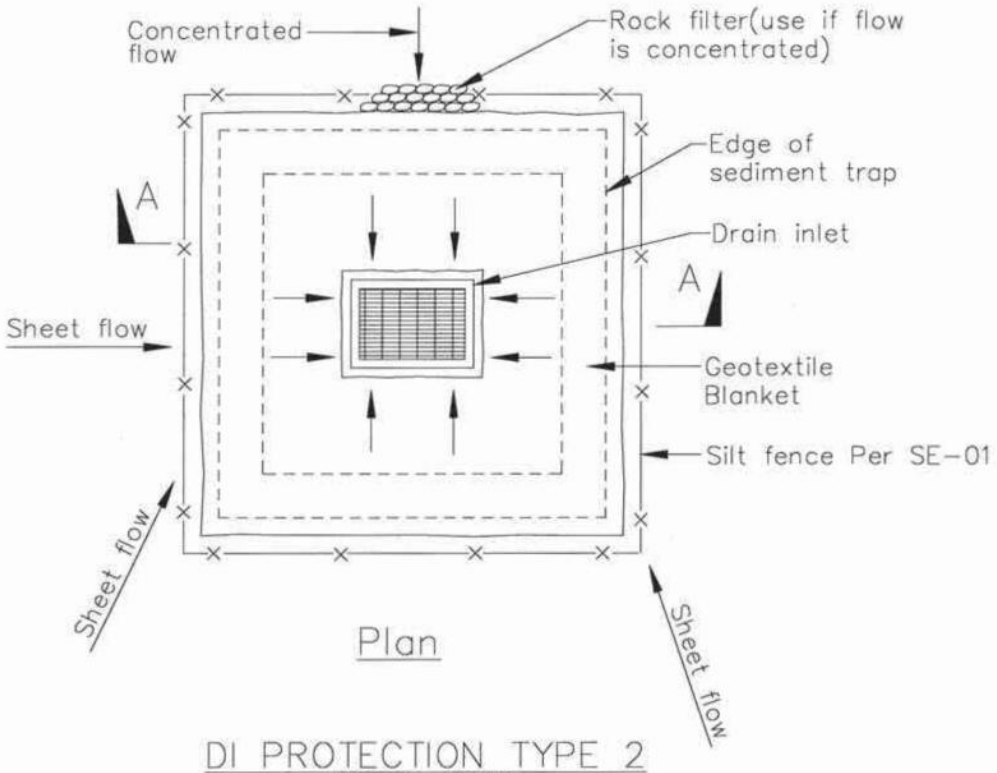
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



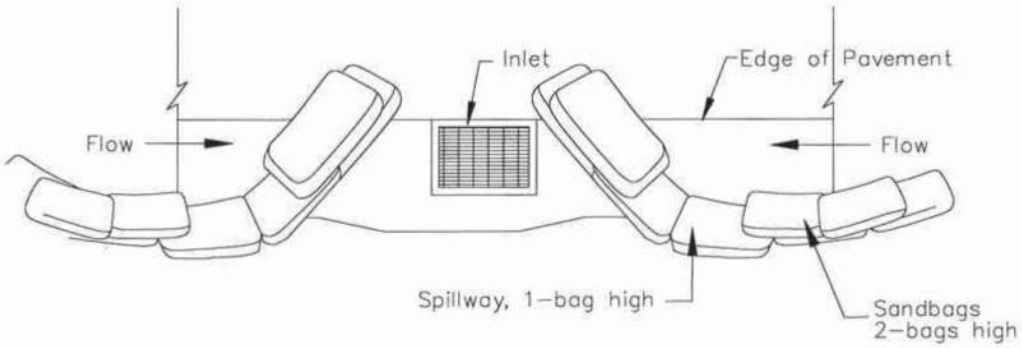
Section A-A



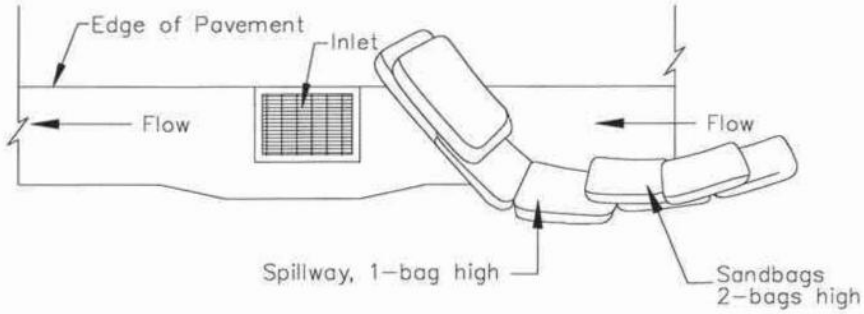
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

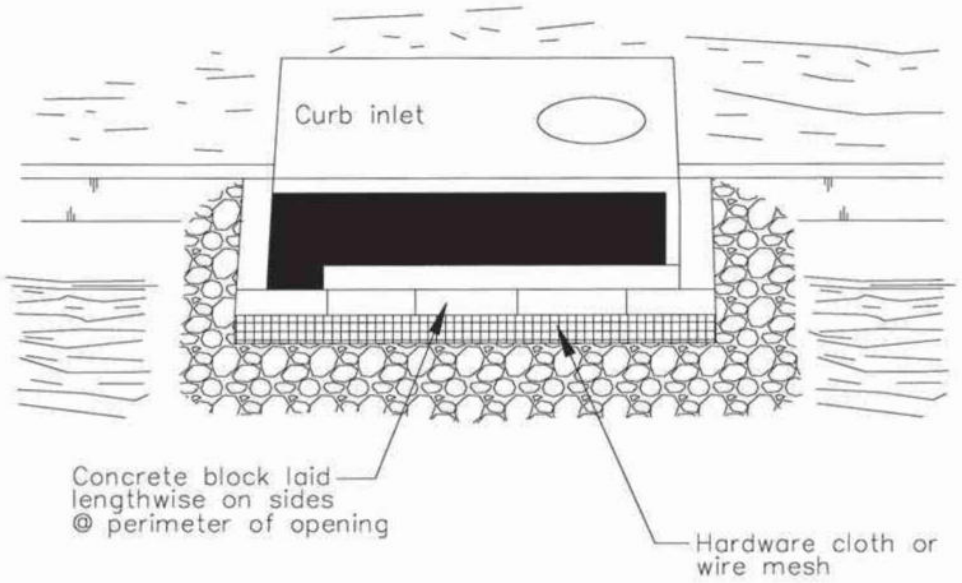


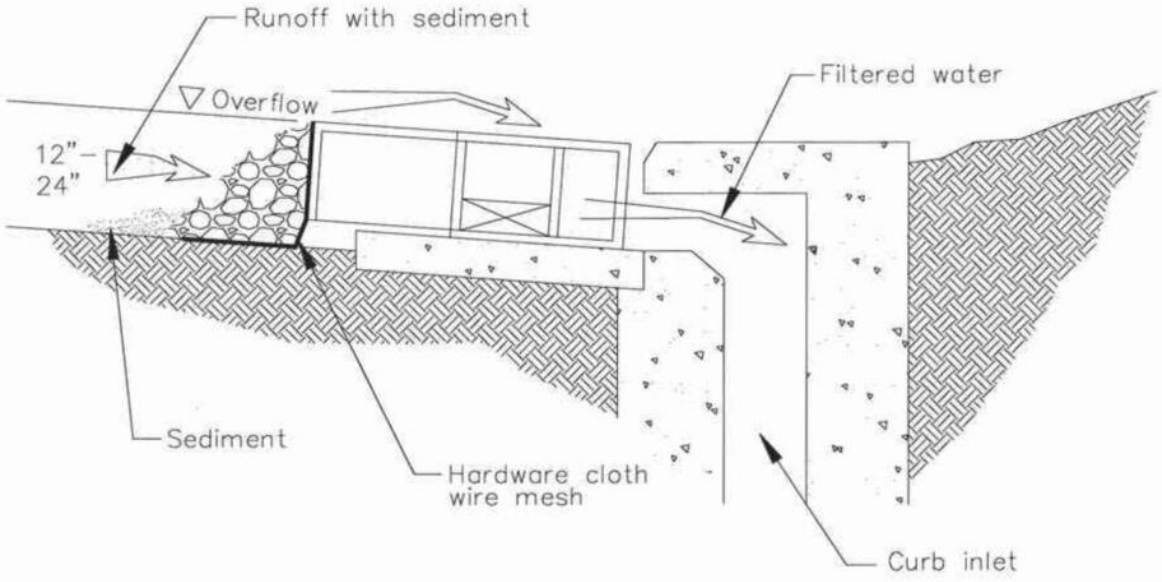
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4
NOT TO SCALE

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

CASQA California Stormwater Quality Association

one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

STORMWATER Pollution Prevention

CONSTRUCTION

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.

Store Materials Safely

Keep construction materials and debris away from the street, gutter and storm drains. 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. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading 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.

Recycling Waste
Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.

Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.

Cleaning & Preventing Spills
Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.

Storing Materials
Keep construction materials and debris away from the street, gutter and storm drains. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

Preventing Erosion
Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

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.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

ROADWORK AND PAVING

Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal 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.

Preventing Erosion
Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

During Construction
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.

Maintaining Vehicles & Equipment
Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal
Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.

Cleaning & Preventing Spills
Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.

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

1 (800) CLEANUP

www.1800cleanup.org

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

STORMWATER Pollution Prevention

HOME & GARDEN

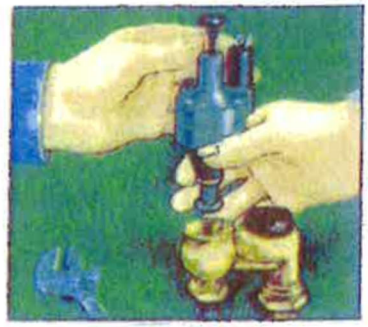
Yard waste and household toxics like paints and pesticides often make their way into the San Bernardino County storm drain system and do not get treated before reaching the Santa Ana River. This pollutes our drinking water and contaminates waterways, making them unsafe for people and wildlife. Follow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

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

FOOD AND RESTAURANT

Food waste, grease, cleaning fluids, mop water and trash from restaurant operations 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.

Recycle Oil & Grease

Oil and grease wastes can be recycled. Look in the yellow pages for rendering companies, or call (909) 386-8401 for disposal information. Don't pour oil or grease into sinks, floor drains or onto a parking lot or street. Keep grease bins covered and contained. Keep your grease interceptor maintained to prevent sewer overflows or backups and keep records of grease waste hauling.

Dumpster Areas

Keep dumpster lids closed and the areas around them clean. Do not fill with liquid waste or hose them out. Call your trash hauler to replace any dumpsters that are damaged or leak.

Cleaning & Maintenance

Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to the sewer through a grease trap. Don't wash them or pour wash water in a parking lot, alley, sidewalk or street. Sweep outside areas and put the debris in the garbage, instead of sweeping or hosing it into the parking lot or street.

Managing Spills

Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping, and discharge mop water into the sewer through a grease interceptor. Have spill containment and cleanup kits available. To report serious toxic spills, call 911.

Handling Toxic Chemicals

Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash. For information on hazardous waste pickup, call (909) 386-8401. Use non-toxic cleaning products whenever possible.

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

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

RESTAURANTES

Desechos de comida, grasa, liquidos de limpieza, agua del trapiador y basura de un restaurant acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el rio de Santa Ana. Para prevenir esta contaminación y protejar la salud publica, siga estas practicas.

Reciclando Aceite & Grasa

El aceite y la grasa se pueden reciclar. Busca en las paginas amarillas compañias de reciclaje o llama al (909) 386-8401 para información. No los tires en los lavaderos, las coladeras, el estacionamiento o en la calle. Manten los recipientes de grasa cubiertos y guardados.

Areas de Basura

Manten el bote de basura cerrada y el área del basurero limpia. No lo llenes con desechos liquidos ni utilices la manguera para lavarlo. Llama al transportador de basura para reemplasar los botes de basura que esten dañados.

Limpiando & Mantenimiento

Limpia los tapetes de piso, los filtros y los botes de basura en el contenedor para trapeadores, lavavo, o en la coladera aprupiado que llegue al drenaje. No los laves en el estacionamiento, los callejones, en la banqueta o en la calle. Barre el area de afuera y pon todo en la basura, en ves de dejarlo en la banqueta o en la calle.

Controlando Derrames

Usa métodos secos para limpiar los derrames, barriendo y usando tierra para desechos de gato, no uses la manguera para limpiar los derrames. Manten un kit de limpieza de derramamientos en tu negocio. Para reportar derrames llama al 911.

Manejando Quimicos Toxicos

Deposita los desechos toxicos como limpiadores, solventes, detergentes a un bote para toxicos. Estos no son basura. Para mas información sobre desechos peligrosos, llama al (909) 386-8401. Usa productos de limpiesa que no sean toxicos.

Para reportar actividadas ilegales u obtener más información de la prevención de contaminación llamar al

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

Asfalto, mezcle y materiales de excavaciones del pavimento acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Previniendo Erosiones
Planea las excavaciones trabajo de jardineria durante el clima seco. Desarrolla e implementa planes de embancamientos de control de sedimento y excavaciones. Cubre montones de tierra, grava y otros materiales con un plastico para protejerlos de la lluvia, aire y desagüe.

Durante Construcción
Cubre los lavados y de mantenimiento a los hoyos al aplicar selladura o mezcle. Revisa las areas de excavaciones, y evita pasarte de agua para prevenir polvadura. Nunca laves los materiales llenos de concreto en la calle, drenajes o en el desagüe.

Mantenimiento de Vehiculos & Herramientas
Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y evita goteaduras de autos que no se usan vasiandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Removiendo Asfalto & Concreto
Bloquea alrededor de los drenajes cuando estes usande las maquinas de sierra, tambien recicla todo el pavimento roto en la compañia demolidora. Para más información llama al (909) 386-8401.

Limpiando & Previniendo Derrames
Mentente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin Barre los derrames en ves de lavarlos con la manguera. Previene los derrames de las maquinas usando enbudos o colocanto garras para absorver cualquier liquido. Para reportar derrames llama al 911.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

PINTURA Pintura, solventes y otros quimicos peligrosos que se usan al pintar acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Pinturas de Agua
Usa pinturas de agua cuando sea posible. Son menos toxicos que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or "cleans with water".

Removiendo Pintura
Residuos de pintura, polvo de pintura y pinturas que contienen plomo son peligrosas. Barrelos en ves de lavarlos con la manguera y desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

Limpiando Pintura
Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner, y vuelvalas a guardar en un frasco, para un uso futuro. Envuelve los residuos de pintura en un periodico y tiralos a la basura.

Removiendo Pintura en Exteriores
Al despintar o lavar exteriores de los edificios con agua de alta presión bloquea los drenajes cercanos y desvia el desagüe. Pregunta las autoridades si puedes desecharla en las alcantarillas.

Reciclando Pintura
Recicla la pintura que sobra en un lugar de colección de materiales peligrosos, guardala para re-toques or regalela a alguien que la use, como a un teatro, a la escuela, una oraganizacion de la ciudad o de la comunidad.

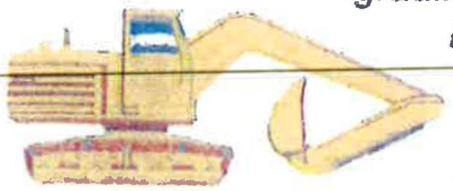
Para reportar actividades ilegales u obtener mas información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

EXCAVATION & GRADING OPERATIONS

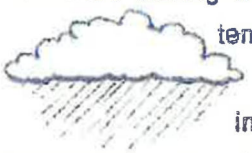
Sediment, cement wash, asphalt, and motor oil from soil excavation and grading operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.



Follow these practices to help prevent stormwater pollution...

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting



temporary vegetation on slopes where construction is not immediately planned. Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Recycling...

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling or disposal information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site. Finally, use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets.

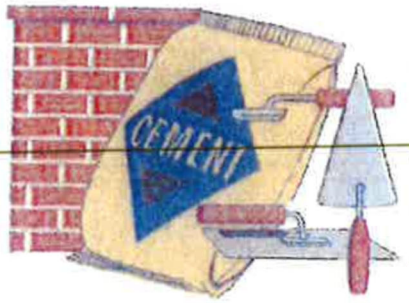
Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find

spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or commeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

FRESH CONCRETE & MORTAR APPLICATION



Cement, cement wash, gravel, asphalt, solvents, and motor oil from fresh concrete and mortar activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

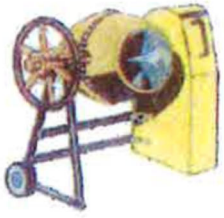
Follow these practices to help prevent stormwater pollution...

General Business Practices...

Schedule excavation and grading work during dry weather, and in case it rains, prevent materials from contacting stormwater by storing them under cover. Also, secure open bags of cement to keep wind-blown cement powder away from streets, gutters and storm drains.

During Construction...

Prevent mortar and cement from entering the storm drains by placing erosion controls (i.e., berms or temporary vegetation) down-slope to capture runoff. When breaking up paving, be sure to pick up all pieces and recycle them at a crushing company; small amounts of excess dry concrete, grout and mortar can be disposed of in the trash. Setup small mixers on tarps or heavy drop cloths to allow for easy cleanup of debris. REMEMBER: Never bury waste material -- recycle or dispose of it as hazardous waste. Call 386-8401 for recycling and disposal information.



Handling Materials & Wastes...

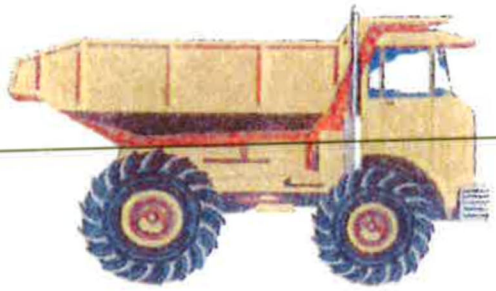
Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Cleaning up...

When cleaning up after driveway or sidewalk construction, wash concrete dust onto designated dirt areas, not down the driveway or into the street or storm drain. Also, wash out concrete mixers and equipment only in specified wash-out areas, where the water flows into containment ponds. Cement washwater can be recycled by pumping it back into cement mixers for reuse. REMEMBER: Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.

For more information, call your city's stormwater representative

GENERAL CONSTRUCTION



Soil, cement wash, asphalt and motor oil 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. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting temporary vegetation on slopes where construction is not immediately planned.

Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Handling Materials & Waste...

Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces; instead, sweep regularly. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

HOME & GARDEN

Yard waste and household toxics such as paints, solvents, 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. These wastes pollute our drinking water and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

In Your Home...

Household products such as paints, paint thinners, drain openers, motor oil, wood polishes, insecticides & herbicides, oven cleaners, and many other general cleaners frequently get dumped on the ground, or into a gutter, street or storm drain. Instead of polluting our stormwaters, take these items to a household hazardous waste collection facility. Call 1-800-OILY-CAT for a facility in your area.

Fertilizers and Pesticides...

Fertilizers and pesticides are often carried into our storm drains by sprinkler runoff. To minimize stormwater pollution, use organic or non-toxic pesticides and fertilizers as directed, and keep them away from ditches, gutters and storm drains. Store them in a covered area, off the ground, to prevent contact with water. For additional gardening questions, call the San Bernardino Master Gardeners at 387-2182.

Trimmin' the Garden...

Decaying organic materials that enter our storm drains, such as grass, leaves, yard clippings, and pet waste, will use up oxygen in nearby streams, stressing aquatic life. Prevent stormwater pollution by not blowing, sweeping, raking or hosing yard waste into the street, gutter, or storm drain. Alternatively, leave grass clippings on your lawn after mowing, or compost your clippings and yard waste. Pet waste should not be composted, but rather disposed of in the trash to prevent the potential spread of diseases.

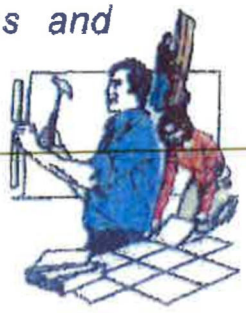
Planting In The Yard

Produce less yard waste and save water by planting low maintenance trees and shrubs. Also, conserve water and minimize unwanted runoff by using drip irrigation, soaker hoses, or micro-spray systems to water vegetation.

For more information, call your city's stormwater representative

HOME REPAIR & REMODELING

Paints, solvents, adhesives, dusts, sediments, pesticides and household toxics commonly associated with home repair and remodeling activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.



Follow these practices to help prevent stormwater pollution...

Household Hazardous Wastes...

Common household cleaners, paint products, and wallpaper & tile adhesives contain toxic substances. Dispose of these products properly. REMEMBER: Toxic wastes should never enter the storm drain system. For disposal information, call 1-800-OILY-CAT.

Construction...

Keep all construction debris away from the street, gutter and storm drain, and if possible, schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of asphalt, sand, etc. with plastic tarps, and prevent erosion by planting fast-growing annual and perennial grasses, which will shield and bind the soil.

Landscape & Gardening...

Use fertilizers and pesticides as directed. Keep them away from ditches, gutters and storm drains, and store them in a covered area to prevent contact with rain water. Also, minimize runoff and conserve water by using drip irrigation, soaker hoses, or micro-spray systems. REMEMBER: Do not deposit leaves into the street, gutter, or storm drain.

Painting...

CLEANUP... Avoid cleaning brushes or rinsing paint containers into a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible, and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

REMOVAL... Paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. Sweep them up and call 1-800-OILY-CAT for disposal information.

RECYCLING... Recycle or reuse leftover paint by using it for touch-ups, or by giving it to someone who can us it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 1-800-OILY-CAT for disposal information.

Concrete & Masonry...

Store bags of cement and plaster away from gutters and storm drains, and under cover, protected from rainfall, runoff and wind. REMEMBER: Never dispose of cement washout or concrete dust onto driveways, streets, gutters or storm drains.

For more information, call your city's stormwater representative

PAINTING

Paints, solvents, adhesives, and toxic chemicals from painting operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Keep all paint products and wastes away from the street, gutter, and storm drains. Reuse paint thinner by setting used thinner aside in a closed, labeled jar to settle out 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.

Water-Based Paints...

Purchase water-based paints whenever possible. Look for products labeled "latex" or "clean up with water."

Recycle or Reuse Paints...

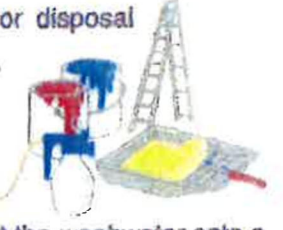
Recycle/reuse leftover paint by using it for touch-ups, or by giving it to someone who can use it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 386-8401 for information on hazardous waste pick-up.

Paint Cleanup...

Avoid cleaning brushes and rinsing paint containers in a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible and and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

Paint Removal...

Chemical paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. For disposal information, call 386-8401. Also, when stripping or cleaning building exteriors with high-pressure water, block storm drains and divert the washwater onto a designated dirt area. Check with your local wastewater treatment authority to find out if you can collect building cleaning water and discharge it to the sewer.



For more information, call your city's stormwater representative

ROADWORK & PAVING

Asphalt, saw-cut slurry, and excavated materials from Road paving, surfacing and pavement removal operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

During Construction...

Cover catch basins and maintenance holes when applying seal coat, slurry seal, fog seal, etc. Use check dams, ditches or berms around excavations, and avoid over-application of water for dust control. REMEMBER: Never wash excess materials from exposed aggregate or concrete into a street, gutter, or storm drain; collect and recycle them.

Asphalt & Concrete Removal...

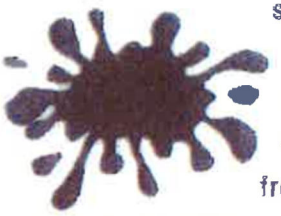
Barricade storm drain openings during saw-cutting, and after breaking up paving, be sure to remove all chunks and pieces and recycle them at a crushing company. For recycling information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Spills...

Be ready for unexpected spills by preparing and using spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Prevent drips from paver machines by catching fluids with drip pans or by placing absorbent material (cloth, rags, etc....) underneath the machines when they're not in use. To report serious spills, call 1-800-33-TOXIC.



General Business Practices...

Schedule excavation and grading work during dry weather, and develop and implement erosion and sediment control plans for excavated embankments. In case it rains, cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

For more information, call your city's stormwater representative

Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555

A Citizen's Guide to Understanding Stormwater

After the Storm

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

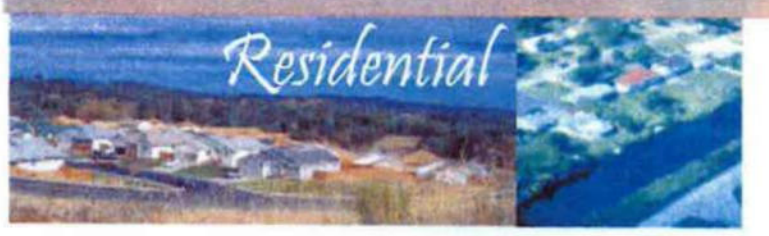
Printed on Recycled Paper

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

Stormwater Pollution Solutions

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

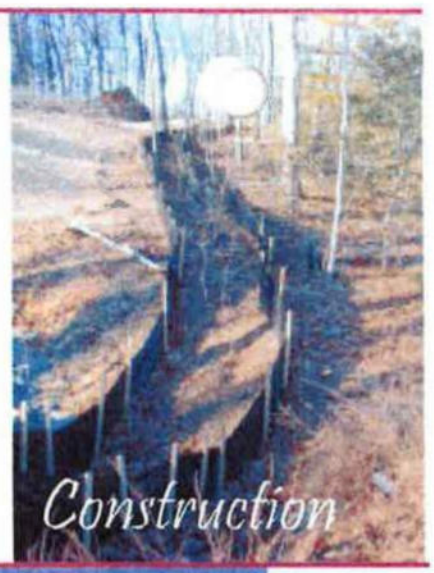
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction



Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be washed into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

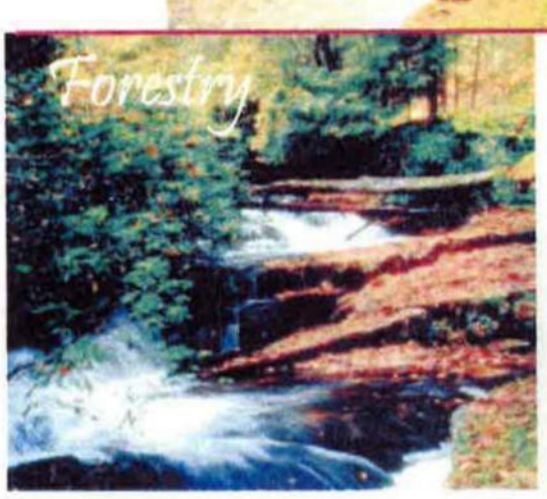
- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.

Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

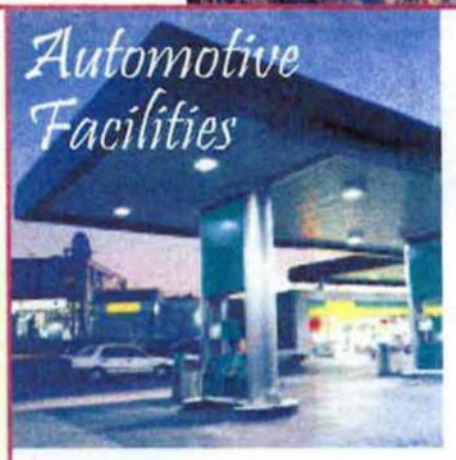
Forestry



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Stormwater Pollution from Construction Activities

The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/stormwtr/

Colorado River Basin Regional Water
Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.swrcb.ca.gov/~rwqcb7/

Santa Ana Regional Water
Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(909) 782-4130
www.swrcb.ca.gov/~rwqcb8/

San Diego Regional Water
Quality Control Board - Region 9
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2952
www.swrcb.ca.gov/~rwqcb9/

StormWater Pollution . . . What You Should Know

Riverside County has two drainage systems - sewers and storm drains. The storm drain system was designed to reduce flooding by carrying excess rainwater away from streets and developed areas. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our local waterways.

Unlike sanitary sewers, storm drains are not connected to a wastewater treatment plant – they flow directly to our local streams, rivers and lakes.

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can significantly alter natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Because preventing pollution is much easier and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management and discharge control that **prohibit** the discharge of pollutants into the storm drain system or local surface waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

To report a hazardous materials spill, call:

Riverside County Hazardous Materials
Emergency Response Team
(909) 358-5055 8:00 a.m. – 5:00 p.m.
(909) 358-5245 after 5:00 p.m.

In an emergency call: **911**

For recycling and hazardous waste disposal, call:

(909) 358-5055

To report an illegal dumping or a clogged storm drain, call:

1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, please call (909) 955-1200 or visit the StormWater/CleanWater Protection Program website at:
www.co.riverside.ca.us/depts/flood/waterquality/npdes.asp

StormWater Pollution

What you should know for...

GENERAL CONSTRUCTION & SITE SUPERVISION

Best Management Practices (BMPs) for:

- Developers
- General Contractors
- Home Builders
- Construction Inspectors
- Anyone in the construction business

StormWater CleanWater
PROTECTION PROGRAM

The StormWater/CleanWater Protection Program gratefully acknowledges the Santa Clara Valley Nonpoint Pollution Control Program, Alameda Countywide CleanWater Program and the City of Los Angeles Stormwater Management Division for information provided in this brochure.

What Should You Do?

Advance Planning to Prevent Pollution

- ❑ Remove existing vegetation only as needed.
- ❑ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ❑ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ❑ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ❑ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ❑ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ❑ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

Best Management Practices

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ❑ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ❑ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ❑ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ❑ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ❑ Phase grading operations to limit disturbed areas and duration of exposure.
- ❑ Perform major maintenance and repairs of vehicles and equipment offsite.
- ❑ Wash out concrete mixers only in designated washout areas at the construction site.
- ❑ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ❑ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ❑ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ❑ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ❑ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ❑ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ❑ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ❑ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

General Construction Activities Stormwater Permit

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (WQ Order No. 99-08DWQ) on August 19, 1999, superseding the now expired SWRCB statewide General Permit (WQ Order No. 92-08DWQ). This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

Does my construction site require coverage under the Construction Activities General Permit?

Yes, if construction activity results in the disturbance of five or more acres of total land area or is part of a common plan of development that results in the disturbance of five or more acres.

How do I obtain coverage under the Construction Activities General Permit?

Obtain the permit package and submit the completed Notice of Intent (NOI) form to the SWRCB prior to grading or disturbing soil at the construction site. For ongoing construction activity involving a change of ownership, the new owner must submit a new NOI within 30 days of the date of change of ownership. The completed NOI along with the required fee should be mailed to the SWRCB.

What must I do to comply with the requirements of the Construction Activities General Permit?

- ● Implement BMPs for non-stormwater discharges year-round.
- ● Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- ● Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- ● Calculate the anticipated stormwater run-off.
- ● Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- ● Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after actual storm event.
- ● Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- ● Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- ● Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at www.swrcb.ca.gov/stormwtr/ to obtain a State Construction Activities Stormwater General Permit packet.*

How long is this Construction Activities General Permit in effect?

The Permit coverage stays in effect untilyou submit a Notice of Termination (NOT) to the SWRCB. For the purpose of submitting a NOT, all soil disturbing activities have to be completed and one of the three following criteria has to be met:

1. Change of ownership;
2. A uniform vegetative cover with 70 percent coverage has been established; or,
3. Equivalent stabilization measures such as the use of reinforced channel liners, soil cement, fiber matrices, geotextiles, etc., have been employed.

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call:
(909) 955-1111.

StormWater CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?

Many industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit

FIND OUT
IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

The basic requirements of the Permit are:

1. The facility must eliminate any non-stormwater discharges or obtain a separate permit for such discharges.

2. The facility must develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must identify sources of pollutants that may be exposed to stormwater. Once the sources of pollutants have been identified, the facility operator must develop and implement Best Management Practices (BMPs) to minimize or prevent polluted runoff.

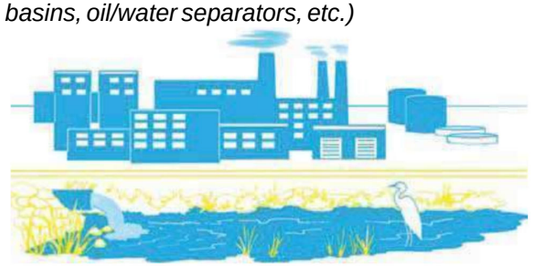
   Guidance in preparing a SWPPP is available from a document prepared by the California Storm Water Quality Task Force called the California Storm Water Best Management Practice Handbook.

3. The facility must develop and implement a Monitoring Program that includes conducting visual observations and collecting samples of the facility's storm water discharges associated with industrial activity. The General Permit requires that the analysis be conducted by a laboratory that is certified by the State of California.

4. The facility must submit to the Regional Board, every July 1, an annual report that includes the results of its monitoring program.

A Non-Storm Water Discharge is... *any discharge to a storm drain system that is not composed entirely of storm water. The following non-storm water discharges are authorized by the General Permit: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; drinking fountain water; atmospheric condensates including refrigeration, air conditioning, and compressor condensate; irrigation drainage; landscape watering; springs; non-contaminated ground water; foundation or footing drainage; and sea water infiltration where the sea waters are discharged back into the sea water source.*

A BMP is . . . *a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs may include simple, non-structural methods such as good housekeeping, staff training and preventive maintenance. Additionally, BMPs may include structural modifications such as the installation of berms, canopies or treatment control (e.g. setting basins, oil/water separators, etc.)*



WARNING*: There are significant penalties for non-compliance: a minimum fine of $5,000 for failing to obtain permit coverage, and, up to $10,000 per day, per violation plus $10 per gallon of discharge in excess of 1,000 gallons.*

Attachment D
Infiltration Report

February 2, 2023
(Revised February 13, 2023)

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Mojave Drive Industrial Park
14180 Dallas Parkway, Suite 730
Dallas, Texas 75254

Attention: Mr. Brandon Gallup
Acquisitions & Asset Management

Project No.: **22G270-2**

Subject: **Results of Infiltration Testing**
Mojave Drive Industrial Park Building 1
NWC Mojave Drive and Topaz Road
Victorville, California

Reference: Geotechnical Investigation, Mojave Drive Industrial Park Building 1, NWC Mojave Drive and Topaz Road, Victorville, California, prepared by Southern California Geotechnical, Inc. (SCG) for Mojave Drive Industrial Park, SCG Project No. 22G270-1, dated February 2, 2023, revised February 13, 2023.

Mr. Gallup:

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

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 22P404, dated November 3, 2022. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the preliminary infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The project site is located at the northwest corner of Mojave Drive and a dirt road (future Topaz Road) in Victorville, California. The site is bounded to the north, east, and west by vacant lots, and to the south by Mojave Drive. The general location of the site is illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

The project site consists of a few parcels, which total 5.8± acres in size. The site is currently vacant and undeveloped. Ground surface cover consists of exposed soil with sparse to moderate native bushes and weed growth. Occasional debris is scattered throughout the site.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the site topography slopes gently downward to the northeast at a gradient of 2± percent with an elevation differential of approximately 11 feet.

Proposed Development

SCG was provided with a conceptual site plan. Based on this site plan, the site will be developed with one (1) industrial building. The building, identified as Building 1, will be 91,000± ft² in size. The building will be constructed with dock-high doors along a portion of the northern building wall. The building will be surrounded by asphaltic concrete pavements in the automobile parking and drive areas, Portland cement concrete pavements in the truck court, and areas of concrete flatwork and landscape planters.

Detailed structural information has not been provided. We assume that the new industrial building will be a single-story structure of tilt-up concrete construction, typically supported on a conventional shallow foundation system with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 6 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of 3 to 5± feet are expected to be necessary to achieve the proposed site grades.

The proposed development will likely use on-site storm water infiltration. The type, depth, and locations of the infiltration system was not available at the time of this report. However, based on our experience with similar projects in the area, we assume that the infiltration area will be located in the truck-court areas of the proposed building. It is expected that the infiltration system will consist of a below-grade chamber extending to a depth of 10± feet.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, two (2) borings (identified as Boring Nos. B-1 and B-2) were advanced to depths of 20 to 25± feet below the existing site grades. Native alluvium was encountered at the ground surface at both of the boring locations, extending to at least the maximum depth explored of 25± feet. Both of the borings encountered medium dense to dense silty sands, with varying clay and gravel content. Boring No. B-3 encountered a stratum consisting of dense clayey sands at a depth of 8 to 12± feet, and hard clayey silts at a depth of 17 to 20± feet. Boring No. B-4 encountered a stratum consisting of dense fine sands at a depth of 22 to 25± feet.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is the California Department of Water Resources Water Data Library website, https://wdl.water.ca.gov/waterdatalibrary/. One monitoring well on record (identified as Station 345267N1173632W001) is located 1± miles east of the site. Water level readings within this monitoring well indicate a high groundwater level of 70± feet below the ground surface, in January 1917.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of one (1) infiltration test boring, advanced to depth a of 10± feet below the existing site grades. The infiltration boring was advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and was logged during drilling by a member of our staff. The approximate location of the infiltration test boring (identified as I-2) is indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration boring, the bottom of the test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into the test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Native alluvial soils were encountered at the ground surface at the infiltration test location, extending to at least the maximum depth explored of 10± feet. The alluvium generally consists of medium dense to very dense silty fine to medium sands and silty fine to coarse sands with trace amounts of clay.

Infiltration Testing

We understand that the results of the testing will be used to prepare a design for the proposed storm water infiltration systems within the project site. As previously mentioned, the infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, the infiltration test boring was pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test hole. The pre-soaking process consisted of filling test boring by inverting a full 5-gallon bottle of clear water supported over the hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Pre-soaking was completed after all of the water had percolated through the test hole.

Infiltration Testing

Following the pre-soaking process of the infiltration test boring, SCG performed the infiltration testing. The test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test hole. In accordance with the San Bernardino County guidelines, since "sandy soils" were encountered at the bottom of Infiltration Test No. I-2 (where 6 inches of water infiltrated into the surrounding soils for two consecutive 25-minute readings), readings were taken at 10-minute intervals for 1 hour. After each reading, water was added to the boring so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rate for each of the timed intervals are also tabulated on the spreadsheet.

The infiltration rate from the test is tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration test be used as the design infiltration rate. The rate is summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-2	10	Silty fine to medium Sand, trace Clay, trace coarse Sand	5.3

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of the infiltration test boring has been determined using a range of wire mesh screens. This test was performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The result of this test is presented on Plate C-1 of this report.

Design Recommendations

One (1) infiltration test was performed at the subject site. As noted above, the infiltration rate at this location is 5.3 inches per hour. Based on the infiltration test result from Infiltration Test No. I-2, we recommend an infiltration rate of 5.3 inches per hour be used for the proposed system located north of Building 1.

The infiltration rate recommended above is applicable if the bottom of the proposed infiltration system extends to depths of 10 to 12± feet below the existing site grades. It should be noted that the provided infiltration rate is preliminary in nature since the type, location and depth of the proposed infiltration system is unknown at the time

of this report. Additional infiltration testing is recommended to verify the actual infiltration rates once detailed information of the proposed infiltration systems is provided by the client or civil engineer.

The design of the storm water infiltration systems should be performed by the project civil engineer, in accordance with the City of Victorville and/or County of San Bernardino guidelines. It is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rate is based on infiltration testing at one (1) discrete location and that the overall infiltration rate of the proposed infiltration system could vary considerably.

Infiltration Rate Considerations

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

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

Construction Considerations

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

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. The infiltration rate of the system will likely vary significantly if the composition of the soil located beneath the system is not consistent with the tested soils.

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

Chamber Maintenance

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

Location of Infiltration Systems

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

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

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project.

However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

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

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

Closure

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

Respectfully Submitted,

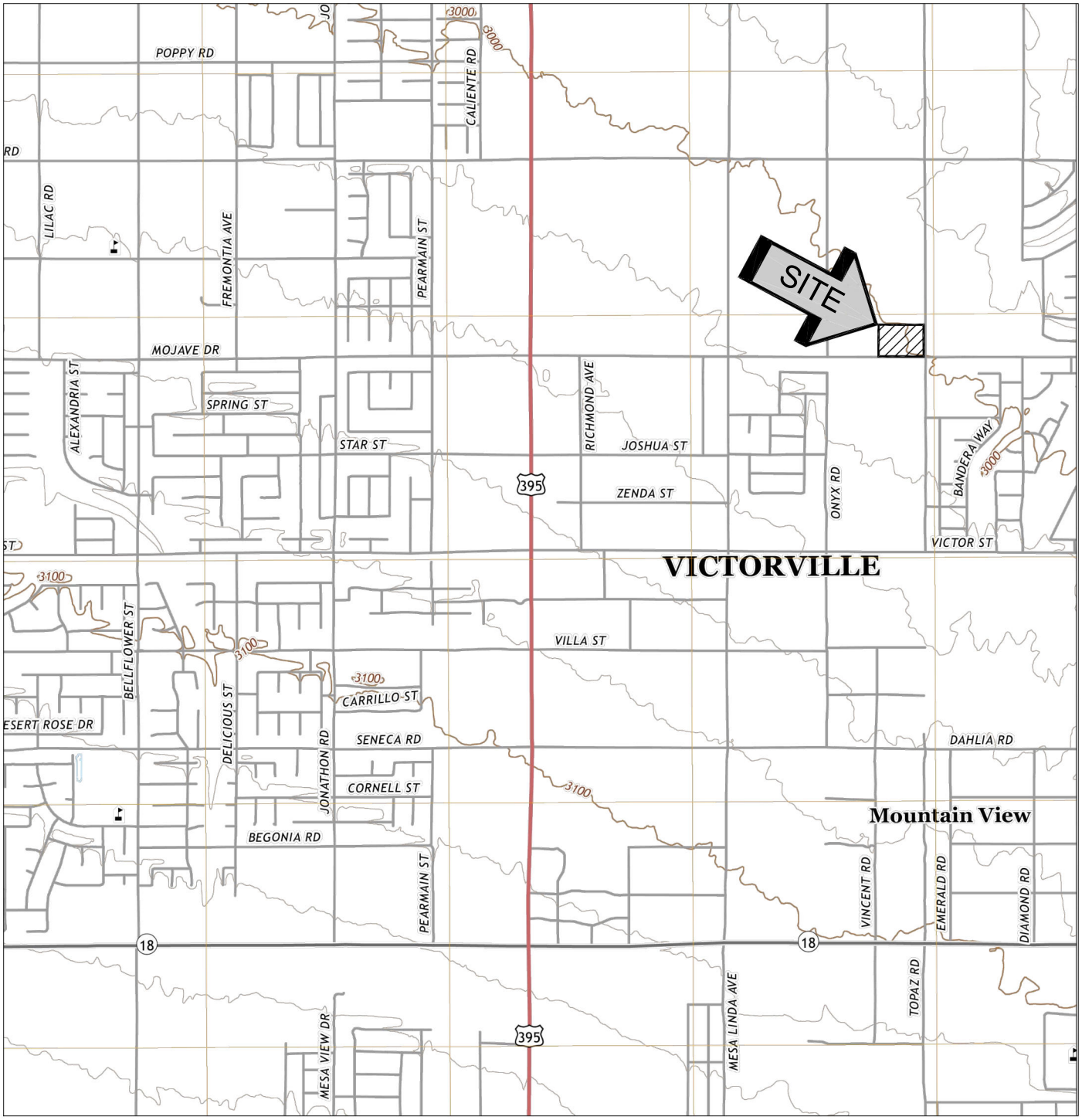
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Jamie Hayward
Staff Geologist

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Log (3 pages)
Infiltration Test Results Spreadsheet (1 pages)
Grain Size Distribution Graph (1 pages)



SITE LOCATION MAP

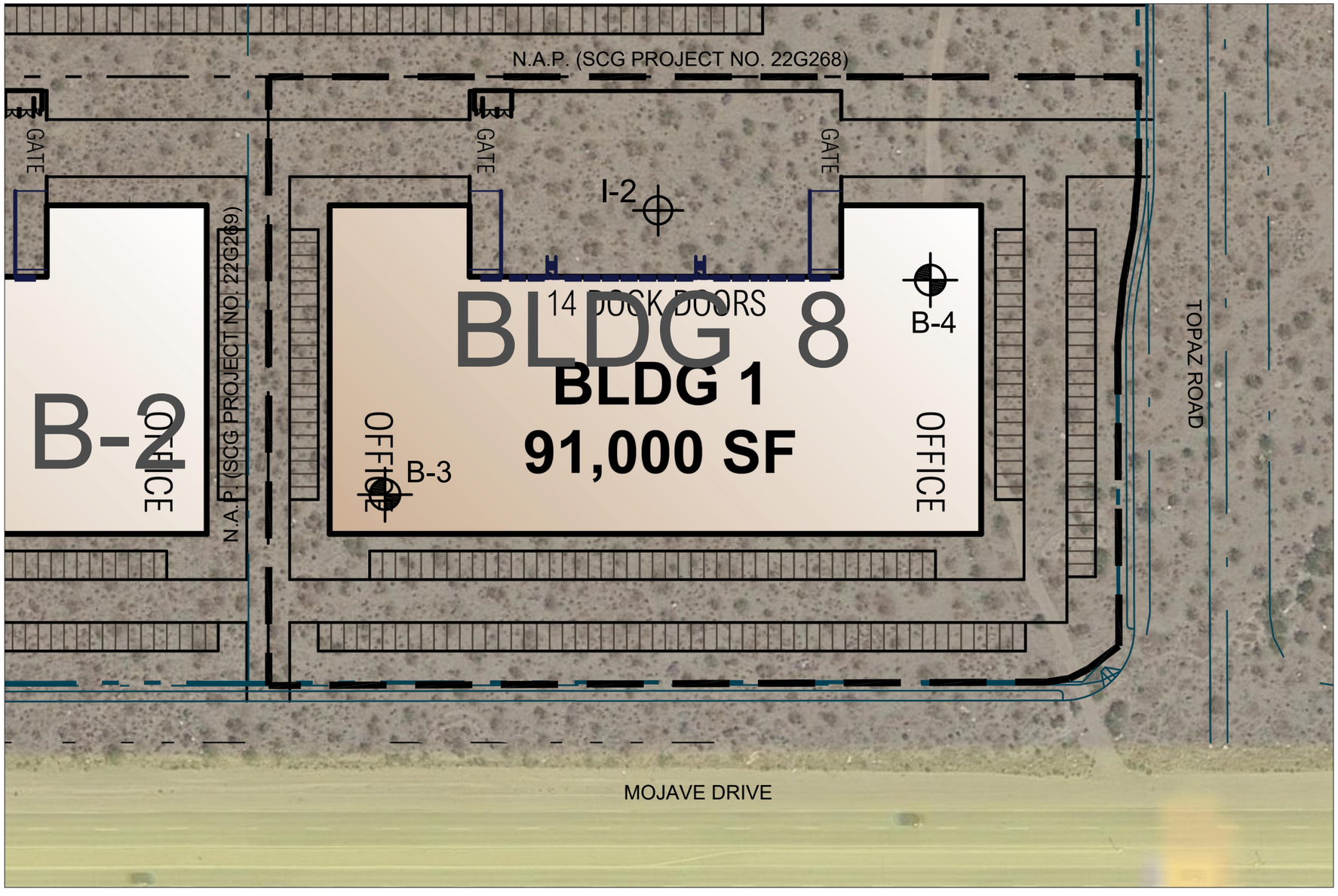
MOJAVE DRIVE INDUSTRIAL PARK BUILDING 1

VICTORVILLE, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: AG CHKD: JLL	
SCG PROJECT 22G270-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

APPROXIMATE INFILTRATION TEST LOCATION

APPROXIMATE BORING LOCATION (SCG PROJECT NO. 22G270-1)

NOTE: CONCEPTUAL SITE PLAN PROVIDED BY THE CLIENT.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

INFILTRATION TEST LOCATION PLAN

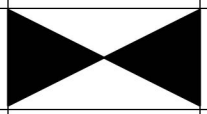
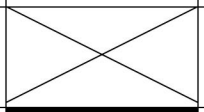
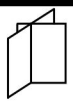
MOJAVE DRIVE INDUSTRIAL PARK BUILDING 1

VICTORVILLE, CALIFORNIA

SCALE: 1" = 80'	
DRAWN: AG CHKD: JLL	
SCG PROJECT 22G270-2	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

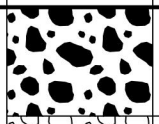
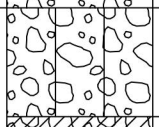
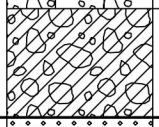
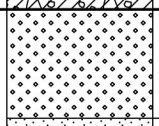
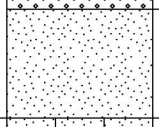
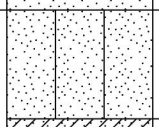
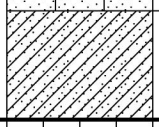
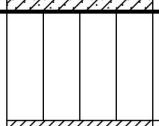
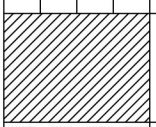
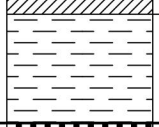
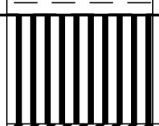
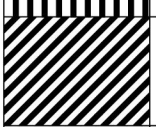
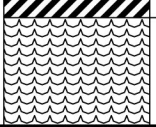
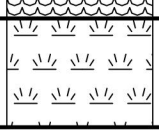
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-2

JOB NO.: 22G270-2
PROJECT: Mojave Drive Industrial Park Bldg 1
LOCATION: Victorville, California

DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to medium Sand, trace to little coarse Sand, trace fine to coarse Gravel, trace fine root fibers, medium dense-damp							
		16					2					
5					Brown Silty fine to coarse Sand, little fine Gravel, medium dense-dry							
		20					1					
					Gray Brown Silty fine to medium Sand, trace Clay, trace coarse Sand, very dense-damp							
		87/11"					6			24		
10					Boring Terminated at 10'							

TBL 22G270-2.GPJ SOCALGEO.GDT 1/25/23

TEST BORING LOG

PLATE B-1

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buidling 1
Project Location	Victorville, California
Project Number	22G270-2
Engineer	CB

Test Hole Radius	4	(in)
Test Depth	9.90	(ft)

Infiltration Test Hole	I-2

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	9:00 AM	25.00	7.00	19.32	YES	SANDY SOILS
	Final	9:25 AM		8.61			
2	Initial	9:25 AM	25.00	7.00	17.04	YES	SANDY SOILS
	Final	9:50 AM		8.42			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:51 AM	10.00	7.00	1.39	2.20	7.06
	Final	10:01 AM		8.39			
2	Initial	10:02 AM	10.00	7.00	1.19	2.31	5.78
	Final	10:12 AM		8.19			
3	Initial	10:12 AM	10.00	7.00	1.14	2.33	5.46
	Final	10:22 AM		8.14			
4	Initial	10:22 AM	10.00	7.00	1.12	2.34	5.38
	Final	10:32 AM		8.12			
5	Initial	10:33 AM	10.00	7.00	1.12	2.34	5.38
	Final	10:43 AM		8.12			
6	Initial	10:43 AM	10.00	7.00	1.11	2.35	5.30
	Final	10:53 AM		8.11			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

Grain Size Distribution

Sample Description	I-2 @ 8½ feet
Soil Classification	Silty fine to medium Sand, trace Clay, trace coarse Sand

Mojave Drive Industrial Park Building 1
Victorville, California
Project No. 22G270-2
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attachment E
Hydromodification

Project: COVINGTON - MIP BUILDING 1

Detention/ Infiltration System Routing Study Summary

Stage Storage Number	Storage Depth (ft)	Elevation (ft)	Area (ft^2)	Incremental volume (ft^3)	Total Volume (ft^3)	Total Volume (acre-ft)	Outflow Q (cfs)	Notes
1	0.0	2,980.50	7,298	0	0	0	0	**Bottom of Infiltration System Rock**
2	0.5	2,981.00	7,298	1,460	1,460	0.034	0.30	**84" CMP Invert**
3	1.5	2,982.00	7,298	4,364	5,824	0.134	0.30	
4	2.5	2,983.00	7,298	5,361	11,185	0.257	0.30	
5	3.0	2,983.50	7,298	2,859	14,043	0.322	0.30	System Releases Water @ 2983.5
6	4.0	2,984.50	7,298	5,877	19,920	0.457	1.67	
7	5.5	2,986.00	7,298	8,735	28,655	0.658	2.77	
8	6.50	2,987.00	7,298	5,361	34,017	0.781	3.29	
9	7.50	2,988.00	7,298	2,382	36,398	0.836	3.73	
10	8.00	2,988.50	7,298	3,442	39,840	0.915	3.93	**Top of Infiltration/ Detention System**
11	9.00	2,989.50	7,298	0	39,840	0.915	4.30	
12	10.00	2,990.50	7,298	0	39,840	0.915	4.64	
13	11.00	2,991.50	7,298	0	39,840	0.915	4.95	
14	12.0	2,992.50	7,298	0	39,840	0.915	5.25	

84" CMP system with 6" rock top & bottom

Infiltration System Bottom Area Discharge ($Q_{out,bottom}$)		
Infiltration Rate per Geo Tech Report (in/hr)	=	5.3
Factor of Safety		3
Unit Conversion (ft/sec) $\frac{6.8\frac{in}{hr}}{3.25} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{60\ min} \times \frac{1\ min}{60\ sec}$	=	0.0000409
Infiltration System Footprint (ft^2)	178 ft x 41 ft =	7,298
$Q_{out,bottom}$ (cfs)	= **0.30**	

*WQMP Design Capture Volume (DCV) is 13,252 CF

Basin Routing Summary Table

	100 YR 24 HR	10 YR 24 HR
Proposed Q100(cfs) 6.2 ac	17.79	10.19
Q (cfs) after Routing	3.19	1.20
WSE (ft)	2986.81	2984.15

note: 0.3 cfs to infiltration

Storm Drain System Net Drainage (Q_{net})		
One 8-inch Outlet Pipe + Infiltration $Q_{out,bottom}$		
Orifice Eqn	$= C * A * \sqrt{2gh} + Q_{out,bottom}$	
	$= 0.6 \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$	
A: Outlet pipe cross sectional area		
h: WSE - outlet pipe centerline elevation		
Example: WSE @ 1113.23 ft		
Q_{net}	$= C \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$	
C		0.6
A (ft^2) = π r^2		0.35
WSE (ft)		2,991.50
Outlet Centerline (ft)		2983.833333
h (ft)		7.666666667
$Q_{out,bottom\ (cfs)}$		0.30
Q_{net}	=	**4.95**

HUITT-ZOLLARS

COVINGTON - MIP UNIT HYDROGRAPH AND STORM WATER MITIGATION SUMMARY									
	EXISTING Q TRIBUTARY TO STREAM (CFS) (47 AC)		PROPOSED Q PRIOR TO MITIGATION (CFS)		PROPOSED Q AFTER MITIGATION (CFS)		Q_{out} DUE TO INFILTRATION (CFS)	PROPOSED Q AFTER MITIGATION TO PUBLIC SD (CFS)	
	10 YR	100 YR	10 YR	100 YR	10 YR	100 YR		10 YR	100 YR
BUILDING 1 (6.2 AC)			10.19	17.79	1.20	3.19	0.30	0.90	2.89
BUILDING 2 (5.7 AC)			9.84	17.18	1.03	3.39	0.34	0.69	3.05
BUILDING 3 (61.1 AC)			93.04	169.07	8.27	26.38	2.27	6.00	24.11
TOTAL	14.29	33.24	113.07	204.04	10.5	32.96		7.59	30.05
IS Q AFTER ROUTING LESS THAN OR EQUAL TO EXISTING Q TRIBUTARY TO STREAM?								YES	YES

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

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Study date 04/28/23

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

Program License Serial Number 6145

COVINGTON - MIP
10 YEAR STORM EVENT EXISTING TRIBUTARY TO OUTLET
5712Q10E
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
47.00	1	0.62
Rainfall data for year 10		
47.00	6	1.27
Rainfall data for year 10		
47.00	24	2.32

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
86.0	86.0	47.00	1.000	0.265	1.000	0.265

Area-averaged adjusted loss rate Fm (In/Hr) = 0.265

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
47.00	1.000	86.0	86.0	1.63	0.473

Area-averaged catchment yield fraction, Y = 0.473
Area-averaged low loss fraction, Yb = 0.527
++
Watercourse length = 2070.00(Ft.)
Length from concentration point to centroid = 1190.00(Ft.)
Elevation difference along watercourse = 22.40(Ft.)
Mannings friction factor along watercourse = 0.350
Watershed area = 47.00(Ac.)
Catchment Lag time = 1.549 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 5.3799
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.265(In/Hr)
Average low loss rate fraction (Yb) = 0.527 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.295(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.621(In)
Computed peak 3-hour rainfall = 0.963(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.320(In)

Rainfall depth area reduction factors:
Using a total area of 47.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.294(In)
30-minute factor = 0.998 Adjusted rainfall = 0.503(In)
1-hour factor = 0.998 Adjusted rainfall = 0.620(In)
3-hour factor = 1.000 Adjusted rainfall = 0.963(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.320(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 568.41 (CFS))		
1	0.237	1.346
2	0.710	2.691
3	1.282	3.251
4	2.163	5.009
5	3.094	5.290
6	4.338	7.072
7	5.673	7.585
8	7.257	9.008
9	9.065	10.275
10	11.281	12.593
11	14.653	19.170
12	18.248	20.431
13	23.363	29.077
14	28.871	31.305
15	33.876	28.449
16	38.481	26.176
17	42.772	24.388
18	46.255	19.802
19	49.644	19.259

20	52.553	16.535
21	55.347	15.885
22	57.717	13.468
23	59.783	11.743
24	61.735	11.097
25	63.424	9.601
26	65.078	9.397
27	66.538	8.302
28	67.957	8.068
29	69.299	7.624
30	70.590	7.339
31	71.813	6.952
32	72.894	6.142
33	73.955	6.034
34	74.920	5.484
35	75.867	5.379
36	76.786	5.226
37	77.690	5.137
38	78.528	4.763
39	79.241	4.053
40	79.951	4.037
41	80.661	4.037
42	81.369	4.025
43	81.994	3.551
44	82.575	3.303
45	83.156	3.303
46	83.737	3.303
47	84.309	3.251
48	84.833	2.976
49	85.349	2.936
50	85.866	2.936
51	86.382	2.936
52	86.865	2.744
53	87.296	2.450
54	87.726	2.446
55	88.157	2.446
56	88.584	2.429
57	88.938	2.013
58	89.261	1.835
59	89.584	1.835
60	89.906	1.835
61	90.225	1.813
62	90.529	1.723
63	90.830	1.712
64	91.131	1.712
65	91.432	1.712
66	91.714	1.604
67	91.973	1.468
68	92.231	1.468
69	92.489	1.468
70	92.747	1.462
71	92.989	1.376
72	93.225	1.346
73	93.462	1.346
74	93.699	1.346
75	93.924	1.281
76	94.110	1.058
77	94.293	1.040
78	94.476	1.040
79	94.659	1.040
80	94.842	1.040
81	95.025	1.040
82	95.208	1.040

83	95.391	1.040
84	95.571	1.024
85	95.720	0.846
86	95.860	0.795
87	95.999	0.795
88	96.139	0.795
89	96.279	0.795
90	96.419	0.795
91	96.559	0.795
92	96.699	0.795
93	96.839	0.795
94	96.954	0.658
95	97.051	0.550
96	97.148	0.550
97	97.245	0.550
98	97.342	0.550
99	97.439	0.550
100	97.535	0.550
101	97.632	0.550
102	97.729	0.550
103	97.813	0.478
104	97.868	0.312
105	97.922	0.306
106	97.976	0.306
107	98.030	0.306
108	98.083	0.306
109	98.137	0.306
110	98.191	0.306
111	98.245	0.306
112	98.300	0.313
113	98.363	0.359
114	98.427	0.367
115	98.492	0.367
116	98.557	0.367
117	98.621	0.367
118	98.686	0.367
119	98.750	0.367
120	98.815	0.367
121	98.879	0.367
122	98.944	0.367
123	99.009	0.367
124	99.073	0.367
125	99.138	0.367
126	99.202	0.367
127	99.267	0.367
128	99.331	0.367
129	99.396	0.367
130	99.460	0.367
131	99.513	0.298
132	99.547	0.192
133	99.580	0.191
134	99.614	0.191
135	99.648	0.191
136	99.681	0.191
137	99.715	0.191
138	99.748	0.191
139	99.782	0.191
140	99.816	0.191
141	99.849	0.191
142	99.883	0.191
143	99.917	0.191
144	99.950	0.191
145	100.000	0.096

Total soil rain loss = 1.07(In)
Total effective rainfall = 1.25(In)
Peak flow rate in flood hydrograph = 14.29(CFS)

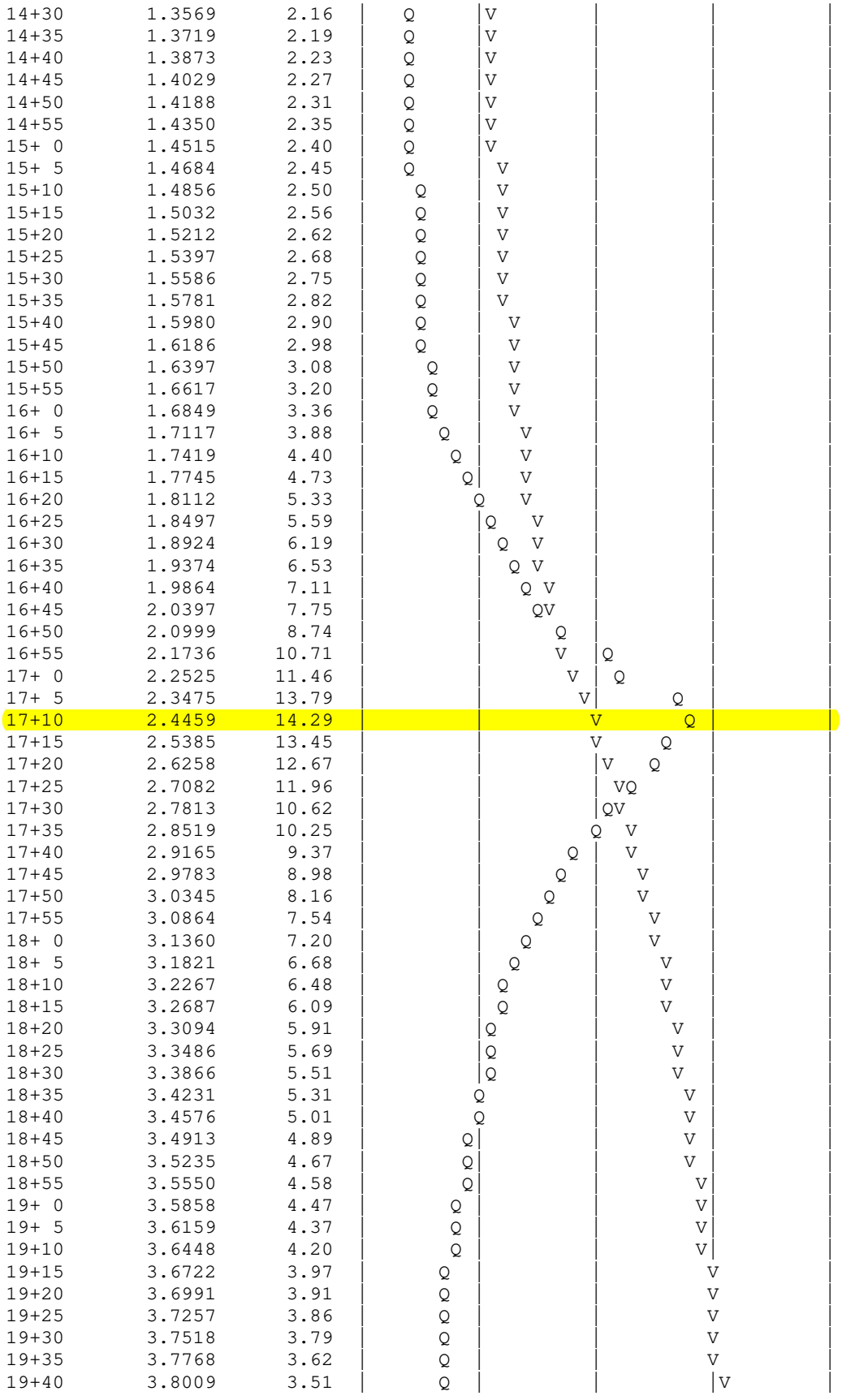
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0001	0.01	Q				
0+20	0.0003	0.02	Q				
0+25	0.0005	0.03	Q				
0+30	0.0008	0.04	Q				
0+35	0.0011	0.05	Q				
0+40	0.0016	0.07	Q				
0+45	0.0022	0.09	Q				
0+50	0.0029	0.11	Q				
0+55	0.0039	0.14	Q				
1+ 0	0.0051	0.17	Q				
1+ 5	0.0066	0.22	Q				
1+10	0.0085	0.28	Q				
1+15	0.0108	0.32	Q				
1+20	0.0133	0.37	Q				
1+25	0.0161	0.41	Q				
1+30	0.0192	0.44	Q				
1+35	0.0224	0.48	Q				
1+40	0.0259	0.51	VQ				
1+45	0.0296	0.53	VQ				
1+50	0.0334	0.56	VQ				
1+55	0.0374	0.58	VQ				
2+ 0	0.0415	0.60	VQ				
2+ 5	0.0458	0.62	VQ				
2+10	0.0501	0.63	VQ				
2+15	0.0546	0.65	VQ				
2+20	0.0592	0.66	VQ				
2+25	0.0639	0.68	VQ				
2+30	0.0686	0.69	VQ				
2+35	0.0735	0.71	VQ				
2+40	0.0785	0.72	VQ				
2+45	0.0835	0.73	VQ				
2+50	0.0886	0.74	VQ				
2+55	0.0939	0.76	VQ				
3+ 0	0.0991	0.77	VQ				
3+ 5	0.1045	0.78	VQ				
3+10	0.1099	0.79	VQ				
3+15	0.1154	0.80	VQ				
3+20	0.1210	0.81	VQ				
3+25	0.1266	0.82	|Q				
3+30	0.1323	0.83	|Q				
3+35	0.1380	0.83	|Q				
3+40	0.1438	0.84	|Q				
3+45	0.1497	0.85	|Q				
3+50	0.1556	0.86	|Q				
3+55	0.1616	0.87	|Q				

4+ 0	0.1676	0.88	Q				
4+ 5	0.1737	0.88	Q				
4+10	0.1798	0.89	Q				
4+15	0.1860	0.90	Q				
4+20	0.1923	0.91	Q				
4+25	0.1985	0.91	Q				
4+30	0.2049	0.92	Q				
4+35	0.2113	0.93	Q				
4+40	0.2177	0.94	Q				
4+45	0.2242	0.94	Q				
4+50	0.2308	0.95	Q				
4+55	0.2374	0.96	Q				
5+ 0	0.2440	0.96	Q				
5+ 5	0.2507	0.97	QV				
5+10	0.2574	0.98	QV				
5+15	0.2642	0.98	QV				
5+20	0.2710	0.99	QV				
5+25	0.2778	1.00	QV				
5+30	0.2847	1.00	Q				
5+35	0.2917	1.01	Q				
5+40	0.2987	1.01	Q				
5+45	0.3057	1.02	Q				
5+50	0.3128	1.03	Q				
5+55	0.3199	1.03	Q				
6+ 0	0.3271	1.04	Q				
6+ 5	0.3343	1.05	Q				
6+10	0.3415	1.05	Q				
6+15	0.3488	1.06	Q				
6+20	0.3562	1.07	Q				
6+25	0.3636	1.07	Q				
6+30	0.3710	1.08	QV				
6+35	0.3784	1.08	QV				
6+40	0.3860	1.09	QV				
6+45	0.3935	1.10	QV				
6+50	0.4011	1.10	QV				
6+55	0.4088	1.11	QV				
7+ 0	0.4164	1.12	QV				
7+ 5	0.4242	1.12	QV				
7+10	0.4320	1.13	QV				
7+15	0.4398	1.14	QV				
7+20	0.4476	1.14	QV				
7+25	0.4556	1.15	QV				
7+30	0.4635	1.15	QV				
7+35	0.4715	1.16	QV				
7+40	0.4795	1.17	QV				
7+45	0.4876	1.17	QV				
7+50	0.4958	1.18	Q V				
7+55	0.5040	1.19	Q V				
8+ 0	0.5122	1.19	Q V				
8+ 5	0.5205	1.20	Q V				
8+10	0.5288	1.21	Q V				
8+15	0.5371	1.21	Q V				
8+20	0.5456	1.22	Q V				
8+25	0.5540	1.23	Q V				
8+30	0.5625	1.24	Q V				
8+35	0.5711	1.24	Q V				
8+40	0.5797	1.25	Q V				
8+45	0.5884	1.26	Q V				
8+50	0.5971	1.26	Q V				
8+55	0.6058	1.27	Q V				
9+ 0	0.6146	1.28	Q V				
9+ 5	0.6235	1.29	Q V				
9+10	0.6324	1.29	Q V				

9+15	0.6413	1.30	Q V			
9+20	0.6503	1.31	Q V			
9+25	0.6594	1.32	Q V			
9+30	0.6685	1.32	Q V			
9+35	0.6777	1.33	Q V			
9+40	0.6869	1.34	Q V			
9+45	0.6962	1.35	Q V			
9+50	0.7056	1.36	Q V			
9+55	0.7150	1.37	Q V			
10+ 0	0.7245	1.37	Q V			
10+ 5	0.7340	1.38	Q V			
10+10	0.7436	1.39	Q V			
10+15	0.7532	1.40	Q V			
10+20	0.7630	1.41	Q V			
10+25	0.7727	1.42	Q V			
10+30	0.7826	1.43	Q V			
10+35	0.7925	1.44	Q V			
10+40	0.8025	1.45	Q V			
10+45	0.8126	1.46	Q V			
10+50	0.8227	1.47	Q V			
10+55	0.8329	1.48	Q V			
11+ 0	0.8432	1.49	Q V			
11+ 5	0.8536	1.50	Q V			
11+10	0.8640	1.51	Q V			
11+15	0.8745	1.53	Q V			
11+20	0.8851	1.54	Q V			
11+25	0.8957	1.55	Q V			
11+30	0.9065	1.56	Q V			
11+35	0.9173	1.57	Q V			
11+40	0.9282	1.58	Q V			
11+45	0.9392	1.60	Q V			
11+50	0.9503	1.61	Q V			
11+55	0.9615	1.62	Q V			
12+ 0	0.9728	1.64	Q V			
12+ 5	0.9842	1.65	Q V			
12+10	0.9956	1.66	Q V			
12+15	1.0072	1.68	Q V			
12+20	1.0188	1.69	Q V			
12+25	1.0305	1.70	Q V			
12+30	1.0423	1.72	Q V			
12+35	1.0543	1.73	Q V			
12+40	1.0663	1.74	Q V			
12+45	1.0784	1.76	Q V			
12+50	1.0906	1.77	Q V			
12+55	1.1028	1.78	Q V			
13+ 0	1.1152	1.79	Q V			
13+ 5	1.1276	1.80	Q V			
13+10	1.1401	1.81	Q V			
13+15	1.1527	1.83	Q V			
13+20	1.1653	1.84	Q V			
13+25	1.1781	1.85	Q V			
13+30	1.1909	1.87	Q V			
13+35	1.2039	1.88	Q V			
13+40	1.2170	1.90	Q V			
13+45	1.2302	1.92	Q V			
13+50	1.2436	1.94	Q V			
13+55	1.2571	1.96	Q V			
14+ 0	1.2708	1.99	Q V			
14+ 5	1.2847	2.01	Q V			
14+10	1.2987	2.04	Q V			
14+15	1.3129	2.07	Q V			
14+20	1.3274	2.09	Q V			
14+25	1.3420	2.13	Q V			

14+30	1.3569	2.16	
14+35	1.3719	2.19	
14+40	1.3873	2.23	
14+45	1.4029	2.27	
14+50	1.4188	2.31	
14+55	1.4350	2.35	
15+ 0	1.4515	2.40	
15+ 5	1.4684	2.45	
15+10	1.4856	2.50	
15+15	1.5032	2.56	
15+20	1.5212	2.62	
15+25	1.5397	2.68	
15+30	1.5586	2.75	
15+35	1.5781	2.82	
15+40	1.5980	2.90	
15+45	1.6186	2.98	
15+50	1.6397	3.08	
15+55	1.6617	3.20	
16+ 0	1.6849	3.36	
16+ 5	1.7117	3.88	
16+10	1.7419	4.40	
16+15	1.7745	4.73	
16+20	1.8112	5.33	
16+25	1.8497	5.59	
16+30	1.8924	6.19	
16+35	1.9374	6.53	
16+40	1.9864	7.11	
16+45	2.0397	7.75	
16+50	2.0999	8.74	
16+55	2.1736	10.71	
17+ 0	2.2525	11.46	
17+ 5	2.3475	13.79	
17+10	2.4459	14.29	
17+15	2.5385	13.45	
17+20	2.6258	12.67	
17+25	2.7082	11.96	
17+30	2.7813	10.62	
17+35	2.8519	10.25	
17+40	2.9165	9.37	
17+45	2.9783	8.98	
17+50	3.0345	8.16	
17+55	3.0864	7.54	
18+ 0	3.1360	7.20	
18+ 5	3.1821	6.68	
18+10	3.2267	6.48	
18+15	3.2687	6.09	
18+20	3.3094	5.91	
18+25	3.3486	5.69	
18+30	3.3866	5.51	
18+35	3.4231	5.31	
18+40	3.4576	5.01	
18+45	3.4913	4.89	
18+50	3.5235	4.67	
18+55	3.5550	4.58	
19+ 0	3.5858	4.47	
19+ 5	3.6159	4.37	
19+10	3.6448	4.20	
19+15	3.6722	3.97	
19+20	3.6991	3.91	
19+25	3.7257	3.86	
19+30	3.7518	3.79	
19+35	3.7768	3.62	
19+40	3.8009	3.51	

19+45	3.8248	3.47	Q		V	
19+50	3.8484	3.43	Q		V	
19+55	3.8716	3.37	Q		V	
20+ 0	3.8940	3.26	Q		V	
20+ 5	3.9161	3.21	Q		V	
20+10	3.9379	3.17	Q		V	
20+15	3.9595	3.13	Q		V	
20+20	3.9804	3.03	Q		V	
20+25	4.0005	2.92	Q		V	
20+30	4.0203	2.88	Q		V	
20+35	4.0399	2.85	Q		V	
20+40	4.0592	2.80	Q		V	
20+45	4.0774	2.65	Q		V	
20+50	4.0952	2.57	Q		V	
20+55	4.1127	2.54	Q		V	
21+ 0	4.1300	2.52	Q		V	
21+ 5	4.1471	2.48	Q		V	
21+10	4.1638	2.43	Q		V	
21+15	4.1804	2.40	Q		V	
21+20	4.1968	2.38	Q		V	
21+25	4.2130	2.35	Q		V	
21+30	4.2288	2.29	Q		V	
21+35	4.2442	2.24	Q		V	
21+40	4.2594	2.21	Q		V	
21+45	4.2745	2.19	Q		V	
21+50	4.2894	2.17	Q		V	
21+55	4.3040	2.12	Q		V	
22+ 0	4.3184	2.09	Q		V	
22+ 5	4.3327	2.07	Q		V	
22+10	4.3468	2.05	Q		V	
22+15	4.3606	2.00	Q		V	
22+20	4.3738	1.93	Q		V	
22+25	4.3869	1.90	Q		V	
22+30	4.3999	1.88	Q		V	
22+35	4.4128	1.87	Q		V	
22+40	4.4255	1.85	Q		V	
22+45	4.4381	1.83	Q		V	
22+50	4.4507	1.82	Q		V	
22+55	4.4630	1.80	Q		V	
23+ 0	4.4752	1.77	Q		V	
23+ 5	4.4870	1.71	Q		V	
23+10	4.4985	1.68	Q		V	
23+15	4.5100	1.66	Q		V	
23+20	4.5213	1.65	Q		V	
23+25	4.5326	1.63	Q		V	
23+30	4.5438	1.62	Q		V	
23+35	4.5548	1.61	Q		V	
23+40	4.5658	1.59	Q		V	
23+45	4.5766	1.57	Q		V	
23+50	4.5870	1.52	Q		V	
23+55	4.5972	1.48	Q		V	
24+ 0	4.6072	1.46	Q		V	
24+ 5	4.6172	1.45	Q		V	
24+10	4.6271	1.43	Q		V	
24+15	4.6368	1.41	Q		V	
24+20	4.6464	1.39	Q		V	
24+25	4.6559	1.37	Q		V	
24+30	4.6651	1.34	Q		V	
24+35	4.6740	1.30	Q		V	
24+40	4.6825	1.23	Q		V	
24+45	4.6908	1.20	Q		V	
24+50	4.6988	1.17	Q		V	
24+55	4.7066	1.13	Q		V	

25+ 0	4.7140	1.08	Q			V
25+ 5	4.7211	1.03	Q			V
25+10	4.7278	0.97	Q			V
25+15	4.7341	0.92	Q			V
25+20	4.7401	0.87	Q			V
25+25	4.7459	0.84	Q			V
25+30	4.7514	0.80	Q			V
25+35	4.7566	0.76	Q			V
25+40	4.7617	0.73	Q			V
25+45	4.7665	0.70	Q			V
25+50	4.7711	0.67	Q			V
25+55	4.7756	0.65	Q			V
26+ 0	4.7799	0.63	Q			V
26+ 5	4.7841	0.61	Q			V
26+10	4.7881	0.59	Q			V
26+15	4.7920	0.57	Q			V
26+20	4.7958	0.55	Q			V
26+25	4.7995	0.53	Q			V
26+30	4.8030	0.52	Q			V
26+35	4.8065	0.50	Q			V
26+40	4.8098	0.49	Q			V
26+45	4.8131	0.47	Q			V
26+50	4.8162	0.45	Q			V
26+55	4.8191	0.42	Q			V
27+ 0	4.8217	0.38	Q			V
27+ 5	4.8242	0.36	Q			V
27+10	4.8266	0.35	Q			V
27+15	4.8289	0.34	Q			V
27+20	4.8312	0.33	Q			V
27+25	4.8334	0.32	Q			V
27+30	4.8356	0.31	Q			V
27+35	4.8376	0.30	Q			V
27+40	4.8396	0.29	Q			V
27+45	4.8416	0.28	Q			V
27+50	4.8435	0.27	Q			V
27+55	4.8453	0.26	Q			V
28+ 0	4.8470	0.25	Q			V
28+ 5	4.8485	0.21	Q			V
28+10	4.8498	0.18	Q			V
28+15	4.8510	0.17	Q			V
28+20	4.8521	0.17	Q			V
28+25	4.8532	0.16	Q			V
28+30	4.8543	0.15	Q			V
28+35	4.8553	0.15	Q			V
28+40	4.8562	0.14	Q			V
28+45	4.8572	0.14	Q			V
28+50	4.8581	0.13	Q			V
28+55	4.8590	0.13	Q			V
29+ 0	4.8598	0.12	Q			V
29+ 5	4.8606	0.12	Q			V
29+10	4.8614	0.11	Q			V
29+15	4.8621	0.11	Q			V
29+20	4.8629	0.11	Q			V
29+25	4.8636	0.10	Q			V
29+30	4.8642	0.10	Q			V
29+35	4.8649	0.09	Q			V
29+40	4.8655	0.09	Q			V
29+45	4.8661	0.09	Q			V
29+50	4.8667	0.08	Q			V
29+55	4.8673	0.08	Q			V
30+ 0	4.8678	0.08	Q			V
30+ 5	4.8684	0.08	Q			V
30+10	4.8689	0.07	Q			V

30+15	4.8693	0.07	Q	|	|	|	V|
30+20	4.8698	0.07	Q	|	|	|	V|
30+25	4.8703	0.07	Q	|	|	|	V|
30+30	4.8707	0.06	Q	|	|	|	V|
30+35	4.8711	0.06	Q	|	|	|	V|
30+40	4.8715	0.06	Q	|	|	|	V|
30+45	4.8719	0.06	Q	|	|	|	V|
30+50	4.8723	0.05	Q	|	|	|	V|
30+55	4.8726	0.05	Q	|	|	|	V|
31+ 0	4.8730	0.05	Q	|	|	|	V|
31+ 5	4.8733	0.05	Q	|	|	|	V|
31+10	4.8736	0.05	Q	|	|	|	V|
31+15	4.8739	0.04	Q	|	|	|	V|
31+20	4.8742	0.04	Q	|	|	|	V|
31+25	4.8745	0.04	Q	|	|	|	V|
31+30	4.8748	0.04	Q	|	|	|	V|
31+35	4.8750	0.04	Q	|	|	|	V|
31+40	4.8753	0.04	Q	|	|	|	V|
31+45	4.8755	0.03	Q	|	|	|	V|
31+50	4.8758	0.03	Q	|	|	|	V|
31+55	4.8760	0.03	Q	|	|	|	V|
32+ 0	4.8762	0.03	Q	|	|	|	V|
32+ 5	4.8764	0.03	Q	|	|	|	V|
32+10	4.8766	0.03	Q	|	|	|	V|
32+15	4.8768	0.03	Q	|	|	|	V|
32+20	4.8770	0.03	Q	|	|	|	V|
32+25	4.8771	0.03	Q	|	|	|	V|
32+30	4.8773	0.02	Q	|	|	|	V|
32+35	4.8775	0.02	Q	|	|	|	V|
32+40	4.8776	0.02	Q	|	|	|	V|
32+45	4.8778	0.02	Q	|	|	|	V|
32+50	4.8779	0.02	Q	|	|	|	V|
32+55	4.8781	0.02	Q	|	|	|	V|
33+ 0	4.8782	0.02	Q	|	|	|	V|
33+ 5	4.8783	0.02	Q	|	|	|	V|
33+10	4.8785	0.02	Q	|	|	|	V|
33+15	4.8786	0.02	Q	|	|	|	V|
33+20	4.8787	0.02	Q	|	|	|	V|
33+25	4.8788	0.02	Q	|	|	|	V|
33+30	4.8789	0.02	Q	|	|	|	V|
33+35	4.8790	0.02	Q	|	|	|	V|
33+40	4.8791	0.01	Q	|	|	|	V|
33+45	4.8792	0.01	Q	|	|	|	V|
33+50	4.8793	0.01	Q	|	|	|	V|
33+55	4.8794	0.01	Q	|	|	|	V|
34+ 0	4.8795	0.01	Q	|	|	|	V|
34+ 5	4.8796	0.01	Q	|	|	|	V|
34+10	4.8796	0.01	Q	|	|	|	V|
34+15	4.8797	0.01	Q	|	|	|	V|
34+20	4.8798	0.01	Q	|	|	|	V|
34+25	4.8798	0.01	Q	|	|	|	V|
34+30	4.8799	0.01	Q	|	|	|	V|
34+35	4.8799	0.01	Q	|	|	|	V|
34+40	4.8800	0.01	Q	|	|	|	V|
34+45	4.8800	0.01	Q	|	|	|	V|
34+50	4.8800	0.00	Q	|	|	|	V|
34+55	4.8801	0.00	Q	|	|	|	V|
35+ 0	4.8801	0.00	Q	|	|	|	V|
35+ 5	4.8801	0.00	Q	|	|	|	V|
35+10	4.8801	0.00	Q	|	|	|	V|
35+15	4.8802	0.00	Q	|	|	|	V|
35+20	4.8802	0.00	Q	|	|	|	V|
35+25	4.8802	0.00	Q	|	|	|	V|

35+30	4.8802	0.00	Q	|	|	|	V|
35+35	4.8802	0.00	Q	|	|	|	V|
35+40	4.8802	0.00	Q	|	|	|	V|
35+45	4.8802	0.00	Q	|	|	|	V|
35+50	4.8802	0.00	Q	|	|	|	V|
35+55	4.8803	0.00	Q	|	|	|	V|
36+ 0	4.8803	0.00	Q	|	|	|	V

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

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Study date 05/16/23

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

Program License Serial Number 6145

COVINGTON - MIP BUILDING 1
10 YEAR STORM EVENT PROPOSED UNIT HYDROGRAPH BUILDING 1
5712Q10PUH1
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
6.20	1	0.62
Rainfall data for year 10		
6.20	6	1.27
Rainfall data for year 10		
6.20	24	2.32

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	6.20	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
0.62	0.100	69.0	69.0	4.49	0.147
5.58	0.900	98.0	98.0	0.20	0.902

Area-averaged catchment yield fraction, Y = 0.826
Area-averaged low loss fraction, Yb = 0.174
User entry of time of concentration = 0.168 (hours)
++
Watershed area = 6.20(Ac.)
Catchment Lag time = 0.134 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 62.0040
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.055(In/Hr)
Average low loss rate fraction (Yb) = 0.174 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.295(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.621(In)
Computed peak 3-hour rainfall = 0.963(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.320(In)

Rainfall depth area reduction factors:
Using a total area of 6.20(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.295(In)
30-minute factor = 1.000 Adjusted rainfall = 0.504(In)
1-hour factor = 1.000 Adjusted rainfall = 0.621(In)
3-hour factor = 1.000 Adjusted rainfall = 0.963(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.320(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 74.98 (CFS))		
1	5.972	4.478
2	43.460	28.109
3	69.299	19.374
4	80.386	8.314
5	86.911	4.892
6	91.059	3.110
7	93.939	2.160
8	95.974	1.526
9	97.381	1.055
10	98.197	0.611
11	98.912	0.537
12	99.567	0.490
13	100.000	0.325

Total soil rain loss = 0.34(In)
Total effective rainfall = 1.98(In)
Peak flow rate in flood hydrograph = 10.19(CFS)

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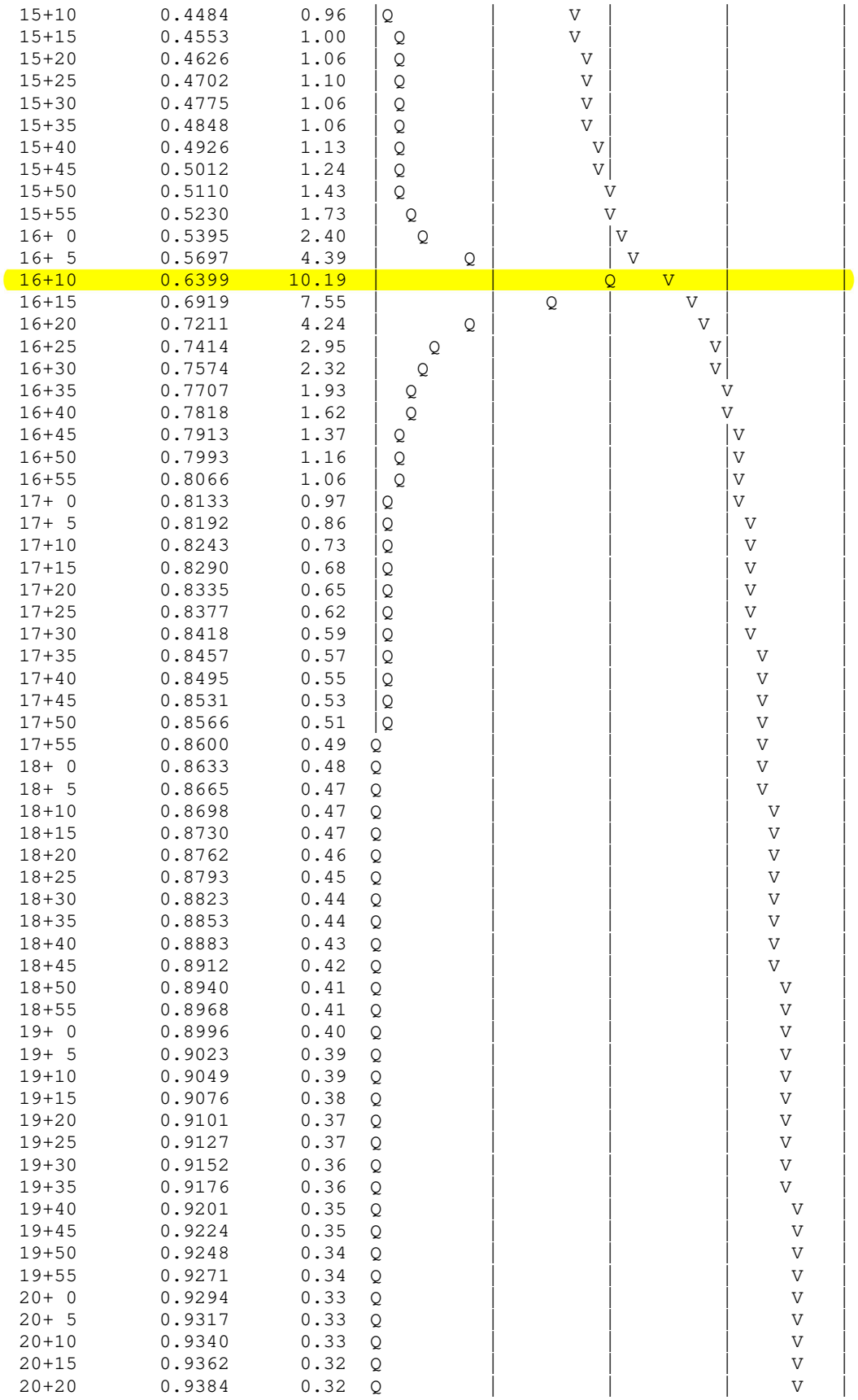
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0001	0.01	Q				
0+10	0.0007	0.09	Q				
0+15	0.0018	0.15	Q				
0+20	0.0030	0.18	Q				
0+25	0.0043	0.19	Q				
0+30	0.0057	0.20	Q				
0+35	0.0071	0.21	Q				
0+40	0.0085	0.21	Q				
0+45	0.0100	0.22	Q				
0+50	0.0115	0.22	Q				
0+55	0.0130	0.22	Q				
1+ 0	0.0146	0.22	Q				
1+ 5	0.0161	0.22	Q				
1+10	0.0176	0.22	Q				
1+15	0.0192	0.22	Q				
1+20	0.0207	0.23	Q				
1+25	0.0223	0.23	Q				
1+30	0.0239	0.23	Q				
1+35	0.0254	0.23	Q				
1+40	0.0270	0.23	QV				
1+45	0.0286	0.23	QV				
1+50	0.0302	0.23	QV				
1+55	0.0318	0.23	QV				
2+ 0	0.0334	0.23	QV				
2+ 5	0.0350	0.23	QV				
2+10	0.0366	0.23	QV				
2+15	0.0382	0.23	QV				
2+20	0.0398	0.23	QV				
2+25	0.0414	0.24	QV				
2+30	0.0430	0.24	QV				
2+35	0.0447	0.24	QV				
2+40	0.0463	0.24	QV				
2+45	0.0479	0.24	QV				
2+50	0.0496	0.24	QV				
2+55	0.0512	0.24	Q V				
3+ 0	0.0529	0.24	Q V				
3+ 5	0.0546	0.24	Q V				
3+10	0.0562	0.24	Q V				
3+15	0.0579	0.24	Q V				
3+20	0.0596	0.24	Q V				
3+25	0.0613	0.25	Q V				
3+30	0.0630	0.25	Q V				
3+35	0.0647	0.25	Q V				
3+40	0.0664	0.25	Q V				
3+45	0.0681	0.25	Q V				
3+50	0.0699	0.25	Q V				
3+55	0.0716	0.25	Q V				
4+ 0	0.0733	0.25	Q V				
4+ 5	0.0751	0.25	Q V				
4+10	0.0768	0.25	Q V				
4+15	0.0786	0.26	Q V				
4+20	0.0803	0.26	Q V				
4+25	0.0821	0.26	Q V				
4+30	0.0839	0.26	Q V				
4+35	0.0857	0.26	Q V				

4+40	0.0875	0.26	Q	V				
4+45	0.0893	0.26	Q	V				
4+50	0.0911	0.26	Q	V				
4+55	0.0929	0.26	Q	V				
5+ 0	0.0947	0.26	Q	V				
5+ 5	0.0965	0.27	Q	V				
5+10	0.0984	0.27	Q	V				
5+15	0.1002	0.27	Q	V				
5+20	0.1021	0.27	Q	V				
5+25	0.1039	0.27	Q	V				
5+30	0.1058	0.27	Q	V				
5+35	0.1077	0.27	Q	V				
5+40	0.1096	0.27	Q	V				
5+45	0.1114	0.27	Q	V				
5+50	0.1133	0.28	Q	V				
5+55	0.1153	0.28	Q	V				
6+ 0	0.1172	0.28	Q	V				
6+ 5	0.1191	0.28	Q	V				
6+10	0.1210	0.28	Q	V				
6+15	0.1230	0.28	Q	V				
6+20	0.1249	0.28	Q	V				
6+25	0.1269	0.29	Q	V				
6+30	0.1289	0.29	Q	V				
6+35	0.1309	0.29	Q	V				
6+40	0.1329	0.29	Q	V				
6+45	0.1349	0.29	Q	V				
6+50	0.1369	0.29	Q	V				
6+55	0.1389	0.29	Q	V				
7+ 0	0.1409	0.30	Q	V				
7+ 5	0.1430	0.30	Q	V				
7+10	0.1450	0.30	Q	V				
7+15	0.1471	0.30	Q	V				
7+20	0.1492	0.30	Q	V				
7+25	0.1513	0.30	Q	V				
7+30	0.1534	0.30	Q	V				
7+35	0.1555	0.31	Q	V				
7+40	0.1576	0.31	Q	V				
7+45	0.1597	0.31	Q	V				
7+50	0.1619	0.31	Q	V				
7+55	0.1640	0.31	Q	V				
8+ 0	0.1662	0.32	Q	V				
8+ 5	0.1684	0.32	Q	V				
8+10	0.1706	0.32	Q	V				
8+15	0.1728	0.32	Q	V				
8+20	0.1750	0.32	Q	V				
8+25	0.1773	0.32	Q	V				
8+30	0.1795	0.33	Q	V				
8+35	0.1818	0.33	Q	V				
8+40	0.1840	0.33	Q	V				
8+45	0.1863	0.33	Q	V				
8+50	0.1886	0.33	Q	V				
8+55	0.1910	0.34	Q	V				
9+ 0	0.1933	0.34	Q	V				
9+ 5	0.1956	0.34	Q	V				
9+10	0.1980	0.34	Q	V				
9+15	0.2004	0.35	Q	V				
9+20	0.2028	0.35	Q	V				
9+25	0.2052	0.35	Q	V				
9+30	0.2076	0.35	Q	V				
9+35	0.2101	0.36	Q	V				
9+40	0.2125	0.36	Q	V				
9+45	0.2150	0.36	Q	V				
9+50	0.2175	0.36	Q	V				

9+55	0.2200	0.37	Q	V	|	|	|	|
10+ 0	0.2226	0.37	Q	V	|	|	|	|
10+ 5	0.2251	0.37	Q	V	|	|	|	|
10+10	0.2277	0.37	Q	V	|	|	|	|
10+15	0.2303	0.38	Q	V	|	|	|	|
10+20	0.2329	0.38	Q	V	|	|	|	|
10+25	0.2356	0.38	Q	V	|	|	|	|
10+30	0.2382	0.39	Q	V	|	|	|	|
10+35	0.2409	0.39	Q	V	|	|	|	|
10+40	0.2436	0.39	Q	V	|	|	|	|
10+45	0.2463	0.40	Q	V	|	|	|	|
10+50	0.2491	0.40	Q	V	|	|	|	|
10+55	0.2519	0.40	Q	V	|	|	|	|
11+ 0	0.2547	0.41	Q	V	|	|	|	|
11+ 5	0.2575	0.41	Q	V		|	|	|
11+10	0.2604	0.41	Q	V		|	|	|
11+15	0.2632	0.42	Q	V		|	|	|
11+20	0.2661	0.42	Q	V		|	|	|
11+25	0.2691	0.43	Q	V		|	|	|
11+30	0.2720	0.43	Q	V		|	|	|
11+35	0.2750	0.43	Q	V		|	|	|
11+40	0.2781	0.44	Q	V		|	|	|
11+45	0.2811	0.44	Q		V	|	|	|
11+50	0.2842	0.45	Q		V	|	|	|
11+55	0.2873	0.45	Q		V	|	|	|
12+ 0	0.2905	0.46	Q		V	|	|	|
12+ 5	0.2936	0.46	Q		V	|	|	|
12+10	0.2968	0.45	Q		V	|	|	|
12+15	0.2998	0.45	Q		V	|	|	|
12+20	0.3029	0.45	Q		V	|	|	|
12+25	0.3060	0.45	Q		V	|	|	|
12+30	0.3092	0.46	Q		| V	|	|	|
12+35	0.3124	0.46	Q		| V	|	|	|
12+40	0.3156	0.47	Q		| V	|	|	|
12+45	0.3188	0.47	Q		| V	|	|	|
12+50	0.3221	0.48	Q		| V	|	|	|
12+55	0.3255	0.49	Q		| V	|	|	|
13+ 0	0.3289	0.49	Q		| V	|	|	|
13+ 5	0.3323	0.50	|Q		| V	|	|	|
13+10	0.3358	0.51	|Q		| V	|	|	|
13+15	0.3394	0.52	|Q		| V	|	|	|
13+20	0.3430	0.53	|Q		| V	|	|	|
13+25	0.3467	0.54	|Q		| V	|	|	|
13+30	0.3505	0.55	|Q		| V	|	|	|
13+35	0.3543	0.56	|Q		| V	|	|	|
13+40	0.3582	0.57	|Q		| V	|	|	|
13+45	0.3622	0.58	|Q		| V	|	|	|
13+50	0.3662	0.59	|Q		| V	|	|	|
13+55	0.3704	0.60	|Q		| V	|	|	|
14+ 0	0.3746	0.62	|Q		| V	|	|	|
14+ 5	0.3789	0.63	|Q		| V	|	|	|
14+10	0.3834	0.64	|Q		| V	|	|	|
14+15	0.3879	0.66	|Q		| V	|	|	|
14+20	0.3926	0.68	|Q		| V	|	|	|
14+25	0.3974	0.70	|Q		| V	|	|	|
14+30	0.4023	0.72	|Q		| V	|	|	|
14+35	0.4074	0.74	|Q		| V	|	|	|
14+40	0.4126	0.76	|Q		| V	|	|	|
14+45	0.4180	0.78	|Q		| V	|	|	|
14+50	0.4236	0.81	|Q		| V	|	|	|
14+55	0.4294	0.84	|Q		| V	|	|	|
15+ 0	0.4355	0.88	|Q		| V	|	|	|
15+ 5	0.4418	0.91	|Q		| V	|	|	|



20+25	0.9405	0.31	Q				V
20+30	0.9427	0.31	Q				V
20+35	0.9448	0.31	Q				V
20+40	0.9469	0.30	Q				V
20+45	0.9490	0.30	Q				V
20+50	0.9510	0.30	Q				V
20+55	0.9531	0.30	Q				V
21+ 0	0.9551	0.29	Q				V
21+ 5	0.9571	0.29	Q				V
21+10	0.9590	0.29	Q				V
21+15	0.9610	0.28	Q				V
21+20	0.9629	0.28	Q				V
21+25	0.9648	0.28	Q				V
21+30	0.9667	0.28	Q				V
21+35	0.9686	0.27	Q				V
21+40	0.9705	0.27	Q				V
21+45	0.9723	0.27	Q				V
21+50	0.9742	0.27	Q				V
21+55	0.9760	0.26	Q				V
22+ 0	0.9778	0.26	Q				V
22+ 5	0.9796	0.26	Q				V
22+10	0.9814	0.26	Q				V
22+15	0.9831	0.26	Q				V
22+20	0.9849	0.25	Q				V
22+25	0.9866	0.25	Q				V
22+30	0.9883	0.25	Q				V
22+35	0.9900	0.25	Q				V
22+40	0.9917	0.25	Q				V
22+45	0.9934	0.24	Q				V
22+50	0.9951	0.24	Q				V
22+55	0.9967	0.24	Q				V
23+ 0	0.9984	0.24	Q				V
23+ 5	1.0000	0.24	Q				V
23+10	1.0017	0.24	Q				V
23+15	1.0033	0.23	Q				V
23+20	1.0049	0.23	Q				V
23+25	1.0065	0.23	Q				V
23+30	1.0080	0.23	Q				V
23+35	1.0096	0.23	Q				V
23+40	1.0112	0.23	Q				V
23+45	1.0127	0.23	Q				V
23+50	1.0143	0.22	Q				V
23+55	1.0158	0.22	Q				V
24+ 0	1.0173	0.22	Q				V
24+ 5	1.0188	0.21	Q				V
24+10	1.0196	0.12	Q				V
24+15	1.0201	0.07	Q				V
24+20	1.0204	0.04	Q				V
24+25	1.0206	0.03	Q				V
24+30	1.0207	0.02	Q				V
24+35	1.0208	0.01	Q				V
24+40	1.0209	0.01	Q				V
24+45	1.0209	0.01	Q				V
24+50	1.0209	0.00	Q				V
24+55	1.0210	0.00	Q				V
25+ 0	1.0210	0.00	Q				V

FLOOD HYDROGRAPH ROUTING PROGRAM
Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2005
Study date: 05/16/23

COVINGTON - MIP BUILDING 1
10 YEAR STORM EVENT BASIN ROUTING BUILDING 1
5712Q10ROUTING1
DS

Program License Serial Number 6145

********** HYDROGRAPH INFORMATION **********

From study/file name: 5712Q10PUH1.rte
**********HYDROGRAPH DATA**********
Number of intervals = 300
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 10.185 (CFS)
Total volume = 1.021 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++
Process from Point/Station 0.000 to Point/Station 0.000
**** RETARDING BASIN ROUTING ****
_____

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 300
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.034	0.300	0.033	0.035
1.500	0.134	0.300	0.133	0.135
2.500	0.257	0.300	0.256	0.258
3.000	0.322	0.300	0.321	0.323
4.000	0.457	1.670	0.451	0.463
5.500	0.658	2.770	0.648	0.668

6.500	0.781	3.290	0.770	0.792
7.500	0.836	3.730	0.823	0.849
8.000	0.915	3.930	0.901	0.929
9.000	0.916	4.300	0.901	0.931
10.000	0.917	4.640	0.901	0.933
11.000	0.918	4.950	0.901	0.935
12.000	0.919	5.250	0.901	0.937

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0 2.5 5.09 7.64 10.19	Depth (Ft.)
0.083	0.01	0.00	0.000	O	0.00
0.167	0.09	0.00	0.000	O	0.01
0.250	0.15	0.01	0.001	O	0.02
0.333	0.18	0.02	0.002	O	0.03
0.417	0.19	0.03	0.003	O	0.05
0.500	0.20	0.04	0.004	O	0.06
0.583	0.21	0.05	0.006	O	0.08
0.667	0.21	0.06	0.007	O	0.10
0.750	0.22	0.07	0.008	O	0.11
0.833	0.22	0.08	0.009	O	0.13
0.917	0.22	0.08	0.010	O	0.14
1.000	0.22	0.09	0.010	O	0.15
1.083	0.22	0.10	0.011	O	0.17
1.167	0.22	0.11	0.012	O	0.18
1.250	0.22	0.11	0.013	O	0.19
1.333	0.23	0.12	0.014	O	0.20
1.417	0.23	0.13	0.014	O	0.21
1.500	0.23	0.13	0.015	O	0.22
1.583	0.23	0.14	0.016	O	0.23
1.667	0.23	0.14	0.016	O	0.24
1.750	0.23	0.15	0.017	O	0.25
1.833	0.23	0.15	0.017	O	0.26
1.917	0.23	0.16	0.018	O	0.26
2.000	0.23	0.16	0.018	O	0.27
2.083	0.23	0.17	0.019	O	0.28
2.167	0.23	0.17	0.019	O	0.28
2.250	0.23	0.17	0.020	O	0.29
2.333	0.23	0.18	0.020	O	0.30
2.417	0.24	0.18	0.021	O	0.30
2.500	0.24	0.18	0.021	O	0.31
2.583	0.24	0.19	0.021	O	0.31
2.667	0.24	0.19	0.022	O	0.32
2.750	0.24	0.19	0.022	O	0.32
2.833	0.24	0.20	0.022	O	0.33
2.917	0.24	0.20	0.022	O	0.33
3.000	0.24	0.20	0.023	O	0.33
3.083	0.24	0.20	0.023	O	0.34
3.167	0.24	0.21	0.023	O	0.34
3.250	0.24	0.21	0.024	O	0.35
3.333	0.24	0.21	0.024	O	0.35
3.417	0.25	0.21	0.024	O	0.35
3.500	0.25	0.21	0.024	O	0.36
3.583	0.25	0.22	0.024	O	0.36
3.667	0.25	0.22	0.025	O	0.36
3.750	0.25	0.22	0.025	O	0.37
3.833	0.25	0.22	0.025	O	0.37
3.917	0.25	0.22	0.025	O	0.37
4.000	0.25	0.22	0.025	O	0.37

4.083	0.25	0.23	0.026	O				0.38
4.167	0.25	0.23	0.026	O				0.38
4.250	0.26	0.23	0.026	O				0.38
4.333	0.26	0.23	0.026	O				0.39
4.417	0.26	0.23	0.026	O				0.39
4.500	0.26	0.23	0.027	O				0.39
4.583	0.26	0.24	0.027	O				0.39
4.667	0.26	0.24	0.027	O				0.39
4.750	0.26	0.24	0.027	O				0.40
4.833	0.26	0.24	0.027	O				0.40
4.917	0.26	0.24	0.027	O				0.40
5.000	0.26	0.24	0.027	O				0.40
5.083	0.27	0.24	0.028	O				0.41
5.167	0.27	0.25	0.028	O				0.41
5.250	0.27	0.25	0.028	O				0.41
5.333	0.27	0.25	0.028	O				0.41
5.417	0.27	0.25	0.028	O				0.42
5.500	0.27	0.25	0.028	O				0.42
5.583	0.27	0.25	0.029	O				0.42
5.667	0.27	0.25	0.029	O				0.42
5.750	0.27	0.25	0.029	O				0.42
5.833	0.28	0.26	0.029	O				0.43
5.917	0.28	0.26	0.029	O				0.43
6.000	0.28	0.26	0.029	O				0.43
6.083	0.28	0.26	0.029	O				0.43
6.167	0.28	0.26	0.030	O				0.43
6.250	0.28	0.26	0.030	O				0.44
6.333	0.28	0.26	0.030	O				0.44
6.417	0.29	0.26	0.030	O				0.44
6.500	0.29	0.27	0.030	O				0.44
6.583	0.29	0.27	0.030	O				0.44
6.667	0.29	0.27	0.030	O				0.45
6.750	0.29	0.27	0.031	O				0.45
6.833	0.29	0.27	0.031	O				0.45
6.917	0.29	0.27	0.031	O				0.45
7.000	0.30	0.27	0.031	O				0.46
7.083	0.30	0.27	0.031	O				0.46
7.167	0.30	0.28	0.031	O				0.46
7.250	0.30	0.28	0.031	O				0.46
7.333	0.30	0.28	0.032	O				0.46
7.417	0.30	0.28	0.032	O				0.47
7.500	0.30	0.28	0.032	O				0.47
7.583	0.31	0.28	0.032	O				0.47
7.667	0.31	0.28	0.032	O				0.47
7.750	0.31	0.29	0.032	O				0.48
7.833	0.31	0.29	0.033	O				0.48
7.917	0.31	0.29	0.033	O				0.48
8.000	0.32	0.29	0.033	O				0.48
8.083	0.32	0.29	0.033	O				0.49
8.167	0.32	0.29	0.033	OI				0.49
8.250	0.32	0.29	0.033	OI				0.49
8.333	0.32	0.30	0.034	OI				0.49
8.417	0.32	0.30	0.034	OI				0.50
8.500	0.33	0.30	0.034	OI				0.50
8.583	0.33	0.30	0.034	OI				0.50
8.667	0.33	0.30	0.034	OI				0.50
8.750	0.33	0.30	0.035	OI				0.51
8.833	0.33	0.30	0.035	OI				0.51
8.917	0.34	0.30	0.035	OI				0.51
9.000	0.34	0.30	0.035	OI				0.51
9.083	0.34	0.30	0.036	OI				0.52
9.167	0.34	0.30	0.036	OI				0.52
9.250	0.35	0.30	0.036	OI				0.52

9.333	0.35	0.30	0.037	OI				0.53
9.417	0.35	0.30	0.037	OI				0.53
9.500	0.35	0.30	0.037	OI				0.53
9.583	0.36	0.30	0.038	OI				0.54
9.667	0.36	0.30	0.038	OI				0.54
9.750	0.36	0.30	0.038	OI				0.54
9.833	0.36	0.30	0.039	OI				0.55
9.917	0.37	0.30	0.039	OI				0.55
10.000	0.37	0.30	0.040	OI				0.56
10.083	0.37	0.30	0.040	OI				0.56
10.167	0.37	0.30	0.041	OI				0.57
10.250	0.38	0.30	0.041	OI				0.57
10.333	0.38	0.30	0.042	OI				0.58
10.417	0.38	0.30	0.042	OI				0.58
10.500	0.39	0.30	0.043	OI				0.59
10.583	0.39	0.30	0.044	OI				0.60
10.667	0.39	0.30	0.044	OI				0.60
10.750	0.40	0.30	0.045	OI				0.61
10.833	0.40	0.30	0.045	OI				0.61
10.917	0.40	0.30	0.046	OI				0.62
11.000	0.41	0.30	0.047	OI				0.63
11.083	0.41	0.30	0.048	OI				0.64
11.167	0.41	0.30	0.048	OI				0.64
11.250	0.42	0.30	0.049	OI				0.65
11.333	0.42	0.30	0.050	OI				0.66
11.417	0.43	0.30	0.051	OI				0.67
11.500	0.43	0.30	0.052	OI				0.68
11.583	0.43	0.30	0.053	OI				0.69
11.667	0.44	0.30	0.054	OI				0.70
11.750	0.44	0.30	0.055	OI				0.71
11.833	0.45	0.30	0.056	OI				0.72
11.917	0.45	0.30	0.057	OI				0.73
12.000	0.46	0.30	0.058	OI				0.74
12.083	0.46	0.30	0.059	OI				0.75
12.167	0.45	0.30	0.060	OI				0.76
12.250	0.45	0.30	0.061	OI				0.77
12.333	0.45	0.30	0.062	OI				0.78
12.417	0.45	0.30	0.063	OI				0.79
12.500	0.46	0.30	0.064	OI				0.80
12.583	0.46	0.30	0.065	OI				0.81
12.667	0.47	0.30	0.066	OI				0.82
12.750	0.47	0.30	0.067	OI				0.83
12.833	0.48	0.30	0.069	OI				0.85
12.917	0.49	0.30	0.070	OI				0.86
13.000	0.49	0.30	0.071	OI				0.87
13.083	0.50	0.30	0.073	OI				0.89
13.167	0.51	0.30	0.074	OI				0.90
13.250	0.52	0.30	0.075	OI				0.91
13.333	0.53	0.30	0.077	OI				0.93
13.417	0.54	0.30	0.079	OI				0.95
13.500	0.55	0.30	0.080	OI				0.96
13.583	0.56	0.30	0.082	OI				0.98
13.667	0.57	0.30	0.084	OI				1.00
13.750	0.58	0.30	0.086	OI				1.02
13.833	0.59	0.30	0.088	OI				1.04
13.917	0.60	0.30	0.090	OI				1.06
14.000	0.62	0.30	0.092	OI				1.08
14.083	0.63	0.30	0.094	OI				1.10
14.167	0.64	0.30	0.096	O I				1.12
14.250	0.66	0.30	0.099	O I				1.15
14.333	0.68	0.30	0.101	O I				1.17
14.417	0.70	0.30	0.104	O I				1.20
14.500	0.72	0.30	0.107	O I				1.23

14.583	0.74	0.30	0.110	O I	|	|	|	1.26
14.667	0.76	0.30	0.113	O I	|	|	|	1.29
14.750	0.78	0.30	0.116	O I	|	|	|	1.32
14.833	0.81	0.30	0.119	O I	|	|	|	1.35
14.917	0.84	0.30	0.123	O I	|	|	|	1.39
15.000	0.88	0.30	0.127	O I	|	|	|	1.43
15.083	0.91	0.30	0.131	O I	|	|	|	1.47
15.167	0.96	0.30	0.135	O I	|	|	|	1.51
15.250	1.00	0.30	0.140	O I	|	|	|	1.55
15.333	1.06	0.30	0.145	O I	|	|	|	1.59
15.417	1.10	0.30	0.151	O I	|	|	|	1.63
15.500	1.06	0.30	0.156	O I	|	|	|	1.68
15.583	1.06	0.30	0.161	O I	|	|	|	1.72
15.667	1.13	0.30	0.167	O I	|	|	|	1.77
15.750	1.24	0.30	0.173	O I	|	|	|	1.81
15.833	1.43	0.30	0.180	O I	|	|	|	1.87
15.917	1.73	0.30	0.189	O I	|	|	|	1.94
16.000	2.40	0.30	0.201	O I	|	|	|	2.04
16.083	4.39	0.30	0.222	O I	|	|	|	2.22
16.167	10.19	0.30	0.270	O	|	|	I	2.60
16.250	7.55	0.37	0.329	O	|	I	|	3.05
16.333	4.24	0.75	0.366	O	I |	|	|	3.32
16.417	2.95	0.94	0.385	O	I |	|	|	3.47
16.500	2.32	1.05	0.396	O I	|	|	|	3.55
16.583	1.93	1.12	0.403	O I	|	|	|	3.60
16.667	1.62	1.17	0.408	O I	|	|	|	3.63
16.750	1.37	1.19	0.410	OI	|	|	|	3.65
16.833	1.16	1.20	0.410	O	|	|	|	3.65
16.917	1.06	1.19	0.410	O	|	|	|	3.65
17.000	0.97	1.18	0.409	O	|	|	|	3.64
17.083	0.86	1.16	0.407	IO	|	|	|	3.63
17.167	0.73	1.14	0.404	IO	|	|	|	3.61
17.250	0.68	1.11	0.402	IO	|	|	|	3.59
17.333	0.65	1.08	0.399	IO	|	|	|	3.57
17.417	0.62	1.05	0.396	I O	|	|	|	3.55
17.500	0.59	1.02	0.393	I O	|	|	|	3.52
17.583	0.57	0.99	0.390	I O	|	|	|	3.50
17.667	0.55	0.96	0.387	I O	|	|	|	3.48
17.750	0.53	0.93	0.384	IO	|	|	|	3.46
17.833	0.51	0.90	0.381	IO	|	|	|	3.44
17.917	0.49	0.88	0.379	IO	|	|	|	3.42
18.000	0.48	0.85	0.376	IO	|	|	|	3.40
18.083	0.47	0.82	0.374	IO	|	|	|	3.38
18.167	0.47	0.80	0.371	IO	|	|	|	3.36
18.250	0.47	0.78	0.369	IO	|	|	|	3.35
18.333	0.46	0.76	0.367	IO	|	|	|	3.33
18.417	0.45	0.74	0.365	IO	|	|	|	3.32
18.500	0.44	0.72	0.363	IO	|	|	|	3.30
18.583	0.44	0.70	0.361	IO	|	|	|	3.29
18.667	0.43	0.68	0.359	IO	|	|	|	3.28
18.750	0.42	0.66	0.358	IO	|	|	|	3.26
18.833	0.41	0.65	0.356	IO	|	|	|	3.25
18.917	0.41	0.63	0.355	O	|	|	|	3.24
19.000	0.40	0.61	0.353	O	|	|	|	3.23
19.083	0.39	0.60	0.352	O	|	|	|	3.22
19.167	0.39	0.59	0.350	O	|	|	|	3.21
19.250	0.38	0.57	0.349	O	|	|	|	3.20
19.333	0.37	0.56	0.348	O	|	|	|	3.19
19.417	0.37	0.55	0.346	O	|	|	|	3.18
19.500	0.36	0.53	0.345	O	|	|	|	3.17
19.583	0.36	0.52	0.344	O	|	|	|	3.16
19.667	0.35	0.51	0.343	O	|	|	|	3.15
19.750	0.35	0.50	0.342	O	|	|	|	3.15

19.833	0.34	0.49	0.341	|O	|	|	|	3.14
19.917	0.34	0.48	0.340	|O	|	|	|	3.13
20.000	0.33	0.47	0.339	|O	|	|	|	3.12
20.083	0.33	0.46	0.338	|O	|	|	|	3.12
20.167	0.33	0.45	0.337	|O	|	|	|	3.11
20.250	0.32	0.44	0.336	|O	|	|	|	3.10
20.333	0.32	0.43	0.335	|O	|	|	|	3.10
20.417	0.31	0.43	0.334	IO	|	|	|	3.09
20.500	0.31	0.42	0.334	IO	|	|	|	3.09
20.583	0.31	0.41	0.333	IO	|	|	|	3.08
20.667	0.30	0.40	0.332	IO	|	|	|	3.08
20.750	0.30	0.40	0.332	IO	|	|	|	3.07
20.833	0.30	0.39	0.331	IO	|	|	|	3.07
20.917	0.30	0.38	0.330	IO	|	|	|	3.06
21.000	0.29	0.38	0.330	IO	|	|	|	3.06
21.083	0.29	0.37	0.329	IO	|	|	|	3.05
21.167	0.29	0.37	0.329	IO	|	|	|	3.05
21.250	0.28	0.36	0.328	IO	|	|	|	3.04
21.333	0.28	0.36	0.328	IO	|	|	|	3.04
21.417	0.28	0.35	0.327	IO	|	|	|	3.04
21.500	0.28	0.35	0.327	IO	|	|	|	3.03
21.583	0.27	0.34	0.326	IO	|	|	|	3.03
21.667	0.27	0.34	0.326	IO	|	|	|	3.03
21.750	0.27	0.33	0.325	IO	|	|	|	3.02
21.833	0.27	0.33	0.325	IO	|	|	|	3.02
21.917	0.26	0.32	0.324	IO	|	|	|	3.02
22.000	0.26	0.32	0.324	IO	|	|	|	3.01
22.083	0.26	0.32	0.324	O	|	|	|	3.01
22.167	0.26	0.31	0.323	O	|	|	|	3.01
22.250	0.26	0.31	0.323	O	|	|	|	3.01
22.333	0.25	0.30	0.322	O	|	|	|	3.00
22.417	0.25	0.30	0.322	O	|	|	|	3.00
22.500	0.25	0.30	0.322	O	|	|	|	3.00
22.583	0.25	0.30	0.321	O	|	|	|	3.00
22.667	0.25	0.30	0.321	O	|	|	|	2.99
22.750	0.24	0.30	0.321	O	|	|	|	2.99
22.833	0.24	0.30	0.320	O	|	|	|	2.99
22.917	0.24	0.30	0.320	O	|	|	|	2.98
23.000	0.24	0.30	0.319	O	|	|	|	2.98
23.083	0.24	0.30	0.319	O	|	|	|	2.98
23.167	0.24	0.30	0.319	O	|	|	|	2.97
23.250	0.23	0.30	0.318	O	|	|	|	2.97
23.333	0.23	0.30	0.318	O	|	|	|	2.97
23.417	0.23	0.30	0.317	O	|	|	|	2.96
23.500	0.23	0.30	0.317	O	|	|	|	2.96
23.583	0.23	0.30	0.316	O	|	|	|	2.96
23.667	0.23	0.30	0.316	O	|	|	|	2.95
23.750	0.23	0.30	0.315	O	|	|	|	2.95
23.833	0.22	0.30	0.315	O	|	|	|	2.94
23.917	0.22	0.30	0.314	O	|	|	|	2.94
24.000	0.22	0.30	0.314	O	|	|	|	2.94
24.083	0.21	0.30	0.313	O	|	|	|	2.93
24.167	0.12	0.30	0.312	O	|	|	|	2.92
24.250	0.07	0.30	0.311	O	|	|	|	2.91
24.333	0.04	0.30	0.309	O	|	|	|	2.90
24.417	0.03	0.30	0.307	O	|	|	|	2.89
24.500	0.02	0.30	0.305	O	|	|	|	2.87
24.583	0.01	0.30	0.303	O	|	|	|	2.86
24.667	0.01	0.30	0.301	O	|	|	|	2.84
24.750	0.01	0.30	0.299	O	|	|	|	2.83
24.833	0.00	0.30	0.297	O	|	|	|	2.81
24.917	0.00	0.30	0.295	O	|	|	|	2.79
25.000	0.00	0.30	0.293	O	|	|	|	2.78

25.083	0.00	0.30	0.291	O	|	|	|	|	2.76
25.167	0.00	0.30	0.289	O	|	|	|	|	2.75
25.250	0.00	0.30	0.287	O	|	|	|	|	2.73
25.333	0.00	0.30	0.285	O	|	|	|	|	2.72
25.417	0.00	0.30	0.283	O	|	|	|	|	2.70
25.500	0.00	0.30	0.281	O	|	|	|	|	2.68
25.583	0.00	0.30	0.279	O	|	|	|	|	2.67
25.667	0.00	0.30	0.277	O	|	|	|	|	2.65
25.750	0.00	0.30	0.275	O	|	|	|	|	2.64
25.833	0.00	0.30	0.273	O	|	|	|	|	2.62
25.917	0.00	0.30	0.271	O	|	|	|	|	2.60
26.000	0.00	0.30	0.268	O	|	|	|	|	2.59
26.083	0.00	0.30	0.266	O	|	|	|	|	2.57
26.167	0.00	0.30	0.264	O	|	|	|	|	2.56
26.250	0.00	0.30	0.262	O	|	|	|	|	2.54
26.333	0.00	0.30	0.260	O	|	|	|	|	2.52
26.417	0.00	0.30	0.258	O	|	|	|	|	2.51
26.500	0.00	0.30	0.256	O	|	|	|	|	2.49
26.583	0.00	0.30	0.254	O	|	|	|	|	2.48
26.667	0.00	0.30	0.252	O	|	|	|	|	2.46
26.750	0.00	0.30	0.250	O	|	|	|	|	2.44
26.833	0.00	0.30	0.248	O	|	|	|	|	2.43
26.917	0.00	0.30	0.246	O	|	|	|	|	2.41
27.000	0.00	0.30	0.244	O	|	|	|	|	2.39
27.083	0.00	0.30	0.242	O	|	|	|	|	2.37
27.167	0.00	0.30	0.240	O	|	|	|	|	2.36
27.250	0.00	0.30	0.237	O	|	|	|	|	2.34
27.333	0.00	0.30	0.235	O	|	|	|	|	2.32
27.417	0.00	0.30	0.233	O	|	|	|	|	2.31
27.500	0.00	0.30	0.231	O	|	|	|	|	2.29
27.583	0.00	0.30	0.229	O	|	|	|	|	2.27
27.667	0.00	0.30	0.227	O	|	|	|	|	2.26
27.750	0.00	0.30	0.225	O	|	|	|	|	2.24
27.833	0.00	0.30	0.223	O	|	|	|	|	2.22
27.917	0.00	0.30	0.221	O	|	|	|	|	2.21
28.000	0.00	0.30	0.219	O	|	|	|	|	2.19
28.083	0.00	0.30	0.217	O	|	|	|	|	2.17
28.167	0.00	0.30	0.215	O	|	|	|	|	2.16
28.250	0.00	0.30	0.213	O	|	|	|	|	2.14
28.333	0.00	0.30	0.211	O	|	|	|	|	2.12
28.417	0.00	0.30	0.209	O	|	|	|	|	2.11
28.500	0.00	0.30	0.206	O	|	|	|	|	2.09
28.583	0.00	0.30	0.204	O	|	|	|	|	2.07
28.667	0.00	0.30	0.202	O	|	|	|	|	2.06
28.750	0.00	0.30	0.200	O	|	|	|	|	2.04
28.833	0.00	0.30	0.198	O	|	|	|	|	2.02
28.917	0.00	0.30	0.196	O	|	|	|	|	2.01
29.000	0.00	0.30	0.194	O	|	|	|	|	1.99
29.083	0.00	0.30	0.192	O	|	|	|	|	1.97
29.167	0.00	0.30	0.190	O	|	|	|	|	1.95
29.250	0.00	0.30	0.188	O	|	|	|	|	1.94
29.333	0.00	0.30	0.186	O	|	|	|	|	1.92
29.417	0.00	0.30	0.184	O	|	|	|	|	1.90
29.500	0.00	0.30	0.182	O	|	|	|	|	1.89
29.583	0.00	0.30	0.180	O	|	|	|	|	1.87
29.667	0.00	0.30	0.178	O	|	|	|	|	1.85
29.750	0.00	0.30	0.175	O	|	|	|	|	1.84
29.833	0.00	0.30	0.173	O	|	|	|	|	1.82
29.917	0.00	0.30	0.171	O	|	|	|	|	1.80
30.000	0.00	0.30	0.169	O	|	|	|	|	1.79
30.083	0.00	0.30	0.167	O	|	|	|	|	1.77
30.167	0.00	0.30	0.165	O	|	|	|	|	1.75
30.250	0.00	0.30	0.163	O	|	|	|	|	1.74

30.333	0.00	0.30	0.161	O	|	|	|	|	1.72
30.417	0.00	0.30	0.159	O	|	|	|	|	1.70
30.500	0.00	0.30	0.157	O	|	|	|	|	1.69
30.583	0.00	0.30	0.155	O	|	|	|	|	1.67
30.667	0.00	0.30	0.153	O	|	|	|	|	1.65
30.750	0.00	0.30	0.151	O	|	|	|	|	1.64
30.833	0.00	0.30	0.149	O	|	|	|	|	1.62
30.917	0.00	0.30	0.147	O	|	|	|	|	1.60
31.000	0.00	0.30	0.144	O	|	|	|	|	1.59
31.083	0.00	0.30	0.142	O	|	|	|	|	1.57
31.167	0.00	0.30	0.140	O	|	|	|	|	1.55
31.250	0.00	0.30	0.138	O	|	|	|	|	1.53
31.333	0.00	0.30	0.136	O	|	|	|	|	1.52
31.417	0.00	0.30	0.134	O	|	|	|	|	1.50
31.500	0.00	0.30	0.132	O	|	|	|	|	1.48
31.583	0.00	0.30	0.130	O	|	|	|	|	1.46
31.667	0.00	0.30	0.128	O	|	|	|	|	1.44
31.750	0.00	0.30	0.126	O	|	|	|	|	1.42
31.833	0.00	0.30	0.124	O	|	|	|	|	1.40
31.917	0.00	0.30	0.122	O	|	|	|	|	1.38
32.000	0.00	0.30	0.120	O	|	|	|	|	1.36
32.083	0.00	0.30	0.118	O	|	|	|	|	1.34
32.167	0.00	0.30	0.116	O	|	|	|	|	1.32
32.250	0.00	0.30	0.113	O	|	|	|	|	1.29
32.333	0.00	0.30	0.111	O	|	|	|	|	1.27
32.417	0.00	0.30	0.109	O	|	|	|	|	1.25
32.500	0.00	0.30	0.107	O	|	|	|	|	1.23
32.583	0.00	0.30	0.105	O	|	|	|	|	1.21
32.667	0.00	0.30	0.103	O	|	|	|	|	1.19
32.750	0.00	0.30	0.101	O	|	|	|	|	1.17
32.833	0.00	0.30	0.099	O	|	|	|	|	1.15
32.917	0.00	0.30	0.097	O	|	|	|	|	1.13
33.000	0.00	0.30	0.095	O	|	|	|	|	1.11
33.083	0.00	0.30	0.093	O	|	|	|	|	1.09
33.167	0.00	0.30	0.091	O	|	|	|	|	1.07
33.250	0.00	0.30	0.089	O	|	|	|	|	1.05
33.333	0.00	0.30	0.087	O	|	|	|	|	1.03
33.417	0.00	0.30	0.085	O	|	|	|	|	1.01
33.500	0.00	0.30	0.082	O	|	|	|	|	0.98
33.583	0.00	0.30	0.080	O	|	|	|	|	0.96
33.667	0.00	0.30	0.078	O	|	|	|	|	0.94
33.750	0.00	0.30	0.076	O	|	|	|	|	0.92
33.833	0.00	0.30	0.074	O	|	|	|	|	0.90
33.917	0.00	0.30	0.072	O	|	|	|	|	0.88
34.000	0.00	0.30	0.070	O	|	|	|	|	0.86
34.083	0.00	0.30	0.068	O	|	|	|	|	0.84
34.167	0.00	0.30	0.066	O	|	|	|	|	0.82
34.250	0.00	0.30	0.064	O	|	|	|	|	0.80
34.333	0.00	0.30	0.062	O	|	|	|	|	0.78
34.417	0.00	0.30	0.060	O	|	|	|	|	0.76
34.500	0.00	0.30	0.058	O	|	|	|	|	0.74
34.583	0.00	0.30	0.056	O	|	|	|	|	0.72
34.667	0.00	0.30	0.054	O	|	|	|	|	0.70
34.750	0.00	0.30	0.052	O	|	|	|	|	0.68
34.833	0.00	0.30	0.049	O	|	|	|	|	0.65
34.917	0.00	0.30	0.047	O	|	|	|	|	0.63
35.000	0.00	0.30	0.045	O	|	|	|	|	0.61
35.083	0.00	0.30	0.043	O	|	|	|	|	0.59
35.167	0.00	0.30	0.041	O	|	|	|	|	0.57
35.250	0.00	0.30	0.039	O	|	|	|	|	0.55
35.333	0.00	0.30	0.037	O	|	|	|	|	0.53
35.417	0.00	0.30	0.035	O	|	|	|	|	0.51
35.500	0.00	0.29	0.033	O	|	|	|	|	0.48

35.583	0.00	0.27	0.031	O	|	|	|	0.46
35.667	0.00	0.26	0.029	O	|	|	|	0.43
35.750	0.00	0.24	0.027	O	|	|	|	0.40
35.833	0.00	0.23	0.026	O	|	|	|	0.38
35.917	0.00	0.21	0.024	O	|	|	|	0.36
36.000	0.00	0.20	0.023	O	|	|	|	0.34
36.083	0.00	0.19	0.022	O	|	|	|	0.32
36.167	0.00	0.18	0.020	O	|	|	|	0.30
36.250	0.00	0.17	0.019	O	|	|	|	0.28
36.333	0.00	0.16	0.018	O	|	|	|	0.26
36.417	0.00	0.15	0.017	O	|	|	|	0.25
36.500	0.00	0.14	0.016	O	|	|	|	0.23
36.583	0.00	0.13	0.015	O	|	|	|	0.22
36.667	0.00	0.12	0.014	O	|	|	|	0.21
36.750	0.00	0.12	0.013	O	|	|	|	0.19
36.833	0.00	0.11	0.012	O	|	|	|	0.18
36.917	0.00	0.10	0.012	O	|	|	|	0.17
37.000	0.00	0.10	0.011	O	|	|	|	0.16
37.083	0.00	0.09	0.010	O	|	|	|	0.15
37.167	0.00	0.09	0.010	O	|	|	|	0.14
37.250	0.00	0.08	0.009	O	|	|	|	0.14
37.333	0.00	0.08	0.009	O	|	|	|	0.13
37.417	0.00	0.07	0.008	O	|	|	|	0.12
37.500	0.00	0.07	0.008	O	|	|	|	0.11
37.583	0.00	0.06	0.007	O	|	|	|	0.11
37.667	0.00	0.06	0.007	O	|	|	|	0.10
37.750	0.00	0.06	0.006	O	|	|	|	0.09
37.833	0.00	0.05	0.006	O	|	|	|	0.09
37.917	0.00	0.05	0.006	O	|	|	|	0.08
38.000	0.00	0.05	0.005	O	|	|	|	0.08
38.083	0.00	0.04	0.005	O	|	|	|	0.07
38.167	0.00	0.04	0.005	O	|	|	|	0.07
38.250	0.00	0.04	0.004	O	|	|	|	0.07
38.333	0.00	0.04	0.004	O	|	|	|	0.06
38.417	0.00	0.03	0.004	O	|	|	|	0.06
38.500	0.00	0.03	0.004	O	|	|	|	0.05
38.583	0.00	0.03	0.003	O	|	|	|	0.05
38.667	0.00	0.03	0.003	O	|	|	|	0.05
38.750	0.00	0.03	0.003	O	|	|	|	0.05
38.833	0.00	0.03	0.003	O	|	|	|	0.04
38.917	0.00	0.02	0.003	O	|	|	|	0.04
39.000	0.00	0.02	0.003	O	|	|	|	0.04
39.083	0.00	0.02	0.002	O	|	|	|	0.04
39.167	0.00	0.02	0.002	O	|	|	|	0.03
39.250	0.00	0.02	0.002	O	|	|	|	0.03
39.333	0.00	0.02	0.002	O	|	|	|	0.03
39.417	0.00	0.02	0.002	O	|	|	|	0.03
39.500	0.00	0.02	0.002	O	|	|	|	0.03
39.583	0.00	0.01	0.002	O	|	|	|	0.02
39.667	0.00	0.01	0.002	O	|	|	|	0.02
39.750	0.00	0.01	0.001	O	|	|	|	0.02
39.833	0.00	0.01	0.001	O	|	|	|	0.02
39.917	0.00	0.01	0.001	O	|	|	|	0.02
40.000	0.00	0.01	0.001	O	|	|	|	0.02
40.083	0.00	0.01	0.001	O	|	|	|	0.02
40.167	0.00	0.01	0.001	O	|	|	|	0.02
40.250	0.00	0.01	0.001	O	|	|	|	0.02
40.333	0.00	0.01	0.001	O	|	|	|	0.01
40.417	0.00	0.01	0.001	O	|	|	|	0.01
40.500	0.00	0.01	0.001	O	|	|	|	0.01
40.583	0.00	0.01	0.001	O	|	|	|	0.01
40.667	0.00	0.01	0.001	O	|	|	|	0.01
40.750	0.00	0.01	0.001	O	|	|	|	0.01

40.833	0.00	0.01	0.001	O	|	|	|	|	0.01
40.917	0.00	0.01	0.001	O	|	|	|	|	0.01
41.000	0.00	0.01	0.001	O	|	|	|	|	0.01
41.083	0.00	0.00	0.001	O	|	|	|	|	0.01
41.167	0.00	0.00	0.001	O	|	|	|	|	0.01
41.250	0.00	0.00	0.000	O	|	|	|	|	0.01
41.333	0.00	0.00	0.000	O	|	|	|	|	0.01
41.417	0.00	0.00	0.000	O	|	|	|	|	0.01
41.500	0.00	0.00	0.000	O	|	|	|	|	0.01
41.583	0.00	0.00	0.000	O	|	|	|	|	0.01
41.667	0.00	0.00	0.000	O	|	|	|	|	0.01
41.750	0.00	0.00	0.000	O	|	|	|	|	0.01
41.833	0.00	0.00	0.000	O	|	|	|	|	0.00
41.917	0.00	0.00	0.000	O	|	|	|	|	0.00
42.000	0.00	0.00	0.000	O	|	|	|	|	0.00
42.083	0.00	0.00	0.000	O	|	|	|	|	0.00
42.167	0.00	0.00	0.000	O	|	|	|	|	0.00
42.250	0.00	0.00	0.000	O	|	|	|	|	0.00
42.333	0.00	0.00	0.000	O	|	|	|	|	0.00
42.417	0.00	0.00	0.000	O	|	|	|	|	0.00
42.500	0.00	0.00	0.000	O	|	|	|	|	0.00
42.583	0.00	0.00	0.000	O	|	|	|	|	0.00
42.667	0.00	0.00	0.000	O	|	|	|	|	0.00
42.750	0.00	0.00	0.000	O	|	|	|	|	0.00
42.833	0.00	0.00	0.000	O	|	|	|	|	0.00
42.917	0.00	0.00	0.000	O	|	|	|	|	0.00
43.000	0.00	0.00	0.000	O	|	|	|	|	0.00
43.083	0.00	0.00	0.000	O	|	|	|	|	0.00
43.167	0.00	0.00	0.000	O	|	|	|	|	0.00
43.250	0.00	0.00	0.000	O	|	|	|	|	0.00
43.333	0.00	0.00	0.000	O	|	|	|	|	0.00

**********HYDROGRAPH DATA**********

Number of intervals = 520
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 1.196 (CFS)
Total volume = 1.021 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

COVINGTON - MIP - BUILDING 2

PERMIT NUMBERS: TBD

Prepared for:

Mojave 80 Gray, LLC,

c/o Covington Development Partners, LLC

3 Corporate Plaza, Suite 230

Newport Beach, Ca 92660

949-514-0274

Prepared by:

Huitt-Zollars, Inc

3990 Concours, Suite 330

Ontario, CA 91764

909-941-7799

Project: R315712.01

Submittal Date: 05/08/2023

Revision No. and Date: 05/08/2023 using Mojave Template

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Covington Development Partners, LLC by Huitt-Zollars, Inc.. The WQMP is intended to comply with the requirements of the County of San Bernardino 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):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-04

Owner's Signature			
Owner Name: Dana Whitmer			
Title	Partner		
Company	Mojave 80 Gray, LLC, c/o Covington Development Partners, LLC		
Address	3 Corporate Development Plaza, Suite 230		
Email	dwhitmer@covingtongroupinc.com		
Telephone #	949-514-0274		
Signature		Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-04

"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: Johnny Murad, PE		PE Stamp Below
Title	Project Manager	
Company	Huitt-Zollars, Inc	
Address	3990 Concours, Suite 330 Ontario, CA 91764	
Email	jmurad@huitt-zollars.com	
Telephone #	909-941-7799	
Signature		
Date	05/19/2023	

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Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Covington - MIP - Building 2				
Project Owner Contact Name:	Dana Whitmer				
Mailing Address:	3 Corporate Plaza, Suite 230 Newport Beach, ca 92660	E-mail Address:	dwhitmer@covingtongroupinc.com	Telephone:	949-514-0274
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	APN 3128-631-04	
Additional Information/ Comments:	N/A				
Description of Project:	The project is a new development of an industrial warehouse facility located on the northwest corner of Mojave Drive and Topaz Road, in the City of Victorville, California. The proposed building is appoximately 104,000 square feet on approximately 5.7 acres of land.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	All on-site runoff will be collected by catch basins on the north side of the building and conveyed to the infiltration/detention basin north of the truck dock area for treatment. The design captured volume will infiltrate through the bottom of the basin. Once WQMP DCV (Design Capture Volume) is reached the water will outlet to the proposed off-site storm drain system in Onyx Road. Refer to the Hydrology Study for more calculations and details.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 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):	248,816	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	

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:

The property is being developed by Covington Development Partners, LLC. Covinton Development Partners, LLC, will be the entity responsible for long term maintenance of WQMP Storm Water Facilities throughout the site.

Name: Mojave 80 Gray, LLC, c/o Covington Development Partners, LLC
Address: 3 Corporate Plaza, Suite 230, Newport Beach, CA 92660
Contact Person: Dana Whitmer/ Partner
Phone: 949-514-0274

2.3 Potential Stormwater Pollutants

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

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Pathogens are typically caused by the transport of animal or human fecal wastes from the watershed.
Nutrients - Phosphorous	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Noxious aquatic plants are typically from animals or vehicle transport that grow aggressively, multiply quickly without natural controls (native herbivores, soil chemistry, etc.), and adversely affect native habitats.
Sediment	E ☒	N ☐	Sediments are solid materials that are eroded from the land surface.
Metals	E ☒	N ☐	The primary source of metal pollution in stormwater is typically commercially available metals and metal products, as well as emissions from brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste from human or animals.
Pesticides / Herbicides	E ☒	N ☐	Pesticides and herbicides can be washed off urban landscapes during storm events.
Organic Compounds	E ☒	N ☐	Sources of organic compounds may include waste handling areas and vehicle or landscape maintenance areas.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°31'53.96"N	Longitude 117°23'02.03"W	Thomas Bros Map page 4295

1 San Bernardino County climatic region: ☒ Desert

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

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	Runoff from the project site will be directed to the proposed infiltration/ detention basin on the north side of the project site. After the DCV WQMP volume is reached then water will outlet to the proposed storm drain system in Onyx Road.
DA1 DMA B to Outlet 1	N/A
DA2 to Outlet 2	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1				
For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	248,816	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	0	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC II	N/A	N/A	N/A
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	C	N/A	N/A	N/A
5 Longest flowpath length (ft)	714	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	~0.0144	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	N/A	N/A	N/A
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	N/A	N/A	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)	N/A	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	N/A	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	N/A	N/A	N/A	N/A
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	N/A	N/A	N/A	N/A
5 Longest flowpath length (ft)	N/A	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	N/A	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	N/A	N/A	N/A	N/A
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*	N/A	N/A	N/A	N/A

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	City Storm Drain Line T, Ciry Master Plan Facility E-01, Mojave River, Silver Lake and Soda Lake
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Per 2010 303(d) list, Mojave River: TMDLs still required. Soda Lake: TMDLs still required.
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	The project expects to generate Pathogens, Nutrients (Soda Lake), metals and Other Inorganics (fluoride & sulfate) (Mojave River) which are listed for downstream receiving waters on the latest CWA 303(d) list.
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	NO
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	☒	☐	Property owners shall review and become familiar with the site specific WQMP. Additional educational materials for day to day operations are contained in Attachment C. Additional materials can be obtained from the local water pollution prevention program. Education of property owners begin with the review/preparation of the site specific WQMP and continues through the review of additional educational material as it applies to their project.
N2	Activity Restrictions	☒	☐	Activity restriction shall be stated in the owners lease terms prior to occupancy; • Fuelling areas, air/water supply areas, maintenance bays, vehicle washing areas, outdoor material storage areas, outdoor work areas, outdoor processing areas, wash water from food preparation areas within the project site will not be allowed on the project site. • Storage of hazardous materials will not be allowed on the project site. • All pesticide applications shall be performed by a licensed contractor certified by the California Department of Pesticide Regulation. • All dumpster lids shall be kept closed at all times. • Blowing, Sweeping or hosing of debris (leaf, litter, grass clippings, trash or debris) into the streets, underground stormdrain facilities or other storm water conveyance areas shall be strictly prohibited
N3	Landscape Management BMPs	☒	☐	A landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate the use of native and drought tolerant trees and shrubs throughout the project site.
N4	BMP Maintenance	☒	☐	Property owners shall maintain the designated on-site BMP areas, see Section 5 for self inspection and maintenance form
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Industrial purposed warehouse does not apply to Title 22 CCR (California Code of Regulations). CCR licensing in child care, residential and family child care.

Form 4.1-1 Non-Structural Source Control BMPs				
N6	Local Water Quality Ordinances	☒	☐	Local Water Quality Ordinances will be addressed by implementation of this WQMP
N7	Spill Contingency Plan	☒	☐	Industrial Warehouse buildings and truck dock areas have potential for spills and therefore each tenant shall be required to prepare a spill contingency plan and it shall be implemented in accordance with section 6.95 of the California Health and Safety Code. The spill contingency plan shall identify responsible persons in the event of a spill, an action item list identifying how the spill should be contained, cleaned up and who should be contacted in the event of a spill. Documentation of any spill event and cleanup process shall be kept on site in perpetuity.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed for this site
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials are planned to be stored on this site.

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	☒	☐	Underground fire protection service and fire sprinklers will be provided per the uniform fire code and the requirements of the County of San Bernardino Fire Department.
N11	Litter/Debris Control Program	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
N12	Employee Training	☒	☐	The following shall be provided to the tentant by the onwer; an Employee Training/Education program shall be provided annually to help educate employees about storm water quality management and practices that help prevent storm water pollution. Documentation of such training/education program implementation shall be kept by the owner for a minimum of ten years. Sample education materials have been provided in Attachment D. Additional educational materials can be obtained from the County of San Bernardino storm water program.
N13	Housekeeping of Loading Docks	☒	☐	The project site will have truck docks. The truck docks shall be inspected on a weekly basis to help ensure that any trash and debris are collected prior to being washed into the underground storm drain system. All storm water runoff from the loading dock areas will be discharged into infiltration basins and/or underground infiltration chambers prior to conveyance to the public storm drain system. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected on a quarterly basis. Inspection of the on-site catch basins shall consist of visual inspection of any sediment, trash or debris collected in the bottom of each catch basin. Any sediment, trash or debris found shall be removed from the catch basins and disposed of in a legal manner. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The on-site parking lots, drive aisles, and loading dock areas shall be hand swept on a monthly basis. Documentation of such sweeping shall be kept by the owner in perpetuity. Frequency of sweeping shall be adjusted as needed to maintain a clean site.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	None, proposed BMP's satisfy requirements
N17	Comply with all other applicable NPDES permits	☒	☐	General construction permit "SWRCB Orders No. 2009-009-DWQ as amended by Order 2010-0014-DWQ"

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)	☒	☐	The on-site storm drain catch basins shall be stenciled with the phrase "Drains to River" or other approved language. The signage shall be inspected on an annual basis. Missing or faded signage shall be replaced. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas are proposed for this site
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	The landscape architect will follow CASQA SD-12 for design and provide design plans for the on-site irrigation system. The irrigation system shall be inspected on a monthly basis to ensure proper operation. Any broken sprinkler heads shall be repaired immediately to ensure that the system continues to operate efficiently. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	The landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate that finish grade of landsapced areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement throughout the project site.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Perimeter slopes and slopes to catch grade will have a maximum slope of 2:1. The slopes will be landscaped appropriately to also help ensure that erosion of the slopes does not occur. Slopes will be inspected and maintained bi-annually. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Docks are not covered
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are planned for this site.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash area are planned for this site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas are planned for this site.

Form 4.1-2 Structural Source Control BMPs

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

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: The developer has chosen to maximize the building and parking footprint. However, the infiltration was oversized to accommodate more pervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: The entire site drains to the infiltration/ detention basin thereby maximizing the natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: The existing drainage pattern, south to north, will be preserved. The flood routing and controlled outlet in the infiltration/ detention Basin will lengthen the time of concentration thus mimicking the existing conditions.
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: The site layout does not allow for roof drains to discharge to previous areas.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement will not be used and is not practical for developments with heavy trucks.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The site has no existing vegetation to protect. Planting of new vegetation will occur throughout the site.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: All landscape areas will be vegetated for stablization using drought tolerant plants and trees.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The soils in the proposed infiltration system area will be uncompacted in-place native material.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: No rock-lined drainage swales are proposed, except for the pipe discharge areas in the basin.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: All landscaped areas will be staked by designation of curb throughout the project site.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: No rain barrels or cisterns are planned for this site.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: There are no streams within or adjacent to the project.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
[1] Project area DA 1 (ft^2): 248,816	[2] Imperviousness after applying preventative site design practices (Imp%): 0.77	[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): 0.361 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.41 *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): 1/12*[248,816* 0.73* 0.41 * 1.963] = 12,182 CF *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] SEE CALCS *Form 4.2-3 Item 12*	[2] N/A *Form 4.2-4 Item 13*	[3] N/A *Form 4.2-5 Item 10*
Post-developed	[4] N/A *Form 4.2-3 Item 13*	[5] N/A *Form 4.2-4 Item 14*	[6] N/A *Form 4.2-5 Item 14*
Difference	[7] *N/A* *Item 4 – Item 1*	[8] *N/A* *Item 2 – Item 5*	[9] *N/A* *Item 6 – Item 3*
Difference (as % of pre-developed)	[10] *N/A%* *Item 7 / Item 1*	[11] *N/A%* *Item 8 / Item 2*	[12] *N/A%* *Item 9 / Item 3*

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

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

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

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

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

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

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): SEE SEPARATE HYD CALCULATIONS IN APPENDIX B
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

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

8 Pre-developed Q_p at T_c for DMA A: N/A *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: N/A *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: N/A *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): N/A *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: N/A *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: N/A *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: N/A *Same as Item 10 for post-developed values*

14 Peak runoff from post-developed condition confluence analysis (cfs): N/A *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): N/A *$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

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

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

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

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that

either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	N/A	N/A	N/A
3 Ratio of pervious area receiving runoff to impervious area	N/A	N/A	N/A
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*	N/A	N/A	N/A
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 $V_{retention}$ *=Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	N/A	N/A	N/A
8 Ponding depth (ft) (min. 0.5 ft.)	N/A	N/A	N/A
9 Surface area of amended soil/gravel (ft^2)	N/A	N/A	N/A
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	N/A	N/A	N/A
11 Average porosity of amended soil/gravel	N/A	N/A	N/A
12 Retention volume achieved from on-lot infiltration (ft^3) $V_{retention}$ *= (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	N/A	N/A	N/A
13 Runoff volume retention from on-lot infiltration (ft^3): 0 $V_{retention}$ *=Sum of Item 12 for all BMPs*			

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

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

4.3.3 Infiltration BMPs

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

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 12,182 *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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	7.6	N/A	N/A
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	N/A	N/A
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	2.53	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	N/A	N/A
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	9	N/A	N/A
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	9	N/A	N/A
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*	5,850	N/A	N/A
9 Amended soil depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity	N/A	N/A	N/A
11 Gravel depth, *d_{media}* (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0.5	N/A	N/A
12 Gravel porosity	0.4	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	N/A	N/A
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	0	N/A	N/A
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	12,396	N/A	N/A

16 Total Retention Volume from LID Infiltration BMPs: 12,396 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 102% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

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

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

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

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

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0, NA *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA 0 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A
2 Amended soil infiltration rate *Typical ~ 5.0*	N/A	N/A	N/A
3 Amended soil infiltration safety factor *Typical ~ 2.0*	N/A	N/A	N/A
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	N/A	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	N/A	N/A	N/A
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	N/A	N/A	N/A
8 Amended soil surface area (ft^2)	N/A	N/A	N/A
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity, *n*	N/A	N/A	N/A
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
12 Gravel porosity, *n*	N/A	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	N/A	N/A	N/A
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	N/A	N/A	N/A
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A	N/A
2 Bottom width (ft)	N/A	N/A	N/A	N/A
3 Bottom length (ft)	N/A	N/A	N/A	N/A
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*	N/A	N/A	N/A	N/A
5 Side slope (ft/ft)	N/A	N/A	N/A	N/A
6 Depth of storage (ft)	N/A	N/A	N/A	N/A
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*	N/A	N/A	N/A	N/A
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*	N/A	N/A	N/A	N/A
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*	N/A		N/A	
10 Outflow rate (cfs) Q_{BMP} = *(Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*	N/A		N/A	
11 Duration of design storm event (hrs)	N/A		N/A	
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*	N/A		N/A	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

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): 12,182 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 12,396 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 0 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 248,816 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☒
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☒

For the 10-year storm event, the total Q allowed to be released for all 3 Buildings is being limited to the existing 10-year storm event Q which is Tributary to Line T.

4.4 Alternative Compliance Plan (if applicable)

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

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Under-ground Infiltrati-on Basin/ Treatment Unit (FDHC)	Owner	- Inspect/maintain underground infiltration systems -Isolator row for collected trash, sediments and/or debris. Remove trash, sediments and debris by jet-vac and pump and dispose of trash, sediemnts and debris in a legal manner -Inspect system for standing water. If system has standing water. If system has standing water, peform re-inspection within 48 hours. If system still has standing water then the system shall be jet-vaccumed and pumped and removed debris shall be disposed of in a legal manner. -Inspect Treatment Unit for sediment, floating trash, and debris	Bi-monthly and prior to storm event and 48 hours after storm has passed
Loading Dock and Parking Lot Sweeping	Owner	Sweep loading dock and parking lot and truck courts.	Monthly / As needed.

Catch Basin Filter	Owner	- Inspect and maintain catch basin filters as required. - Inspect catch basin bottom for debris / remove debris and dispose as required.	Quarterly
Truck Dock	Owner	Inspect loading dock for trash debris and sediments. Inspect loading dock for evidence of spills and broken containers. Clean up spills and dispose of collected material in a legal manner.	Weekly
Planting	Owner	Inspect helth of planting and erosion of landscape area. Trimming trees and bushes when needed.	Monthly
Efficient Irrigation	Owner	- Inspect irrigation system general operation and durations. - Repair damaged sprinkler and drip irrigation lines as needed. - Reduce durations during the winter season to prevent over irrigation.	Monthly
Storm drain system signage	Owner	Inspect Catch basin signage for faded or lost signs / repair or replace as needed.	Annually
Trash Storage Areas and Litter Control (SD-32)	Owner	Inspect trash container, lids, screens and clean trash storage areas..	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

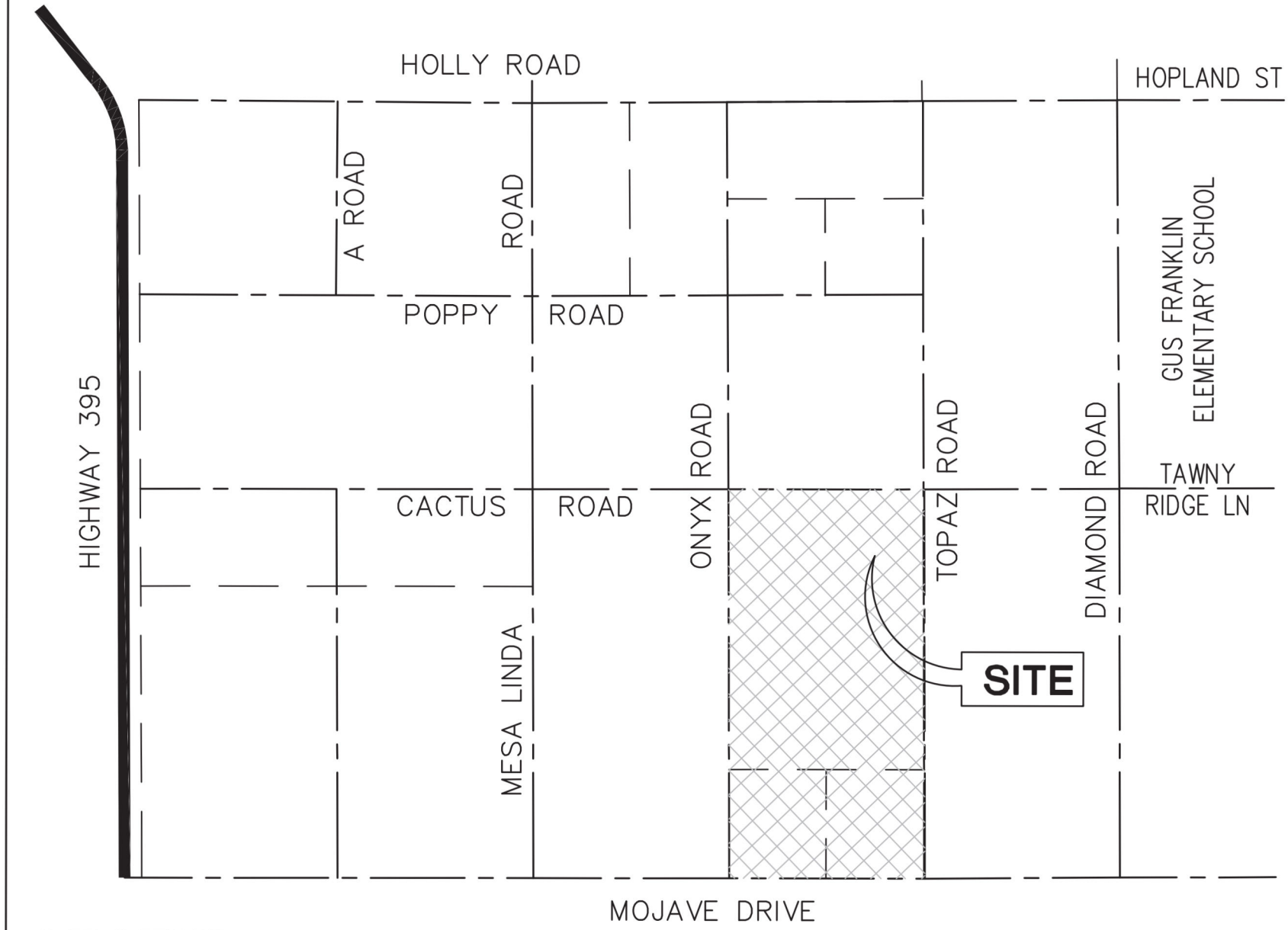
6.3 Post Construction

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

6.4 Other Supporting Documentation

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

Attachment A
WQMP Site Plan



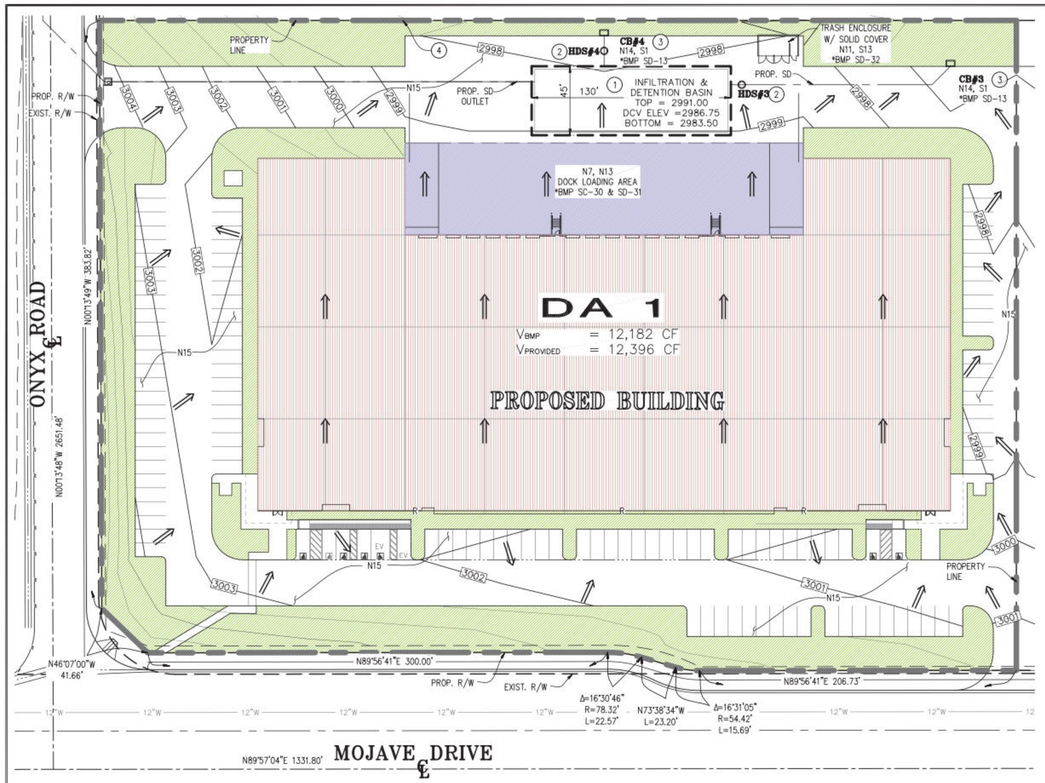
LEGEND

PROJECT LIMITS

VICINITY MAP

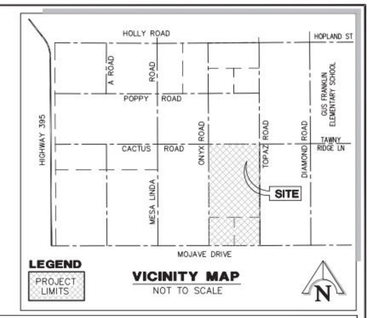
NOT TO SCALE

N



LEGEND

- PROPOSED STORM DRAIN
- WQMP & DA BOUNDARY
- PROPOSED CURB OPENING INLET W/ FILTER INSERT
- CB CATCH BASIN
- R BUILDING RIDGE LINE
- FLOW DIRECTION
- PROPOSED LANDSCAPING AREA – N3, S5, *BMP SD-10 & SD-12
- PROPOSED LOADING DOCK AREA – N7, N13, *BMP SC-30 & SC-31
- PROPOSED ROOF AREA
- PROPOSED IMPERVIOUS (PARKING, DRIVE LANE, SIDEWALKS, RAMPS)



BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

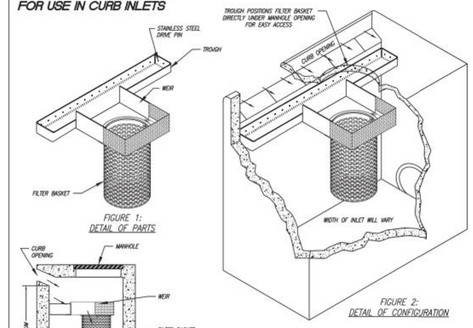


FIGURE 1: DETAIL OF PARTS

FIGURE 2: DETAIL OF CONFIGURATION

FIGURE 4: DETAIL OF PROFILE

FIGURE 3: DETAIL OF MOUNTING

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS
TREATMENT FLOW RATE: 2.85 cfs
WARRANTY: 1 YEAR MANUFACTURER'S

MEETS FULL CAPTURE REQUIREMENTS
MODEL #: BIO-CURB-FULL

BIO CLEAN ENVIRONMENTAL SERVICES, INC.
398 VIA EL CENTRO, OCEANSIDE CA 92058
PHONE: 760-433-7640 FAX: 760-433-3178

DATE: 10/12/2017 SCALE: NTS
DRAWTER: M.C.P. UNITS = INCHES

PROJECT:
REVISIONS DATE:
REVISIONS DATE:
REVISIONS DATE:
REVISIONS DATE:

NOTES:
1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 1008 STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
Page 1

CURB INLET SYSTEM

(3) NOT TO SCALE

WQMP BMP NOTES

** (1) INSTALL CONTECH 96" CMP INFILTRATION/RETENTION SYSTEM OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION

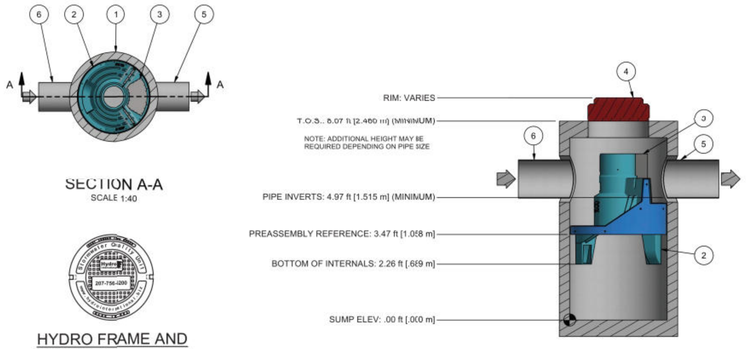
** (2) INSTALL ADS HDS UNIT OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION

(3) INSTALL BIOCLEAN CURB INLET FILTER, SEE DETAIL HEREON

(4) INSTALL SILT FENCE PER CASQA BMP EC SE-1 (OR APPROVED EQUAL)

** DETAIL TO BE PROVIDED IN FINAL

NAME	TOTAL AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	I	C	V_{BMP} (CF)	BMP	$V_{PROVIDED}$ (CF) (RETENTION)	V_{TOTAL} (CF) (DETENTION)
DA 1	248,816	192,650	56,166	0.77	0.73	12,182	INFILTRATION BASIN/ DETENTION BASIN	12,396	36,803



SECTION A-A
SCALE 1:40

HYDRO FRAME AND COVER (INCLUDED)
GRADE RINGS BY OTHERS AS REQUIRED

SECTION A-A
SCALE 1:30

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.
2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.
3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
3. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1			5mm TRASH SCREEN (PRE-INSTALLED)
4	1	30	750	FRAME AND COVER (ROUND)
5	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
6	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

PROJECTION

IF IN DOUBT ASK

DATE: 12/13/2021 SCALE: 1:40
DRAWN BY: EHR CHECKED BY: APPROVED BY:
TITLE: 4-ft DIAMETER FDHC FULL TRASH CAPTURE
GENERAL ARRANGEMENT

Hydro International
hydro-int.com
©2020 HYDRO INTERNATIONAL
WEIGHT: MATERIAL: Stainless Steel
STOCK NUMBER:
DRAWING NO.: FDHC-FTC
SHEET SIZE: B SHEET: 1 OF 1 REV: -

HDS #3 AND #4

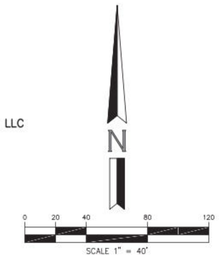
(2) NOT TO SCALE

OWNER/DEVELOPER

MOJAVE 80 GRAY, LLC
C/O COVINGTON DEVELOPMENT PARTNERS, LLC
3 CORPORATE PLAZA, SUITE 230
NEWPORT BEACH, CA 92660
OFFICE: 949-514-0274
CONTACT: DANA WHITMER

ENGINEER

HUITT-ZOLLARS
3990 CONCOURS, SUITE 330
ONTARIO, CALIFORNIA 91764
PHONE: (909) 941-7799
CONTACT: JOHNNY MURAD



SOURCE CONTROL BMPs INCLUDED ONSITE		
IDENTIFIER	DESCRIPTION OF BMP	RESPONSIBLE PARTY
N3	LANDSCAPE MAINTENANCE BMP'S	OWNER
N7	PROVIDE SPILL PLAN	OWNER
N11	LITTER/DEBRIS CONTROL PROGRAM	OWNER
N13	HOUSEKEEPING OF LOADING DOCKS	OWNER
N14	CATCH BASIN INSPECTION PROGRAM	OWNER
N15	VACUUM SWEEPING OF PARKING LOTS	OWNER
N17	NPDES COMPLIANCE	OWNER
S1	STORM DRAIN STENCILING	OWNER
S3	REDUCED WASTE STORAGE POLLUTION	OWNER
S4	EFFICIENT IRRIGATION SYSTEM	OWNER
S5	LANDSCAPING MIN. 1-2" BELOW CURB	OWNER

*SEE WQMP REPORT ATTACHMENT C FOR BMP FACT SHEET

CITY CASE NO. (to be assigned at plan submittal)

BASIS OF BEARINGS:
BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN SOPAC STATION P581 AND SOPAC STATION AVRY BEING N85°20'40"W

BENCH MARK
V-215
NAVD29, ELEVATION=2998.27'
MOJAVE DR. @ TOPAZ RD., TC OF CENTER ISLAND NOSE 48' E/O INT.

BY	MARK	DESCRIPTION	APPR.	DATE
ENGINEER		REVISIONS	CITY	

DESIGNED BY: M.M.
DRAWN BY: H-Z STAFF
CHECKED BY: J.M.
SCALE: AS SHOWN

CITY OF VICTORVILLE
ENGINEERING DEPARTMENT
14343 Civic Drive, Victorville, CA 92392 (760) 955-5000
Approved By:
Brian W. Gengler, RCE C44730
City Engineer
DATE

REGISTERED PROFESSIONAL ENGINEER JOHNNY MURAD NO. 67512 EXPIRATION 6-30-2025 CIVIL STATE OF CALIFORNIA

PREPARED BY:
REGISTERED CIVIL ENGINEER NO. 67512
EXPIRATION: 6-30-2025
DATE

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS * SUITE 330 * ONTARIO, CALIFORNIA 91764
PHONE (909) 941-7799 * FAX (909) 941-7789

CITY OF VICTORVILLE
MOJAVE INDUSTRIAL PARK
WQMP MAP - PRELIMINARY CONDITION
BUILDING 2

SHEET 1 OF 1 SHEETS

FOR COVINGTON GROUP | M.O. | CITY FILE NO. .

Plotted: May 15, 2023 13:30:05 | By: Layout | Saved: 5/15/2023 1:30:05 PM | Path: C:\Users\Layout\Desktop\Projects\Covington\Victorville\Mojave Industrial Park\Bldg 2\Exhibits\WQMP\WQMP Exhibit.dwg

Attachment B
BMP Details & Support Calc's

PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 522 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = 36,546 CF
- PIPE STORAGE VOLUME = 26,239 CF
- BACKFILL STORAGE VOLUME = 10,565 CF
- TOTAL STORAGE PROVIDED = 36,803 CF

PIPE DETAILS
- DIAMETER = 96"
- CORRUGATION = 5x1
- GAGE = 16
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 24"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 24"
- 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 $2\frac{2}{3}$" x $1\frac{1}{2}$" 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'

C:\EXPORTS\TEMPLATES\CMP_V8.DWG 10/18/2019 10:02 AM

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If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered 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.

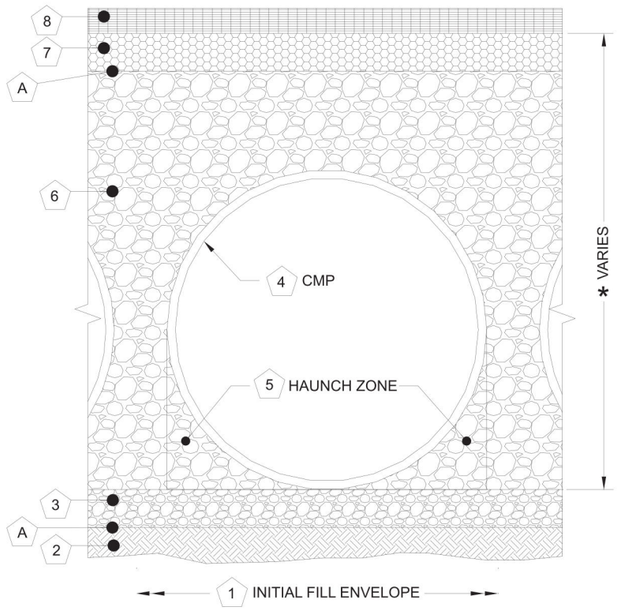
DATE	REVISION DESCRIPTION	BY

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

CONTECH® CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYO30948 Covington - Mojave Industrial Park
Building 2
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30948	4/28/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



	Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
	Material Location	Description	Material Designation	Designation
8	Rigid or Flexible Pavement (if applicable)			
7	Road Base (if applicable			
A	Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6	Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3	Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A	Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of Infiltration systems due to the propensity for geotextiles to clog over time.
*	Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 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 BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

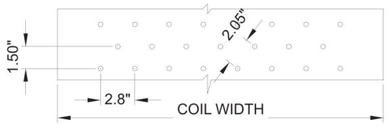
5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL
MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

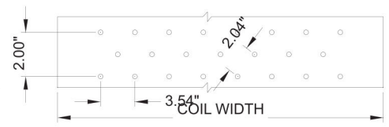
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2"
CORRUGATION - STEEL AND ALUMINUM CMP
EDGE SPACING EQUAL ON BOTH SIDES



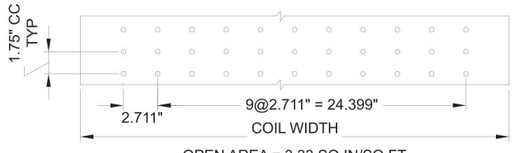
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION - STEEL AND ALUMINUM CMP
(COIL PROVIDED FROM CONTECH LANTANA, FL PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY
EDGE SPACING EQUAL ON BOTH SIDES



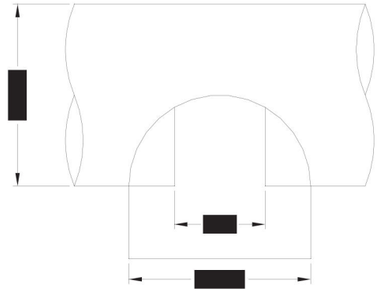
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

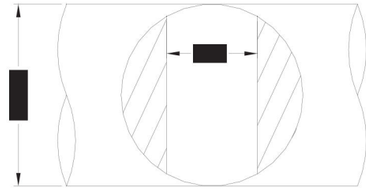
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ⌀3/8".

TYPICAL PERFORATION DETAIL

SCALE: N.T.S.



PLAN

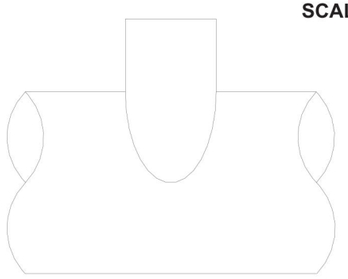


FRONT

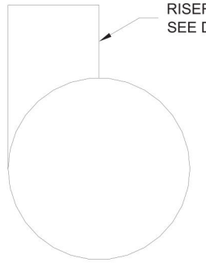
TYPICAL MANWAY DETAIL

SCALE: N.T.S.

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.



ELEVATION

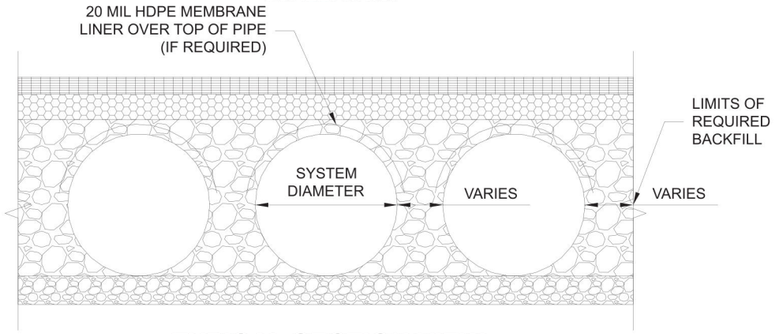


END

TYPICAL RISER DETAIL

SCALE: N.T.S.

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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CONTECH® CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO30948 Covington - Mojave Industrial Park
Building 2
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30948	4/28/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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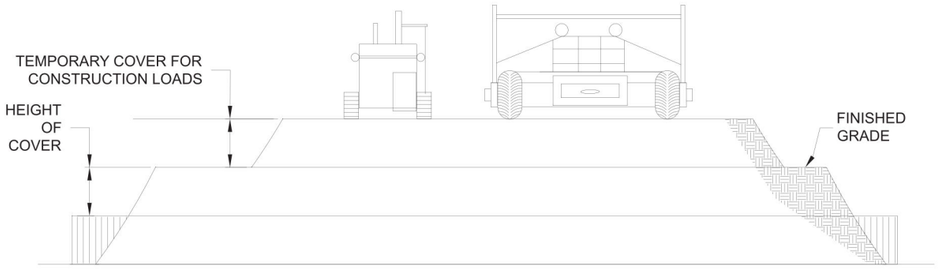


CONSTRUCTION LOADS

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.

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

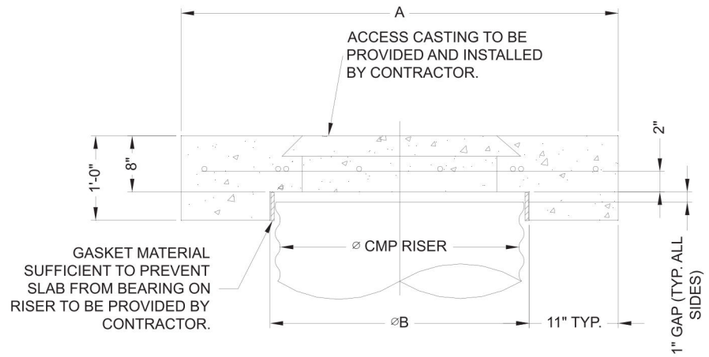
ALUMINUM: AASHTO M-196 OR ASTM B-745

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.

APPLICABLE 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.

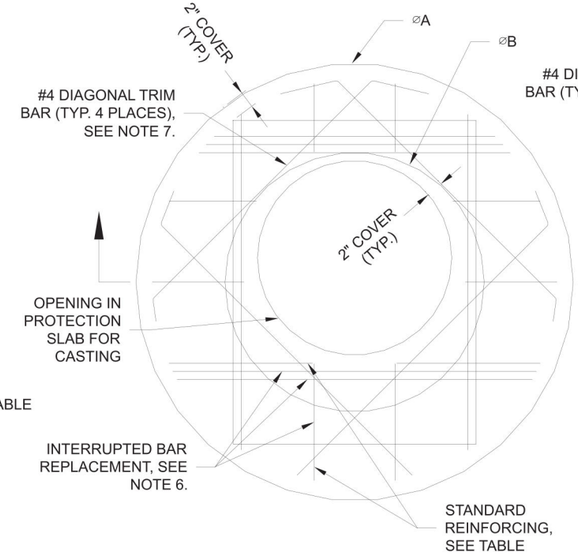
NOTE:
THESE DRAWINGS ARE FOR CONCEPTUAL PURPOSES AND DO NOT REFLECT ANY LOCAL PREFERENCES OR REGULATIONS. PLEASE CONTACT YOUR LOCAL CONTECH REP FOR MODIFICATIONS.



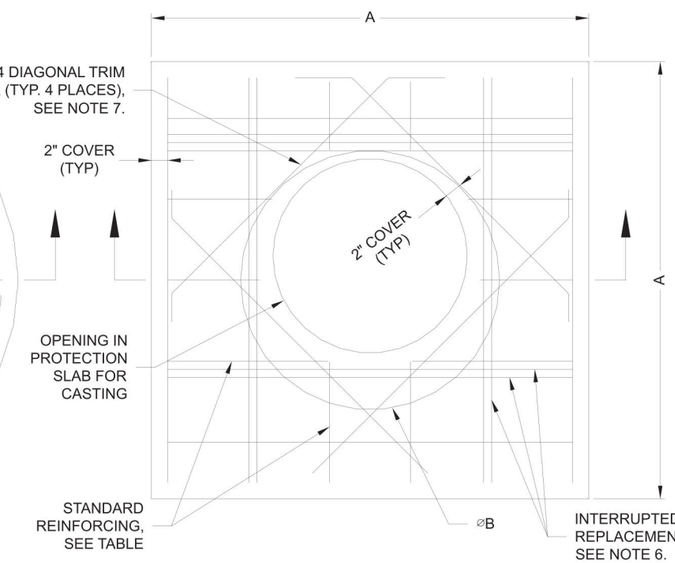
SECTION VIEW

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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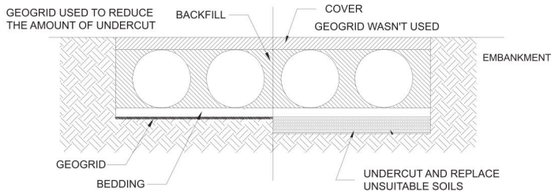
CMP DETENTION INSTALLATION GUIDE

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.

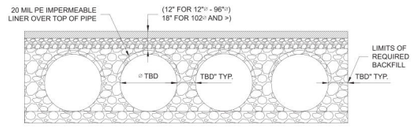


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING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

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

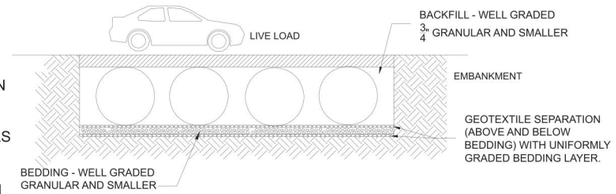
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

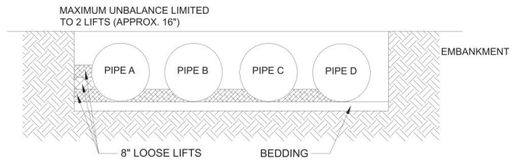
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION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



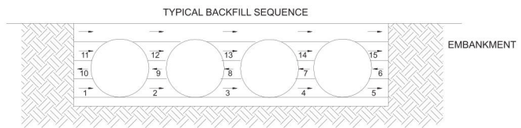
BACKFILL PLACEMENT

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

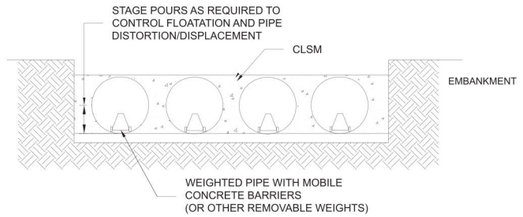


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE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

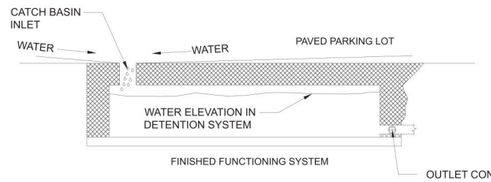


CONSTRUCTION LOADING

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

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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

DYO30948 Covington - Mojave Industrial Park
Building 2
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30948	4/28/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 2
Location: HDS#3

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 1.7 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 0.28 $\frac{ft^3}{s}$	***(12)***

Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 2
Location: HDS #4

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 4.0 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 0.66 $\frac{ft^3}{s}$	***(12)***

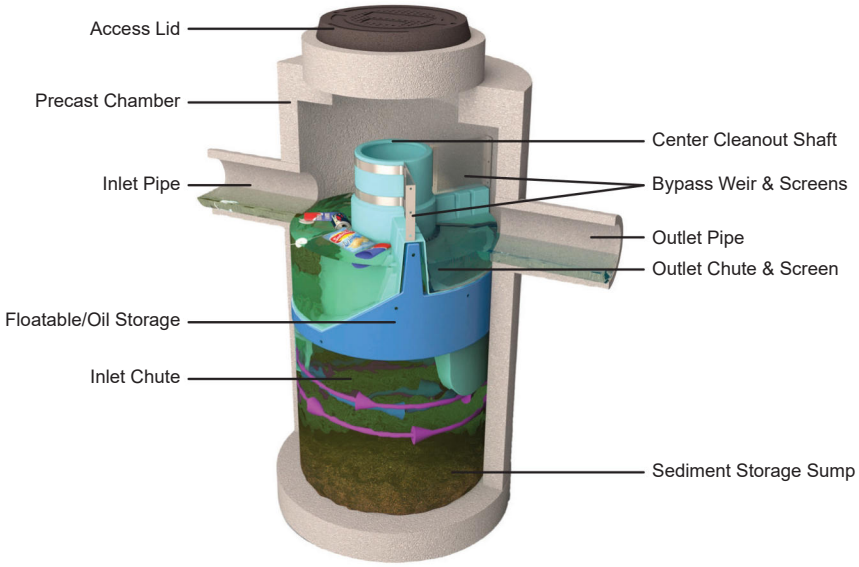
First Defense® FTC

Full Trash Capture Hydrodynamic Separator

Product Summary

First Defense Full Trash Capture (FTC) is an advanced hydrodynamic separator that combines enhanced vortex technology for total suspended solids (TSS) removal with a 5mm screen to meet full trash capture requirements set by the California Water Boards.*

Features



*One-hour, one-year design storm.

Applications

- Removal of Total Suspended Solids (TSS), floatable trash, and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pre-treatment for green infrastructure and ponds
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- LEED® development projects
- Retrofitting existing systems

How It Works

1. Stormwater enters the Inlet Chute, where water is directed downwards and into a rotational motion around the Sediment Storage Sump.
2. Free floating trash is retained in the Inlet Chute area. Sediment and other settleable solids are retained in the Sediment Storage Sump as water follows a rotational path to the screened Outlet Chute.
3. Water then exits upward in the Outlet Chute where a horizontal screen prevents the loss of any suspended debris larger than 5mm. High flows can bypass directly to the outlet via the Bypass Weirs.
4. Two Bypass Screens continue to treat and retain the free floating debris. In extreme events water can crest the bypass screen and go directly to the outlet to prevent upstream flooding.

Model Number	Diameter	Maximum Pipe Diameter[1]	Trash Storage Capacity[2]	Flow Rate (cfs) for Screen Blinding Percentage[3]				Bypass Capacity	Typical TSS Treatment Rates
Model	(ft / m)	(in / mm)	(yd^3 / m^3)	0%	25%	50%	75%	(cfs)	(cfs / L/s)
FD-4 FTC	4 / 1.2	24 / 600	0.83 / 0.63	7.94	7.10	5.27	3.43	18	1.88 / 53.2
FD-5 FTC	5 / 1.5	24 / 600	1.54 / 1.18	13.02	10.51	7.87	6.07	20	2.94 / 83.2
FD-6 FTC	6 / 1.8	30 / 750	2.22 / 1.70	25.60	21.50	16.01	10.66	32	4.23 / 119.8
FD-8 FTC	8 / 2.4	48 / 1219	5.28 / 4.00	34.16	33.75	26.29	16.88	50	7.52 / 212.9

[1]*Contact Hydro International when larger pipe sizes are required.*
[2]*Trash storage volume estimated as half the chamber volume from the base of the Inlet Chute to top of Bypass Weirs (not bypass screens). Actual volume of material stored will vary with size, density, and type. Larger volumes of trash may be retained.*
[3]*Calculated using HydroCAD modelling. A lower blinding factor can be applied to sites with lower anticipated loads.*

HDS #3 & #4

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200
Email: stormwaterinquiry@hydro-int.com
Web: www.hydro-int.com/firstdefense

FD-FTC_SS_E_2110

Download Drawings:

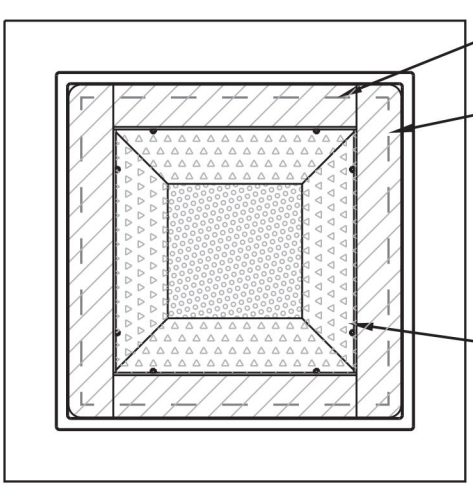
→ hydro-int.com/fddrawings

Operation & Maintenance Manual:

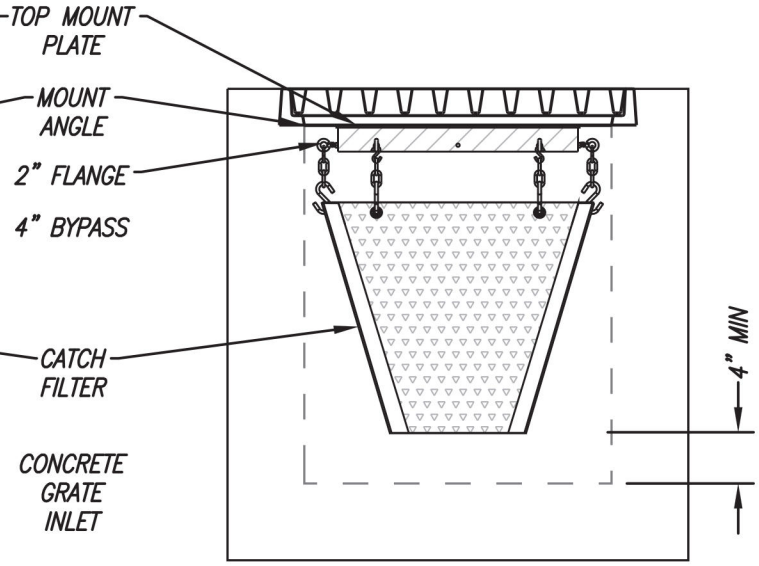
→ hydro-int.com/fd-om

BIO CLEAN FULL CAPTURE FILTER

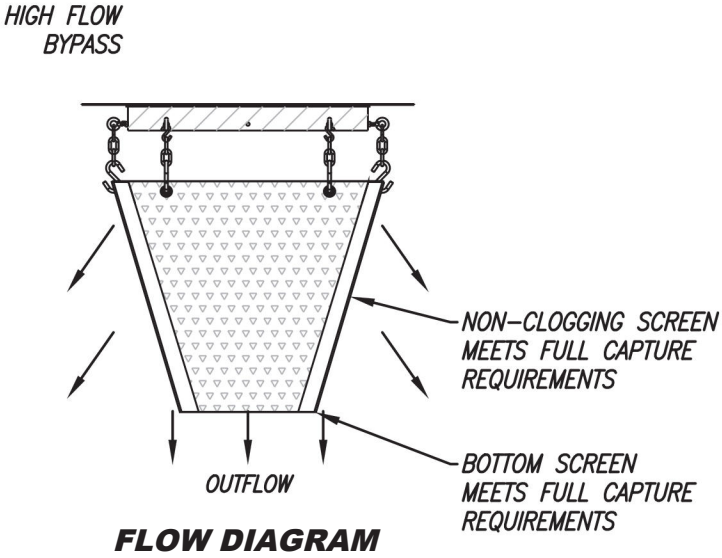
FOR USE IN GRATE INLETS



PLAN VIEW
(GRATE NOT SHOWN)



ELEVATION VIEW



FLOW DIAGRAM

MODEL #	TREATMENT FLOW RATE (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.04	1.24	0.15
BIO-GRATE-FULL 18-18-12	1.78	2.79	0.33
BIO-GRATE-FULL 24-24-12	2.70	4.96	0.59
BIO-GRATE-FULL 24-40-12	3.70	6.35	0.88
BIO-GRATE-FULL 24-24-24	7.31	4.96	1.22
BIO-GRATE-FULL 24-40-24	9.53	6.35	1.82
BIO-GRATE-FULL 36-36-24	11.93	7.74	2.73

INSTALLATION NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL.
2. OPTIONAL HYDROCARBON BOOM SHALL BE 2" DIAMETER.
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

NOT TO SCALE

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GRATE INLET FILTER
FULL CAPTURE
STANDARD DETAIL

9/23/22CSCHIPPER

BIO CLEAN FULL CAPTURE FILTER WITH TROUGH SYSTEM

FOR USE IN CURB INLETS

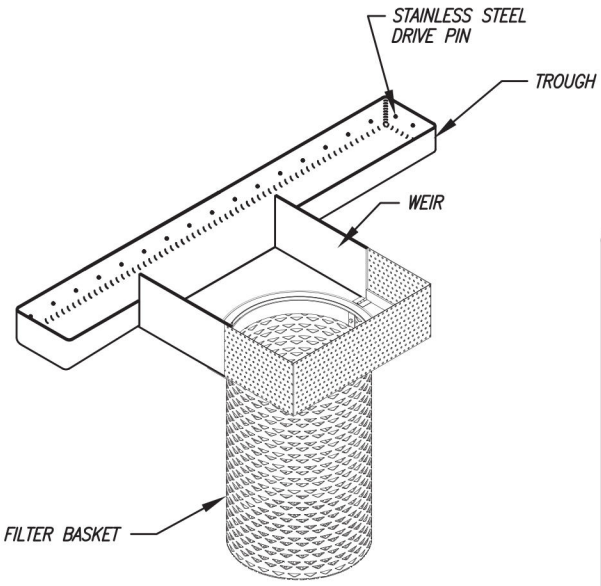

FIGURE 1:
DETAIL OF PARTS

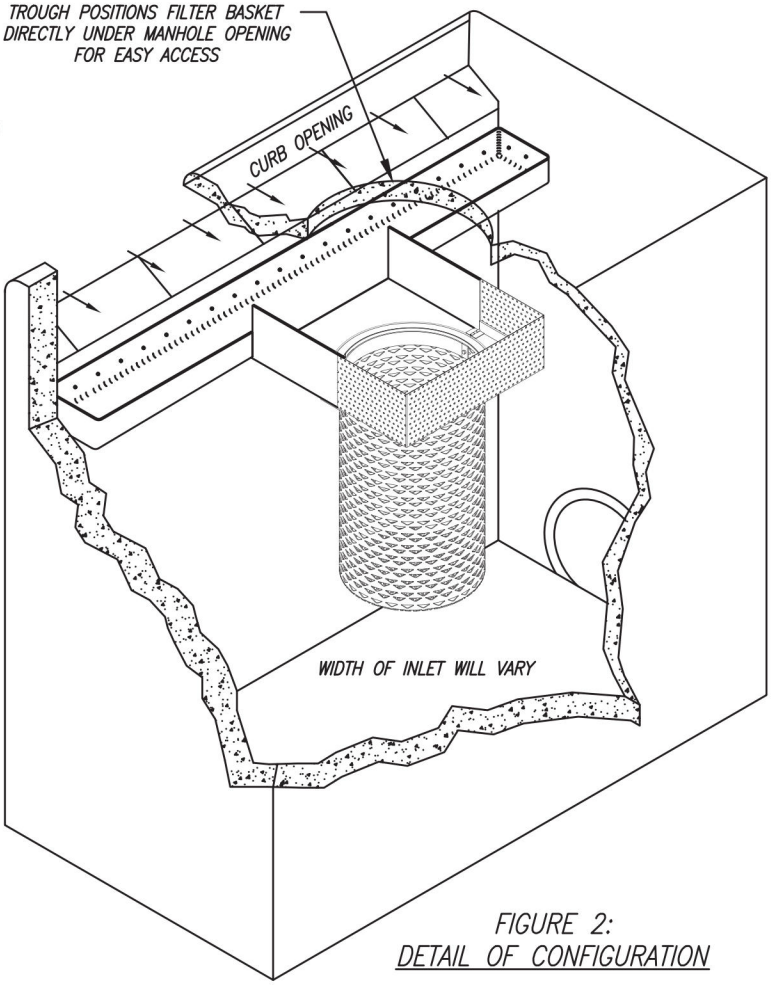

FIGURE 2:
DETAIL OF CONFIGURATION

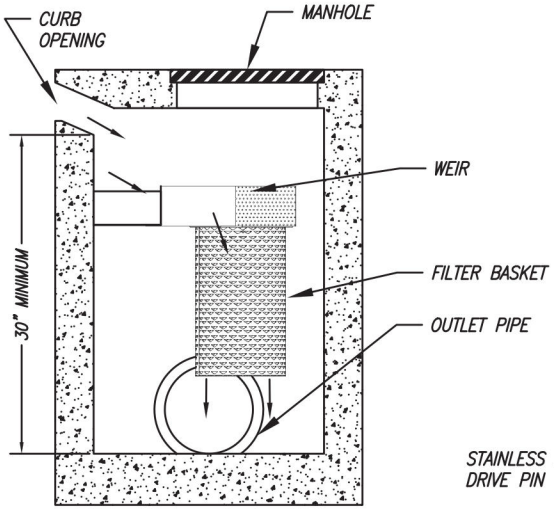

FIGURE 4:
DETAIL OF PROFILE

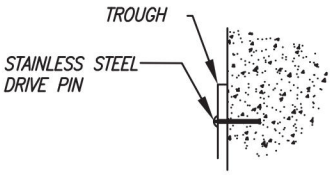

FIGURE 3:
DETAIL OF MOUNTING

NOTES:

1. TROUGH SYSTEM PROVIDES FOR ENTIRE COVERAGE OF INLET OPENING SO TO DIVERT ALL FLOW TO FILTER.
2. TROUGH SYSTEM MANUFACTURED FROM MARINE GRADE FIBERGLASS, GEL COATED FOR UV PROTECTION.
3. SYSTEM ATTACHED TO THE CATCH BASIN WITH NON-CORROSIVE HARDWARE.
4. FILTER MANUFACTURED OF 100% STAINLESS STEEL.
5. FILTER MADE OF NON-CLOGGIN SCREEN WITH 4.7 MM OPENINGS AND MEETS FULL CAPTURE REQUIREMENTS.
6. FILTER CAN BE FITTED WITH HYDROCARBON ABSORBENT BOOM
7. FILTER IS LOCATED DIRECTLY UNDER THE MANHOLE FOR EASY REMOVAL AND MAINTENANCE.
8. LENGTH OF TROUGH CAN VARY FROM 2' TO 30'
9. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE - CONTACT BIO CLEAN FOR MORE INFORMATION.
10. CONSIDERS A SAFETY FACTOR OF 2.0
11. BYPASS IS FACILITATED VIA OVERFLOW OF THE TROUGH SYSTEM AND IS EQUAL TO THE CAPACITY OF THE CURB OPENING
12. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
13. ADDITIONAL TREATMENT AND STORAGE CAPACITY CAN BE ACHIEVED BY UTILIZING MULTIPLE FILTER BASKETS.

MODEL NUMBER	TREATMENT FLOW (cfs)*	SOLIDS STORAGE CAPACITY (cu ft)
BIO-CURB-FULL-24	2.85	1.40
BIO-CURB-FULL-12	2.85	0.70

*SEE PAGE 2 FOR EXPLANATION OF FLOW RATES

DRAWING: BIO CLEAN CURB INLET FILTER DETAILS		MEETS FULL CAPTURE REQUIREMENTS	
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BIO-CURB-FULL	
WARRANTY: 1 YEAR MANUFACTURER'S		PROJECT:	
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:
		REVISIONS:	DATE:
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:

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MODEL # BIO-CURB-FULL FILTER

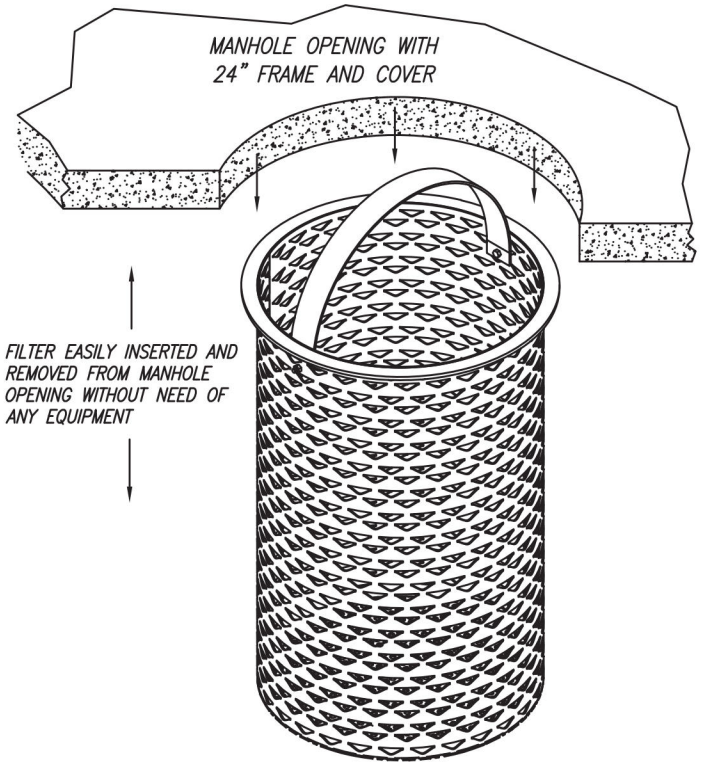

FIGURE 1:
DETAIL OF INSTALLATION

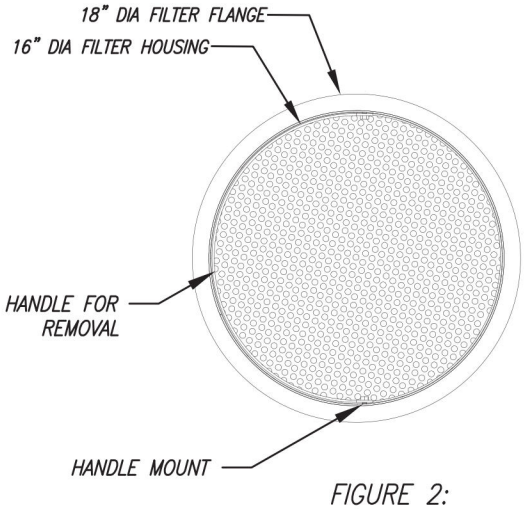

FIGURE 2:
DETAIL OF DIAMETERS

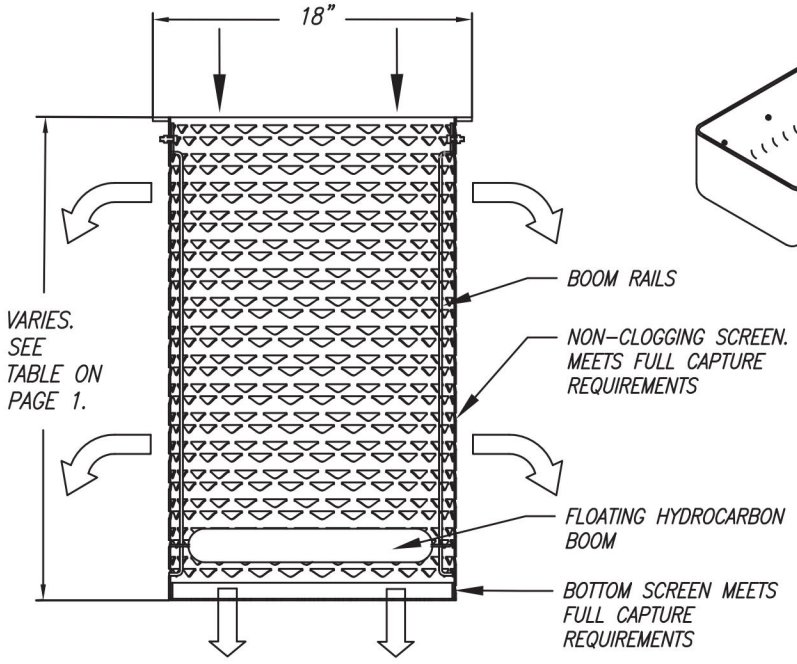

FIGURE 3:
DETAIL OF PARTS

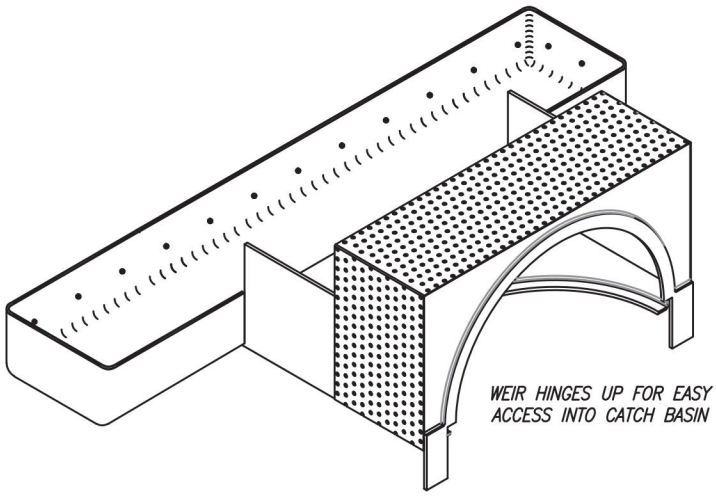

FIGURE 4:
DETAIL OF WEIR

FLOW RATES – CURB FILTER		
TREATMENT FLOW RATE	2.85 cfs	SAFETY FACTOR OF 2X
*TREATMENT FLOW RATE IS BASED ON THE CRITICAL POINT OF RESTRICTION, WHICH IS EITHER THE WEIR OR THE SCREEN CAPACITIES.		WEIR CAPACITY=2.85 CFS SCREEN CAPACITY=4.82 CFS
**FLOW RATES CALCULATED USING THE FOLLOWING EQUATION $Q=SO*c_d*A\sqrt{2*g*h}$		c_d = COEFFICIENT of DISCHARGE = .62

DRAWING: BIO-CURB-FULL FILTER		MEETS FULL CAPTURE REQUIREMENTS		SEE PAGE 1 FOR NOTES
TREATMENT FLOW RATE: 2.85 cfs		MODEL #: BIO-CURB-FULL		
WARRANTY: 1 YEAR MANUFACTURER'S		PROJECT:		
BIO CLEAN ENVIRONMENTAL SERVICES, INC. 398 VIA EL CENTRO, OCEANSIDE CA 92058 PHONE: 760-433-7640 FAX: 760-433-3176		REVISIONS:	DATE:	
		REVISIONS:	DATE:	
DATE: 10/12/2017	SCALE: NTS	REVISIONS:	DATE:	
DRAFTER: M.C.P.	UNITS = INCHES	REVISIONS:	DATE:	PAGE 2

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Attachment C
Educational Materials

Outdoor Loading/Unloading SC-30

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

CASQA California Stormwater Quality Association

Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/unloading area to a drain that is connected to a deadend.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

CASQA California Stormwater Quality Association

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

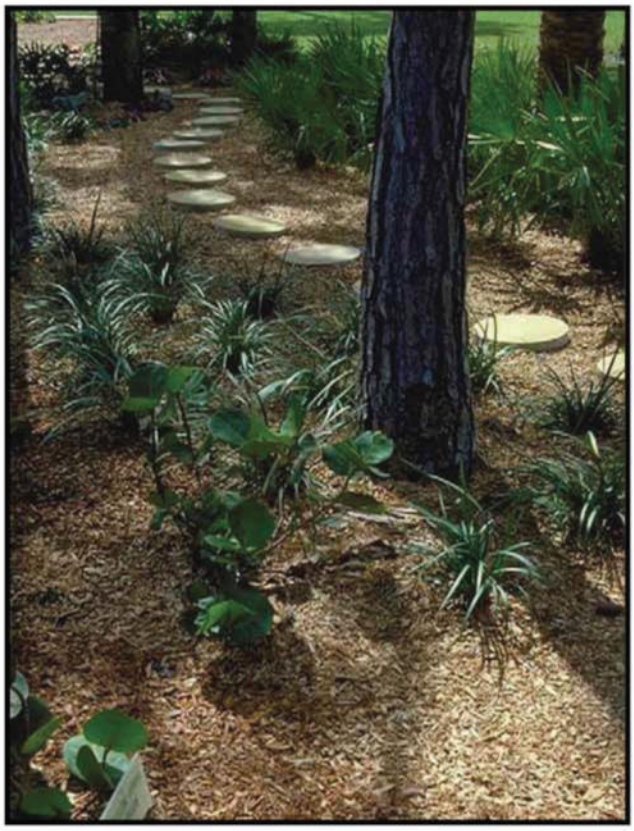
Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

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.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

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

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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

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– 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.

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be 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.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Design Objectives

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

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

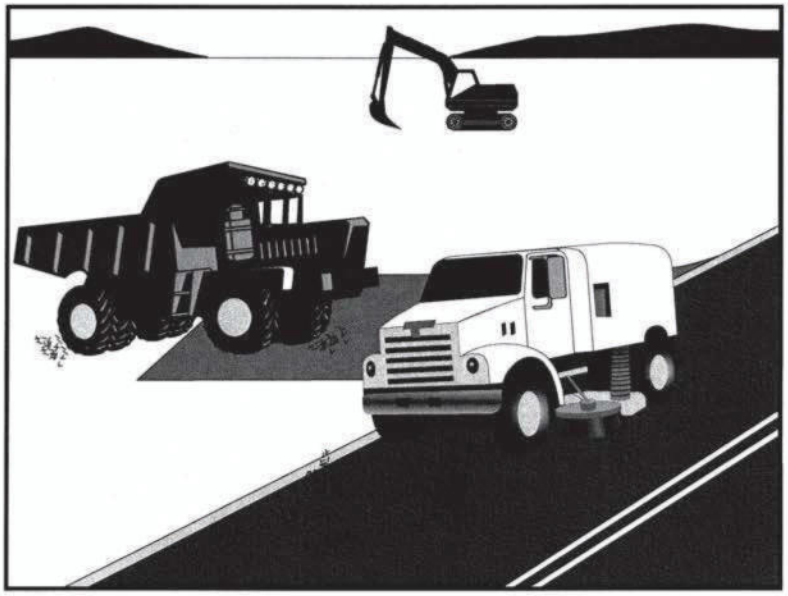
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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

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

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

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

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- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

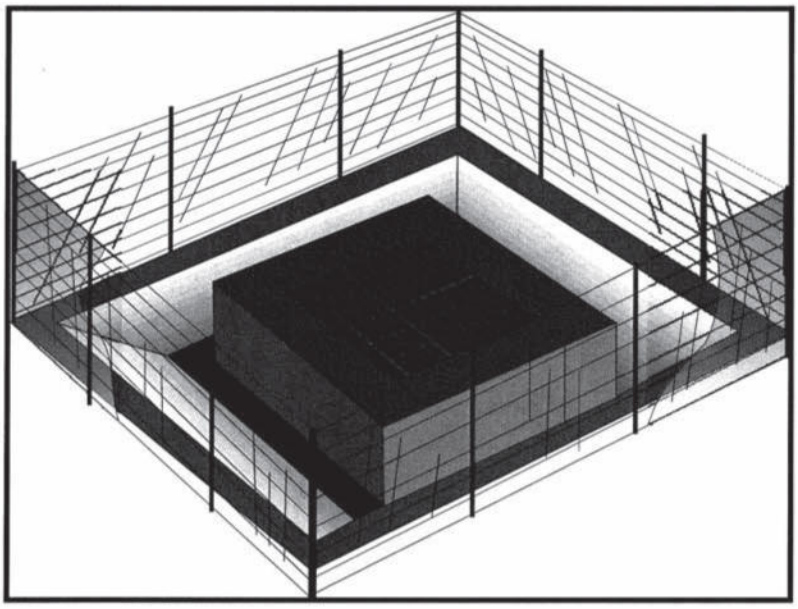
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.

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- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other onsite sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Six types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
  - Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag*** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.
  2. Leave room upstream of barrier for water to pond and sediment to settle.
  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.
  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.

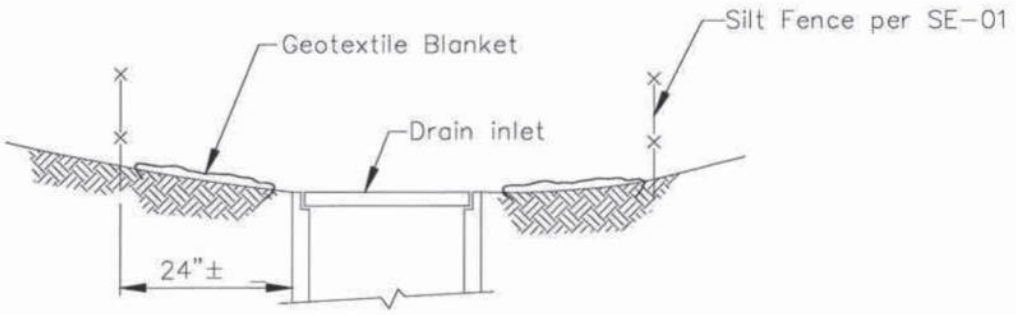
- Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

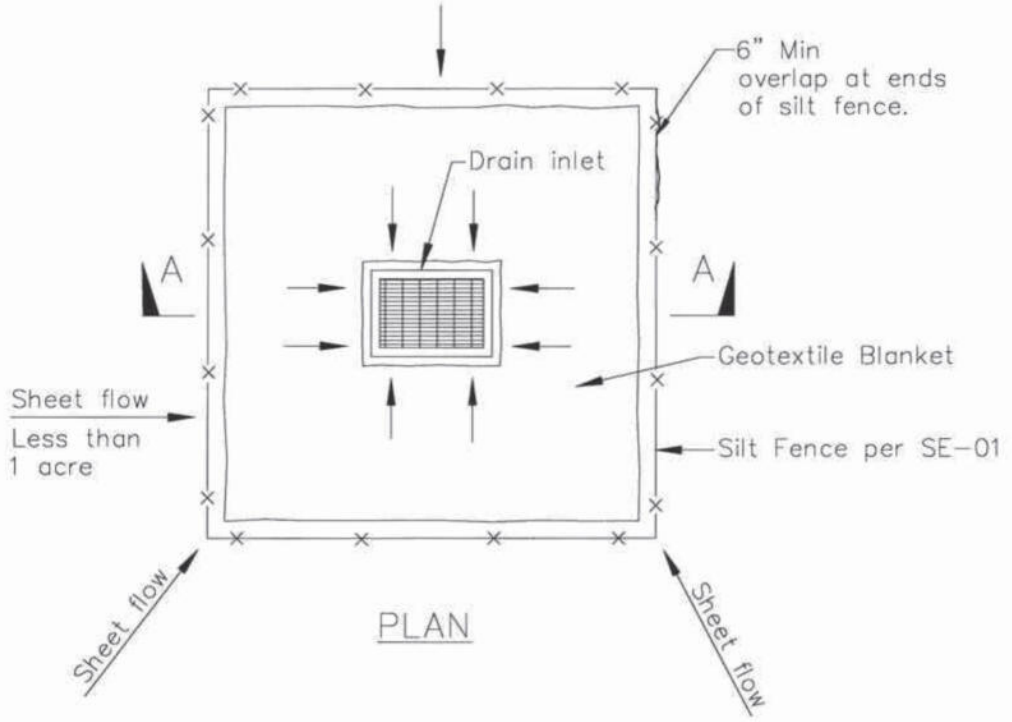
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

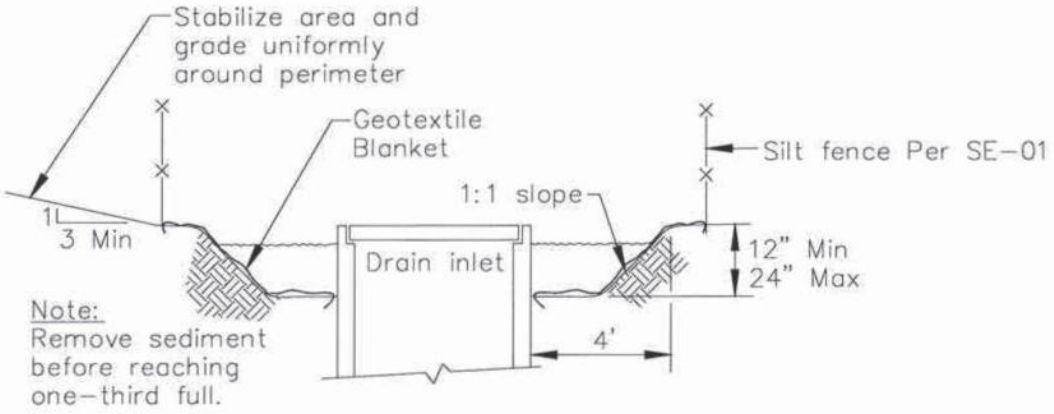


PLAN

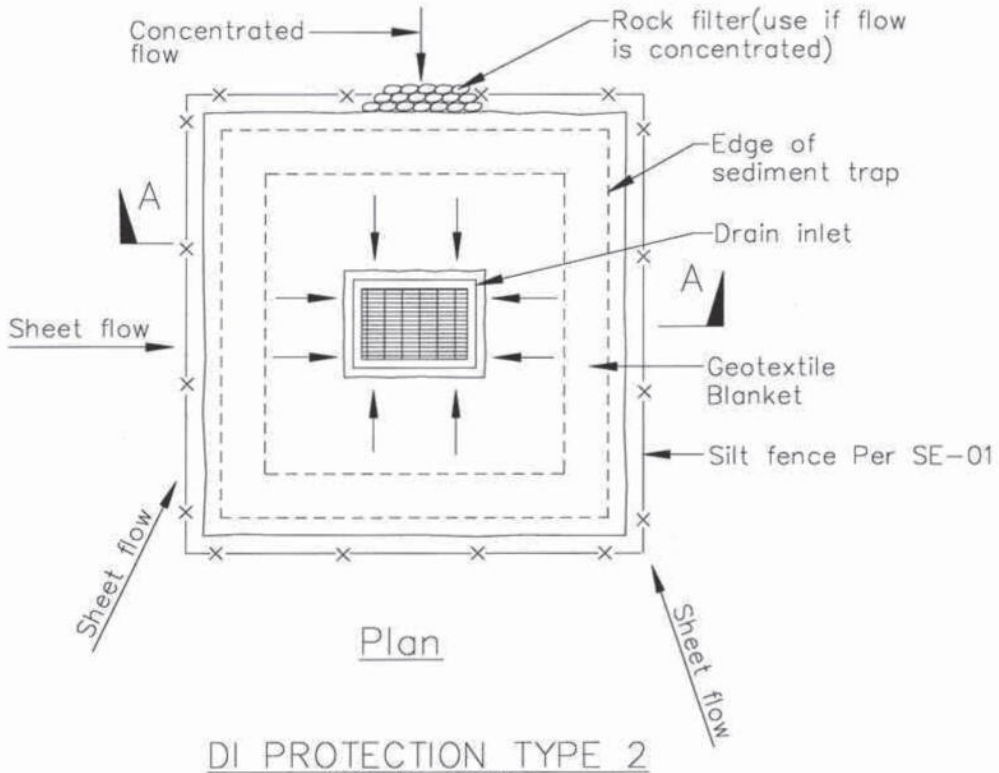
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



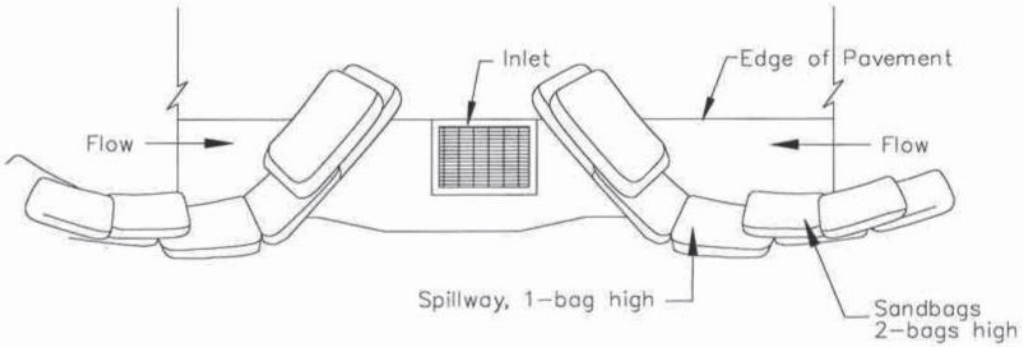
Section A-A



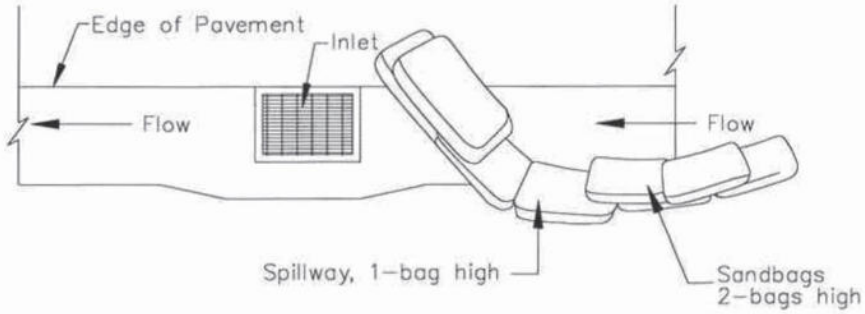
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

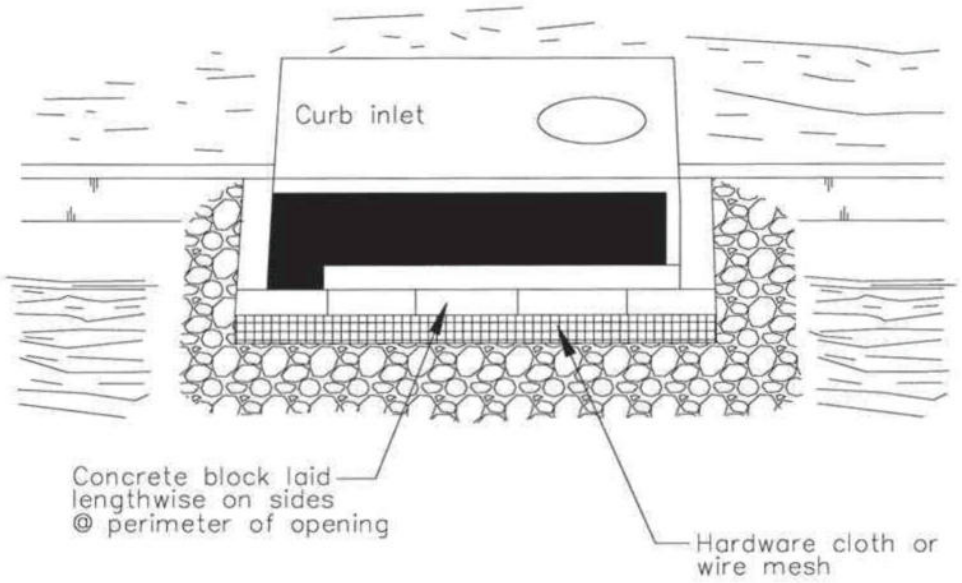


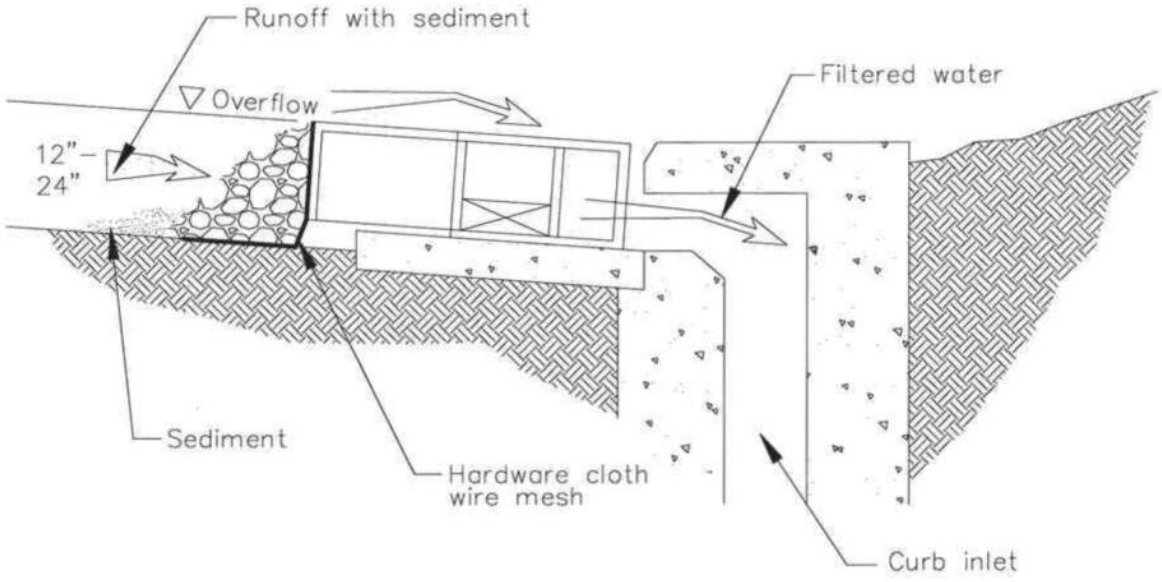
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4
NOT TO SCALE

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

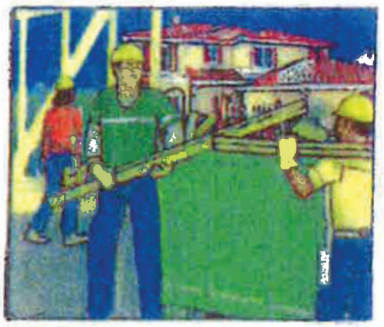
STORMWATER Pollution Prevention

CONSTRUCTION

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.

Store Materials Safely

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



Ordering Materials & Recycling Waste

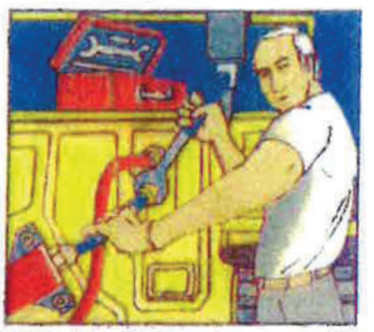
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling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

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

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

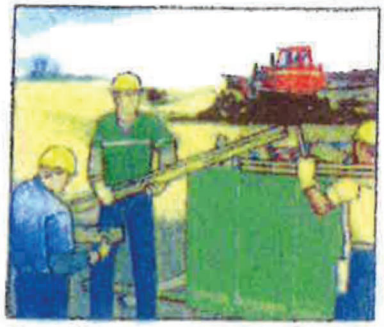
1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

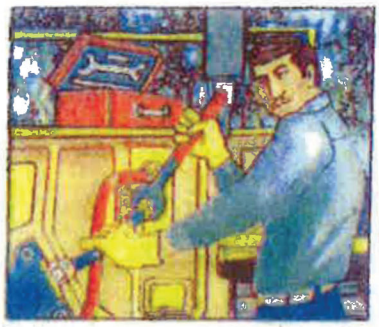
EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading 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.



Recycling Waste

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.

Storing Materials

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

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

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.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

ROADWORK AND PAVING

Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal 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.

Preventing Erosion

Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

During Construction

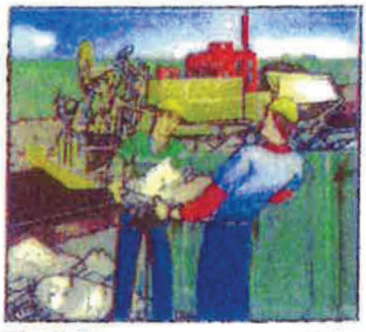
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.

Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal

Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills

Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.

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

1 (800) CLEANUP

www.1800cleanup.org

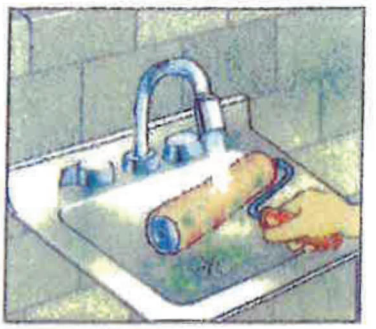
STORMWATER Pollution Prevention

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

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.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

FOOD AND RESTAURANT

Food waste, grease, cleaning fluids, mop water and trash from restaurant operations 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.

Recycle Oil & Grease

Oil and grease wastes can be recycled. Look in the yellow pages for rendering companies, or call (909) 386-8401 for disposal information. Don't pour oil or grease into sinks, floor drains or onto a parking lot or street. Keep grease bins covered and contained. Keep your grease interceptor maintained to prevent sewer overflows or backups and keep records of grease waste hauling.

Dumpster Areas

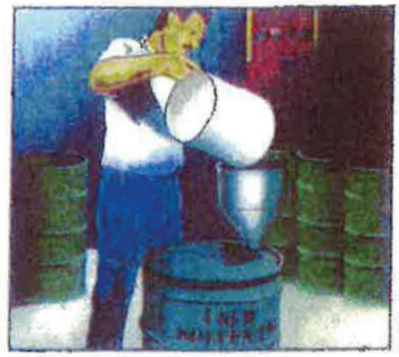
Keep dumpster lids closed and the areas around them clean. Do not fill with liquid waste or hose them out. Call your trash hauler to replace any dumpsters that are damaged or leak.

Cleaning & Maintenance

Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to the sewer through a grease trap. Don't wash them or pour wash water in a parking lot, alley, sidewalk or street. Sweep outside areas and put the debris in the garbage, instead of sweeping or hosing it into the parking lot or street.

Managing Spills

Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping, and discharge mop water into the sewer through a grease interceptor. Have spill containment and cleanup kits available. To report serious toxic spills, call 911.



Handling Toxic Chemicals

Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash. For information on hazardous waste pickup, call (909) 386-8401. Use non-toxic cleaning products whenever possible.

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

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

RESTAURANTES

Desechos de comida, grasa, liquidos de limpieza, agua del trapiador y basura de un restaurant acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el rio de Santa Ana. Para prevenir esta contaminación y protejar la salud publica, siga estas practicas.

Reciclando Aceite & Grasa

El aceite y la grasa se pueden reciclar. Busca en las paginas amarillas compañias de reciclaje o llama al (909) 386-8401 para información. No los tires en los lavaderos, las coladeras, el estacionamiento o en la calle. Manten los recipientes de grasa cubiertos y guardados.

Areas de Basura

Manten el bote de basura cerrada y el área del basurero limpia. No lo llenes con desechos liquidos ni utilices la manguera para lavarlo. Llama al transportador de basura para reemplasar los botes de basura que esten dañados.

Controlando Derrames

Usa métodos secos para limpiar los derrames, barriendo y usando tierra para desechos de gato, no uses la manguera para limpiar los derrames. Manten un kit de limpieza de derramamientos en tu negocio. Para reportar derrames llama al 911.

Limpiando & Mantenimiento

Limpia los tapetes de piso, los filtros y los botes de basura en el contenedor para trapeadores, lavavo, o en la coladera aprupiado que llegue al drenaje. No los laves en el estacionamiento, los callejones, en la banqueta o en la calle. Barre el area de afuera y pon todo en la basura, en ves de dejarlo en la banqueta o en la calle.

Manejando Quimicos Toxicos

Deposita los desechos toxicos como limpiadores, solventes, detergentes a un bote para toxicos. Estos no son basura. Para mas información sobre desechos peligrosos, llama al (909) 386-8401. Usa productos de limpieza que no sean toxicos.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

Asfalto, mezcle y materiales de excavaciones del pavimento acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigua estas practicas para prevenir la contaminación y protejer la salud publica.

Previniendo Erosiones

Planea las excavaciones trabajo de jardineria durante el clima seco. Desarrolla e implementa planes de embarcamientos de control de sedimento y excavaciones. Cubre montones de tierra, grava y otros materiales con un plastico para protejerlos de la lluvia, aire y desagüe.

Durante Construcción

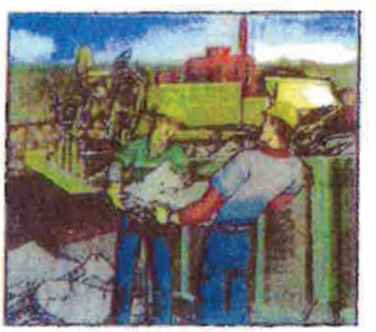
Cubre los lavados y de mantenimiento a los hoyos al aplicar selladura o mezcle. Revisa las areas de excavaciones, y evita pasarte de agua para proveenir polvadura. Nunca laves los materiales llenos de concreto en la calle, drenajes o en el desagüe.

Mantenimiento de Vehiculos & Herramientas

Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y evita goteaduras de autos que no se usan vaciandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Removiendo Asfalto & Concreto

Bloquea alrededor de los drenajes cuando estes usando las maquinas de sierra, tambien recicla todo el pavimento roto en la compañia demolidora. Para más información llama al (909) 386-8401.



Limpiando & Previniendo Derrames

Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin Barre los derrames en ves de lavarlos con la manguera. Previene los derrames de las maquinas usando enbudos o colocanto garras para absorver cualquier liquido. Para reportar derrames llama al 911.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

PINTURA

Pintura, solventes y otros quimicos peligrosos que se usan al pintar acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Pinturas de Agua
Usa pinturas de agua cuando sea posible. Son menos toxicos que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or "cleans with water".

Removiendo Pintura
Residuos de pintura, polvo de pintura y pinturas que contienen plomo son peligrosas. Barrelos en ves de lavarlos con la manguera y desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

Limpiando Pintura
Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner, y vuelvalas a guardar en un frasco, para un uso futuro. Envuelve los residuos de pintura en un periodico y tiralos a la basura.

Removiendo Pintura en Exteriores
Al despintar o lavar exteriores de los edificios con agua de alta presión bloquea los drenajes cercanos y desvia el desagüe. Pregunta las autoridades si puedes desecharla en las alcantarillas.

Reciclando Pintura
Recicla la pintura que sobra en un lugar de colección de materiales peligrosos, guardala para re-toques or regalela a alguien que la use, como a un teatro, a la escuela, una oraganizacion de la ciudad o de la comunidad.

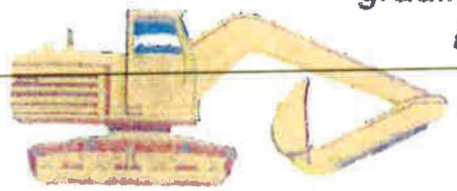
Para reportar actividades ilegales u obtener mas información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

EXCAVATION & GRADING OPERATIONS

Sediment, cement wash, asphalt, and motor oil from soil excavation and grading operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.



Follow these practices to help prevent stormwater pollution...

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting

temporary vegetation on slopes where construction is not immediately planned. Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Recycling...

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling or disposal information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site. Finally, use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets.

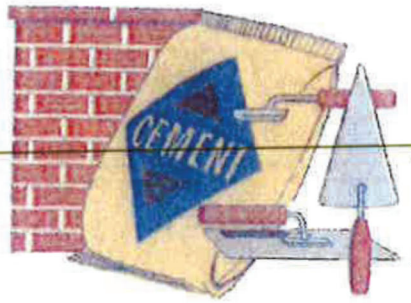
Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find

spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or commeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

FRESH CONCRETE & MORTAR APPLICATION



Cement, cement wash, gravel, asphalt, solvents, and motor oil from fresh concrete and mortar activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

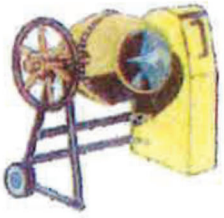
Follow these practices to help prevent stormwater pollution...

General Business Practices...

Schedule excavation and grading work during dry weather, and in case it rains, prevent materials from contacting stormwater by storing them under cover. Also, secure open bags of cement to keep wind-blown cement powder away from streets, gutters and storm drains.

During Construction...

Prevent mortar and cement from entering the storm drains by placing erosion controls (i.e., berms or temporary vegetation) down-slope to capture runoff. When breaking up paving, be sure to pick up all pieces and recycle them at a crushing company; small amounts of excess dry concrete, grout and mortar can be disposed of in the trash. Setup small mixers on tarps or heavy drop cloths to allow for easy cleanup of debris. REMEMBER: Never bury waste material -- recycle or dispose of it as hazardous waste. Call 386-8401 for recycling and disposal information.



Handling Materials & Wastes...

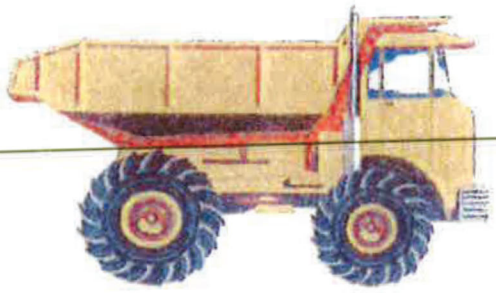
Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Cleaning up...

When cleaning up after driveway or sidewalk construction, wash concrete dust onto designated dirt areas, not down the driveway or into the street or storm drain. Also, wash out concrete mixers and equipment only in specified wash-out areas, where the water flows into containment ponds. Cement washwater can be recycled by pumping it back into cement mixers for reuse. REMEMBER: Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.

For more information, call your city's stormwater representative

GENERAL CONSTRUCTION



Soil, cement wash, asphalt and motor oil 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. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting temporary vegetation on slopes where construction is not immediately planned.

Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Handling Materials & Waste...

Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces; instead, sweep regularly. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

HOME & GARDEN

Yard waste and household toxics such as paints, solvents, 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. These wastes pollute our drinking water and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

In Your Home...

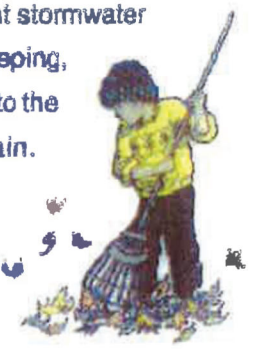
Household products such as paints, paint thinners, drain openers, motor oil, wood polishes, insecticides & herbicides, oven cleaners, and many other general cleaners frequently get dumped on the ground, or into a gutter, street or storm drain. Instead of polluting our stormwaters, take these items to a household hazardous waste collection facility. Call 1-800-OILY-CAT for a facility in your area.

Fertilizers and Pesticides...

Fertilizers and pesticides are often carried into our storm drains by sprinkler runoff. To minimize stormwater pollution, use organic or non-toxic pesticides and fertilizers as directed, and keep them away from ditches, gutters and storm drains. Store them in a covered area, off the ground, to prevent contact with water. For additional gardening questions, call the San Bernardino Master Gardeners at 387-2182.

Trimmin' the Garden...

Decaying organic materials that enter our storm drains, such as grass, leaves, yard clippings, and pet waste, will use up oxygen in nearby streams, stressing aquatic life. Prevent stormwater pollution by not blowing, sweeping, raking or hosing yard waste into the street, gutter, or storm drain. Alternatively, leave grass clippings on your lawn after mowing, or compost your clippings and yard waste. Pet waste should not be composted, but rather disposed of in the trash to prevent the potential spread of diseases.



Planting In The Yard

Produce less yard waste and save water by planting low maintenance trees and shrubs. Also, conserve water and minimize unwanted runoff by using drip irrigation, soaker hoses, or micro-spray systems to water vegetation.

For more information, call your city's stormwater representative

HOME REPAIR & REMODELING

Paints, solvents, adhesives, dusts, sediments, pesticides and household toxics commonly associated with home repair and remodeling activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

Household Hazardous Wastes...

Common household cleaners, paint products, and wallpaper & tile adhesives contain toxic substances. Dispose of these products properly. REMEMBER: Toxic wastes should never enter the storm drain system. For disposal information, call 1-800-OILY-CAT.

Construction...

Keep all construction debris away from the street, gutter and storm drain, and if possible, schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of asphalt, sand, etc. with plastic tarps, and prevent erosion by planting fast-growing annual and perennial grasses, which will shield and bind the soil.

Landscape & Gardening...

Use fertilizers and pesticides as directed. Keep them away from ditches, gutters and storm drains, and store them in a covered area to prevent contact with rain water. Also, minimize runoff and conserve water by using drip irrigation, soaker hoses, or micro-spray systems. REMEMBER: Do not deposit leaves into the street, gutter, or storm drain.

Painting...

CLEANUP... Avoid cleaning brushes or rinsing paint containers into a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible, and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

REMOVAL... Paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. Sweep them up and call 1-800-OILY-CAT for disposal information.

RECYCLING... Recycle or reuse leftover paint by using it for touch-ups, or by giving it to someone who can us it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 1-800-OILY-CAT for disposal information.

Concrete & Masonry...

Store bags of cement and plaster away from gutters and storm drains, and under cover, protected from rainfall, runoff and wind. REMEMBER: Never dispose of cement washout or concrete dust onto driveways, streets, gutters or storm drains.

For more information, call your city's stormwater representative

PAINTING

Paints, solvents, adhesives, and toxic chemicals from painting operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Keep all paint products and wastes away from the street, gutter, and storm drains. Reuse paint thinner by setting used thinner aside in a closed, labeled jar to settle out 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.

Water-Based Paints...

Purchase water-based paints whenever possible. Look for products labeled "latex" or "clean up with water."

Recycle or Reuse Paints...

Recycle/reuse leftover paint by using it for touch-ups, or by giving it to someone who can use it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 386-8401 for information on hazardous waste pick-up.

Paint Cleanup...

Avoid cleaning brushes and rinsing paint containers in a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible and and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

Paint Removal...

Chemical paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. For disposal information, call 386-8401. Also, when stripping or cleaning building exteriors with high-pressure water, block storm drains and divert the washwater onto a designated dirt area. Check with your local wastewater treatment authority to find out if you can collect building cleaning water and discharge it to the sewer.

For more information, call your city's stormwater representative

ROADWORK & PAVING

Asphalt, saw-cut slurry, and excavated materials from Road paving, surfacing and pavement removal operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

During Construction...

Cover catch basins and maintenance holes when applying seal coat, slurry seal, fog seal, etc. Use check dams, ditches or berms around excavations, and avoid over-application of water for dust control. REMEMBER: Never wash excess materials from exposed aggregate or concrete into a street, gutter, or storm drain; collect and recycle them.

Asphalt & Concrete Removal...

Barricade storm drain openings during saw-cutting, and after breaking up paving, be sure to remove all chunks and pieces and recycle them at a crushing company. For recycling information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Spills...

Be ready for unexpected spills by preparing and using spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Prevent drips from paver machines by catching fluids with drip pans or by placing absorbent material (cloth, rags, etc....) underneath the machines when they're not in use. To report serious spills, call 1-800-33-TOXIC.

General Business Practices...

Schedule excavation and grading work during dry weather, and develop and implement erosion and sediment control plans for excavated embankments. In case it rains, cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

For more information, call your city's stormwater representative

Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002
January 2003

United States
Environmental Protection
Agency

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

For more information contact:

After the Storm

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

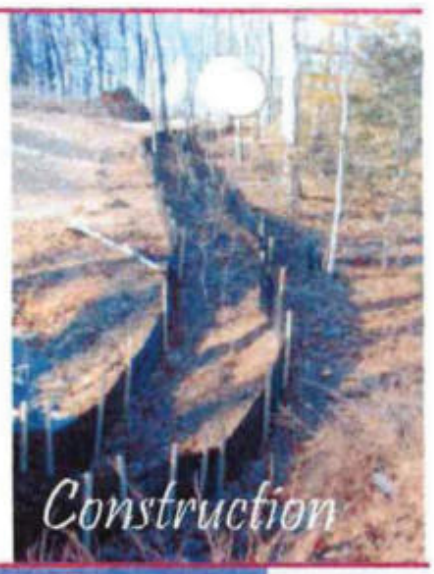
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

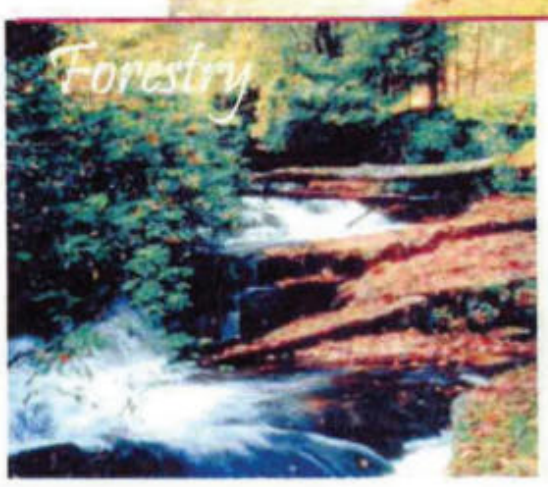
Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be washed into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



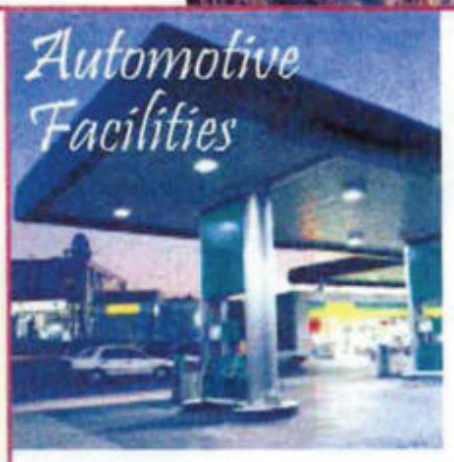
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Stormwater Pollution from Construction Activities

The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/stormwtr/

Colorado River Basin Regional Water
Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.swrcb.ca.gov/~rwqcb7/

Santa Ana Regional Water
Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(909) 782-4130
www.swrcb.ca.gov/~rwqcb8/

San Diego Regional Water
Quality Control Board - Region 9
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2952
www.swrcb.ca.gov/~rwqcb9/

To report a hazardous materials spill, call:

Riverside County Hazardous Materials
Emergency Response Team
(909) 358-5055 8:00 a.m. – 5:00 p.m.
(909) 358-5245 after 5:00 p.m.

In an emergency call: **911**

For recycling and hazardous waste disposal, call:

(909) 358-5055

To report an illegal dumping or a clogged storm drain, call:

1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, please call (909) 955-1200 or visit the StormWater/CleanWater Protection Program website at:
www.co.riverside.ca.us/depts/flood/waterquality/npdes.asp

The StormWater/CleanWater Protection Program gratefully acknowledges the Santa Clara Valley Nonpoint Pollution Control Program, Alameda Countywide CleanWater Program and the City of Los Angeles Stormwater Management Division for information provided in this brochure.

StormWater CleanWater
PROTECTION PROGRAM

StormWater Pollution

What you should know for...

General Construction & Site Supervision

Best Management Practices (BMPs) for:

Developers
General Contractors
Home Builders
Construction Inspectors
Anyone in the construction business

StormWater Pollution . . . What You Should Know

Riverside County has two drainage systems - sewers and storm drains. The storm drain system was designed to reduce flooding by carrying excess rainwater away from streets and developed areas. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our local waterways.

Unlike sanitary sewers, storm drains are not connected to a wastewater treatment plant – they flow directly to our local streams, rivers and lakes.

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can significantly alter natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Because preventing pollution is much easier and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management and discharge control that **prohibit** the discharge of pollutants into the storm drain system or local surface waters. This includes discharges from construction sites containing sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment and pollutants into the streets, the storm drain system or waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.

What Should You Do?

Advance Planning to Prevent Pollution

- ❑ Remove existing vegetation only as needed.
- ❑ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ❑ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ❑ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ❑ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ❑ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ❑ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

Best Management Practices

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ❑ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ❑ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ❑ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ❑ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ❑ Phase grading operations to limit disturbed areas and duration of exposure.
- ❑ Perform major maintenance and repairs of vehicles and equipment offsite.
- ❑ Wash out concrete mixers only in designated washout areas at the construction site.
- ❑ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ❑ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ❑ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ❑ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ❑ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ❑ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ❑ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ❑ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

General Construction Activities Stormwater Permit

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (WQ Order No. 99-08DWQ) on August 19, 1999, superseding the now expired SWRCB statewide General Permit (WQ Order No. 92-08DWQ). This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

Does my construction site require coverage under the Construction Activities General Permit?

Yes, if construction activity results in the disturbance of five or more acres of total land area or is part of a common plan of development that results in the disturbance of five or more acres.

How do I obtain coverage under the Construction Activities General Permit?

Obtain the permit package and submit the completed Notice of Intent (NOI) form to the SWRCB prior to grading or disturbing soil at the construction site. For ongoing construction activity involving a change of ownership, the new owner must submit a new NOI within 30 days of the date of change of ownership. The completed NOI along with the required fee should be mailed to the SWRCB.

What must I do to comply with the requirements of the Construction Activities General Permit?

- ● Implement BMPs for non-stormwater discharges year-round.
- ● Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- ● Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- ● Calculate the anticipated stormwater run-off.
- ● Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- ● Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after actual storm event.
- ● Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- ● Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- ● Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at www.swrcb.ca.gov/stormwtr/ to obtain a State Construction Activities Stormwater General Permit packet.*

How long is this Construction Activities General Permit in effect?

The Permit coverage stays in effect untilyou submit a Notice of Termination (NOT) to the SWRCB. For the purpose of submitting a NOT, all soil disturbing activities have to be completed and one of the three following criteria has to be met:

1. Change of ownership;
2. A uniform vegetative cover with 70 percent coverage has been established; or,
3. Equivalent stabilization measures such as the use of reinforced channel liners, soil cement, fiber matrices, geotextiles, etc., have been employed.

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call:
(909) 955-1111.

StormWater
CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?

any industrial fa ilities and manufa turin o erations must o tain o era e under the ndustrial ti ities Storm Water eneral Permit

FIND OUT
IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

The basic requirements of the Permit are:

1. The facility must eliminate any non-stormwater discharges or obtain a separate permit for such discharges.

2. The facility must develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must identify sources of pollutants that may be exposed to stormwater. Once the sources of pollutants have been identified, the facility operator must develop and implement Best Management Practices (BMPs) to minimize or prevent polluted runoff.

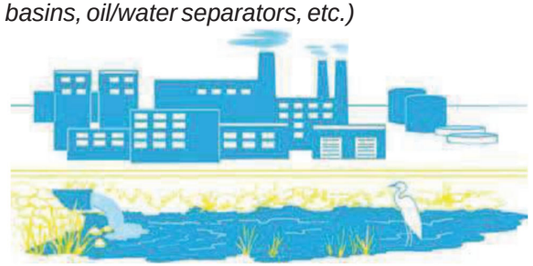
   Guidance in preparing a SWPPP is available from a document prepared by the California Storm Water Quality Task Force called the California Storm Water Best Management Practice Handbook.

3. The facility must develop and implement a Monitoring Program that includes conducting visual observations and collecting samples of the facility's storm water discharges associated with industrial activity. The General Permit requires that the analysis be conducted by a laboratory that is certified by the State of California.

4. The facility must submit to the Regional Board, every July 1, an annual report that includes the results of its monitoring program.

A Non-Storm Water Discharge is... *any discharge to a storm drain system that is not composed entirely of storm water. The following non-storm water discharges are authorized by the General Permit: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; drinking fountain water; atmospheric condensates including refrigeration, air conditioning, and compressor condensate; irrigation drainage; landscape watering; springs; non-contaminated ground water; foundation or footing drainage; and sea water infiltration where the sea waters are discharged back into the sea water source.*

A BMP is . . . *a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs may include simple, non-structural methods such as good housekeeping, staff training and preventive maintenance. Additionally, BMPs may include structural modifications such as the installation of berms, canopies or treatment control (e.g. setting basins, oil/water separators, etc.)*



WARNING*: There are significant penalties for non-compliance: a minimum fine of $5,000 for failing to obtain permit coverage, and, up to $10,000 per day, per violation plus $10 per gallon of discharge in excess of 1,000 gallons.*

Attachment D
Infiltration Report

February 1, 2023

Mojave Drive Industrial Park
14180 Dallas Parkway, Suite 730
Dallas, Texas 75254

Attention: Mr. Brandon Gallup
Acquisitions & Asset Management

Project No.: **22G269-2R**

Subject: **Results of Infiltration Testing**
Mojave Drive Industrial Park Building 2
NEC Mojave Drive and Onyx Road
Victorville, California

Reference: Geotechnical Investigation, Mojave Drive Industrial Park Building 2, NEC Mojave Drive and Onyx Road, Victorville, California, prepared by Southern California Geotechnical, Inc. (SCG) for Mojave Drive Industrial Park, SCG Project No. 22G269-1R.

Mr. Gallup:

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

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 22P404, dated November 3, 2022 and Change Order No. 22G269-CO dated January 11, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the preliminary infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The project site is located at the northeast corner of a dirt road (future Onyx Road) and Mojave Drive in Victorville, California. The site is bounded to the north by a vacant lot, to the west by a dirt road (future Onyx Road), to the south by Mojave Drive, and to the east by a vacant lot. The general locations of the sites are illustrated on the Site Location Map, enclosed as Plate 1 of this report.

The site consists of one (1) rectangular-shaped parcel, which totals 6± acres in size. The site is currently vacant and undeveloped. Ground surface cover consists of exposed soil with sparse to moderate native bushes and weed growth. Occasional debris is scattered throughout the site.

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the site topography slopes gently downward to the northeast at a gradient of 1½± percent with an elevation differential of approximately 12 feet.

Proposed Development

SCG was provided with a conceptual site plan. Based on this site plan, the site will be developed with one (1) industrial building. The building, identified as Building 2, will be 102,000± ft² in size. The building will be constructed with dock-high doors along a portion of the northern building wall. The building will be surrounded by asphaltic concrete pavements in the automobile parking and drive areas, Portland cement concrete pavements in the truck court, and areas of concrete flatwork and landscape planters.

Detailed structural information has not been provided. We assume that the new industrial building will be a single-story structure of tilt-up concrete construction, typically supported on a conventional shallow foundation system with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 6 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of 3 to 6± feet are expected to be necessary to achieve the proposed site grades.

The proposed development will likely use on-site storm water infiltration. The type, depth, and locations of the infiltration systems were not available at the time of this report. However, based on our experience with similar projects in the area, we assume that the infiltration area will be located in the truck-court area of the proposed building. It is expected that the infiltration system will consist of below-grade chambers extending to depths of 10 to 12± feet.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, two (2) borings (identified as Boring Nos. B-1 and B-2) were advanced to depths of 20 to 25± feet below the existing site grades.

Native alluvium was encountered at the ground surface at both of the boring locations, extending to at least the maximum depth explored of 25± feet. Both of the borings encountered medium dense to very dense silty fine to coarse sands, with varying clay and gravel content.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the lack of any water within the borings, and the moisture contents of the recovered soil samples, the static

groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the historic groundwater depths in this area is the California Department of Water Resources Water Data Library website, https://wdl.water.ca.gov/waterdatalibrary/. One monitoring well on record (identified as Station 345267N1173632W001) is located 1.2± miles east of the site. Water level readings within this monitoring well indicate a high groundwater level of 70± feet below the ground surface, in January 1917.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of one (1) infiltration test boring, advanced to depth a of 10± feet below the existing site grades. The infiltration boring was advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and was logged during drilling by a member of our staff. The approximate location of the infiltration test boring (identified as I-1) is indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration boring, the bottom of the test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into the test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Native alluvial soils were encountered at the ground surface at the infiltration test location, extending to at least the maximum depth explored of 10± feet. The alluvium generally consists of hard fine to medium sandy clays with trace amounts of coarse sand and dense silty fine to medium sands with trace amounts of coarse sand and gravel.

Infiltration Testing

We understand that the results of the testing will be used to prepare a design for the proposed storm water infiltration systems within the project site. As previously mentioned, the infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, the infiltration test boring was pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test hole. The pre-soaking process consisted of filling test boring by inverting a full 5-gallon bottle of clear water supported over the hole so that the water flow into the hole holds

constant at a level at least 5 times the hole's radius above the gravel at the bottom of the hole. Pre-soaking was completed after all of the water had percolated through the test hole.

Infiltration Testing

Following the pre-soaking process of the infiltration test boring, SCG performed the infiltration testing. The test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test hole. In accordance with the San Bernardino County guidelines, since "sandy soils" were encountered at the bottom of Infiltration Test No. I-1 (where 6 inches of water infiltrated into the surrounding soils for two consecutive 25-minute readings), readings were taken at 10-minute intervals for 1 hour. After each reading, water was added to the boring so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rate for each of the timed intervals are also tabulated on the spreadsheet.

The infiltration rate from the test is tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration test be used as the design infiltration rate. The rate is summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-1	10	Silty fine to medium Sand, little coarse Sand, trace fine Gravel	7.6

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the boring were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Log.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of the infiltration test boring has been determined using a range of wire mesh screens. This test was performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The result of this test is presented on Plate C-1 of this report.

Design Recommendations

One (1) infiltration test was performed at the subject site. As noted above, the infiltration rate at this location is 7.6 inches per hour. Based on the infiltration test result from Infiltration Test No. I-1, we recommend an infiltration rate of 7.6 inches per hour be used for the proposed system located north of Building 2.

The infiltration rate recommended above is applicable if the bottom of the proposed infiltration system extends to depths of 10 to 12± feet below the existing site grades. It should be noted that the provided infiltration rate is preliminary in nature since the type, location and depth of the proposed infiltration system is unknown at the time of this report. Additional infiltration testing is recommended to verify the actual infiltration rates once detailed information of the proposed infiltration systems is provided by the client or civil engineer.

The design of the storm water infiltration systems should be performed by the project civil engineer, in accordance with the City of Victorville and/or County of San Bernardino guidelines. It is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rate is based on infiltration testing at one (1) discrete location and that the overall infiltration rate of the proposed infiltration system could vary considerably.

Infiltration Rate Considerations

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

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

Construction Considerations

The infiltration rates presented in this report are specific to the tested locations and tested depths. Infiltration rates can be significantly reduced if the soils are exposed to excessive disturbance or compaction during construction. Compaction of the soils at the bottom of the infiltration system can significantly reduce the infiltration ability of the chambers. Therefore, the subgrade soils within proposed infiltration system areas should not be over-excavated, undercut or compacted

in any significant manner. **It is recommended that a note to this effect be added to the project plans and/or specifications.**

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. The infiltration rate of the system will likely vary significantly if the composition of the soil located beneath the system is not consistent with the tested soils.

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

Chamber Maintenance

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

Location of Infiltration Systems

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

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

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

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

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

Closure

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

Respectfully Submitted,

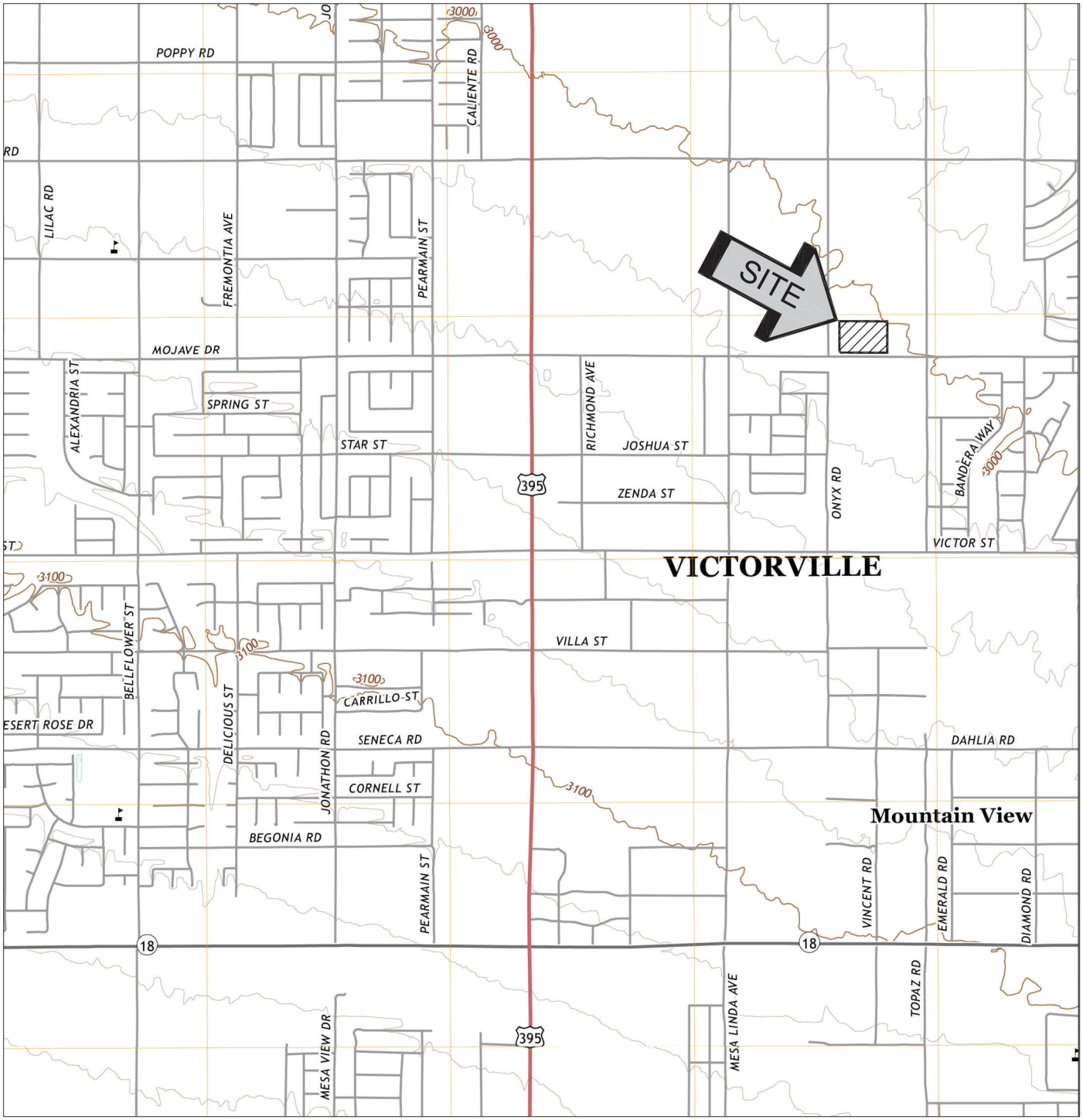
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Oscar Sandoval
Staff Engineer

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Log (3 pages)
Infiltration Test Results Spreadsheet (1 pages)
Grain Size Distribution Graph (1 pages)



SITE LOCATION MAP

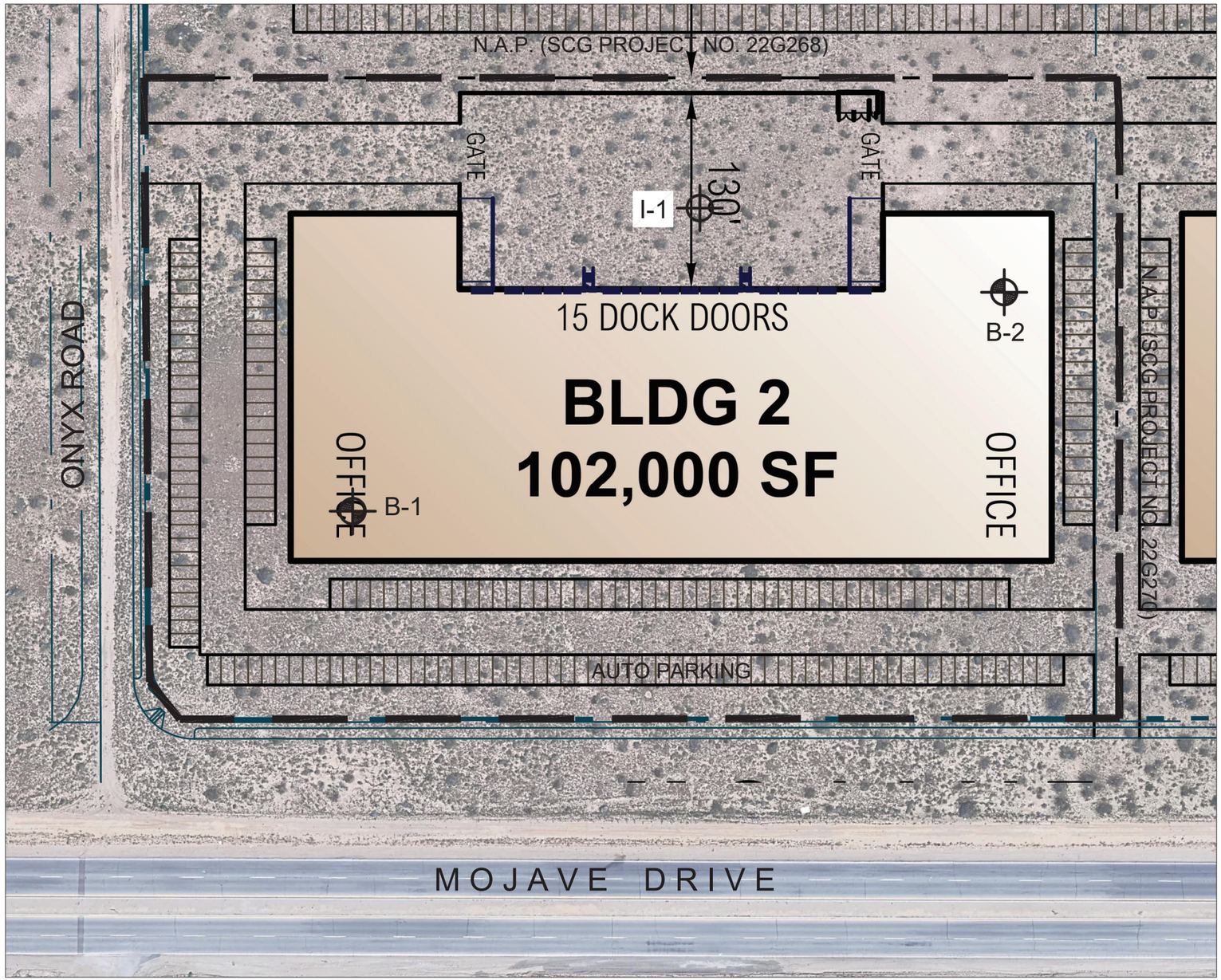
MOJAVE DRIVE INDUSTRIAL PARK BUILDING 2

VICTORVILLE, CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: AG CHKD: RGT	
SCG PROJECT 22G269-2R	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION FROM CONCURRENT STUDY (SCG PROJECT NO. 22G269-1R)

NORTH

NOTE: CONCEPTUAL SITE PLAN PROVIDED BY THE CLIENT.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

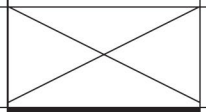
INFILTRATION TEST LOCATION PLAN

MOJAVE DRIVE INDUSTRIAL PARK BUILDING 2

VICTORVILLE, CALIFORNIA

SCALE: 1" = 80'	SOUTHERN CALIFORNIA GEOTECHNICAL
DRAWN: AG CHKD: RGT	
SCG PROJECT 22G269-2R	
PLATE 2	

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

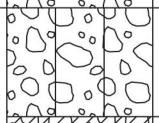
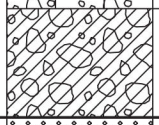
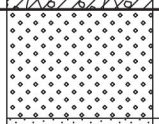
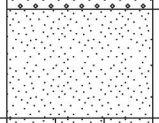
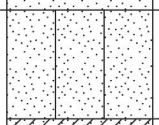
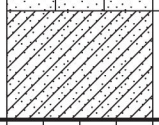
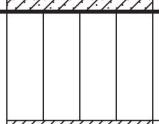
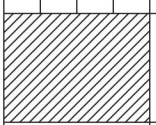
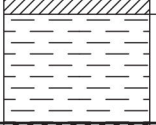
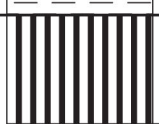
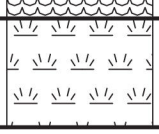
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-1

JOB NO.: 22G269-2R
PROJECT: Mojave Drive Industrial Park Bldg 2
LOCATION: Victorville, California

DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
5		47	4.5		ALLUVIUM: Brown fine to medium Sandy Clay, little Silt, trace coarse Sand, moderately cemented, hard-dry to damp		3					
		41	4.5				1					
10		49			Gray Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel, dense-damp		3			14		
					Boring Terminated at 10'							

TBL 22G269-2.GPJ SOCALGEO.GDT 2/1/23

TEST BORING LOG

PLATE B-1

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Building 2
Project Location	Victorville, California
Project Number	22G269-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	9.30	(ft)

Infiltration Test Hole: I-1

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	10:49 AM	25.00	7.00	27.60	YES	SANDY SOILS
	Final	11:14 AM		9.30			
2	Initial	11:14 AM	25.00	7.00	27.60	YES	SANDY SOILS
	Final	11:39 AM		9.30			

Test Data

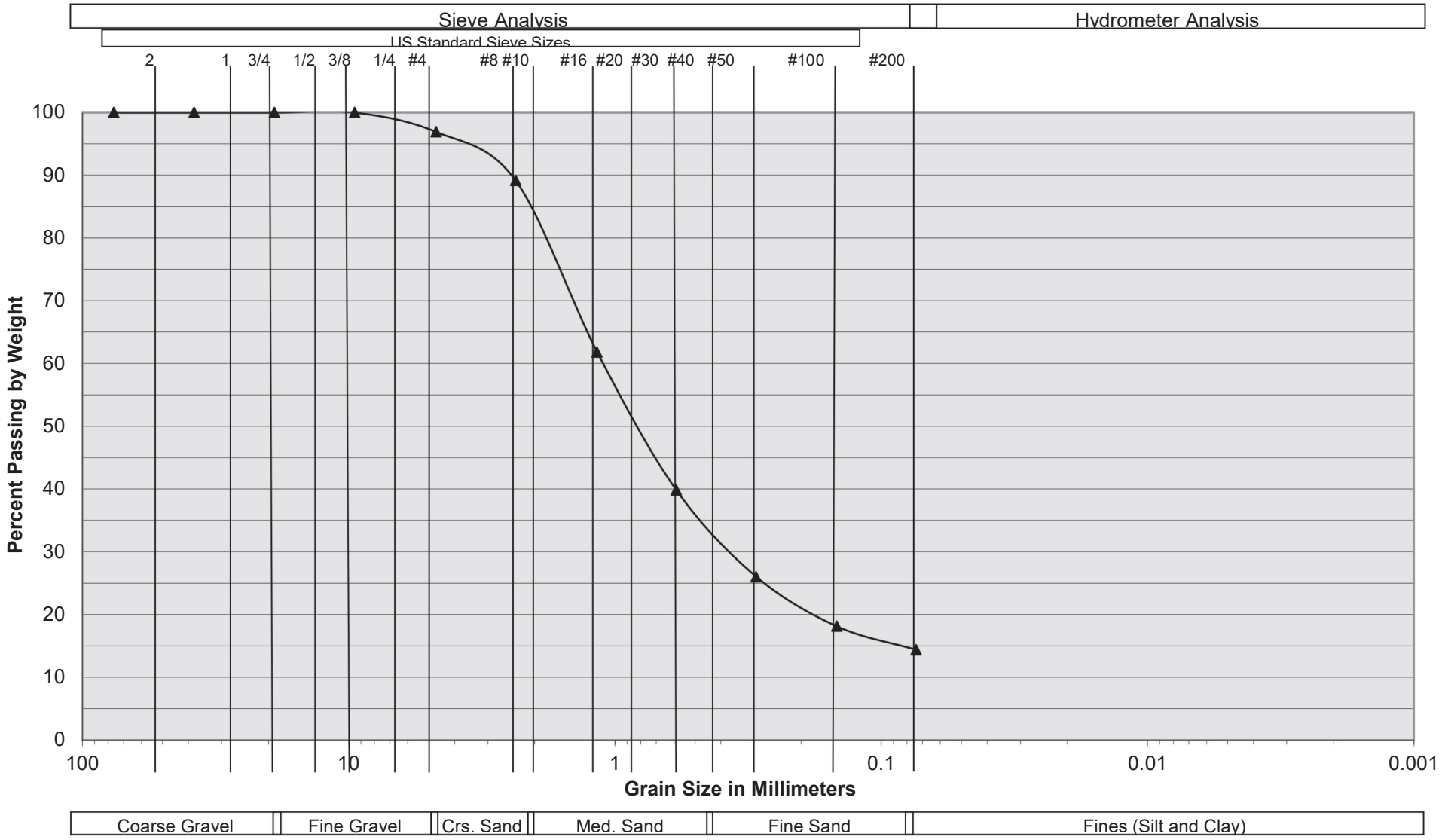
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	11:39 AM	10.00	7.00	1.31	1.65	8.68
	Final	11:49 AM		8.31			
2	Initial	11:49 AM	10.00	7.00	1.15	1.73	7.30
	Final	11:59 AM		8.15			
3	Initial	11:59 AM	10.00	7.00	1.15	1.73	7.30
	Final	12:09 PM		8.15			
4	Initial	12:09 PM	10.00	7.00	1.17	1.72	7.46
	Final	12:19 PM		8.17			
5	Initial	12:19 PM	10.00	7.00	1.18	1.71	7.55
	Final	12:29 PM		8.18			
6	Initial	12:29 PM	10.00	7.00	1.18	1.71	7.55
	Final	12:39 PM		8.18			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

Grain Size Distribution



Sample Description	I-1 @ 8½ feet
Soil Classification	Gray Brown Silty fine to medium Sand, little coarse Sand, trace fine Gravel

Mojave Drive Industrial Park Building 2
Victorville, California
Project No. 22G269-2R
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attachment E
Hydromodification

Project: COVINGTON - MIP BUILDING 2

Detention/ Infiltration System Routing Study Summary

Stage Storage Number	Storage Depth (ft)	Elevation (ft)	Area (ft^2)	Incremental volume (ft^3)	Total Volume (ft^3)	Total Volume (acre-ft)	Outflow Q (cfs)	Notes
1	0.0	2,983.00	5,850	0	0	0	0	**Bottom of Infiltration System Rock**
2	0.5	2,983.50	5,850	1,170	1,170	0.027	0.34	**96" CMP Invert**
3	1.5	2,984.50	5,850	3,476	4,646	0.107	0.34	
4	2.5	2,985.50	5,850	4,282	8,928	0.205	0.34	
5	3.0	2,986.00	5,850	2,295	11,223	0.258	0.34	
6	3.25	2,986.25	5,850	1,173	12,396	0.285	0.34	System Releases Water @ 2986.25
7	4.25	2,987.25	5,850	4,794	17,191	0.395	1.72	
8	5.25	2,988.25	5,850	4,834	22,025	0.506	2.51	
9	7.50	2,990.50	5,850	8,055	30,080	0.691	3.67	
10	8.00	2,991.00	5,850	3,974	34,053	0.782	3.88	
11	9.00	2,992.00	5,850	2,750	36,803	0.845	4.25	**Top of Infiltration/ Detention System**
12	10.00	2,993.00	5,850	0	36,803	0.845	4.60	
13	11.00	2,994.00	5,850	0	36,803	0.845	4.92	
14	12.0	2,995.00	5,850	0	36,803	0.845	5.22	
96" CMP system with 6" rock top & bottom								

Infiltration System Bottom Area Discharge ($Q_{out,bottom}$)		
Infiltration Rate per Geo Tech Report (in/hr)	=	7.6
Factor of Safety		3
Unit Conversion (ft/sec) $\frac{6.8\frac{in}{hr}}{3.25} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{60\ min} \times \frac{1\ min}{60\ sec}$	=	0.0000586
Infiltration System Footprint (ft^2) 130 ft x 45 ft	=	5,850
$Q_{out,bottom}$ (cfs)	=	**0.34**

*WQMP Design Capture Volume (DCV) is 12,182 CF

Basin Routing Summary Table

	100 YR 24 HR	10 YR 24HR
Proposed Q100(cfs) 5.71 ac	17.18	9.84
Q (cfs) after Routing	3.39	1.03
WSE (ft)	2989.95	2986.75

note: 0.34 cfs to infiltration

Storm Drain System Net Drainage (Q_{net})		
One 8-inch Outlet Pipe + Infiltration $Q_{out,bottom}$		
Orifice Eqn $= C * A * \sqrt{2gh} + Q_{out,bottom}$		
$= 0.6 \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$		
A: Outlet pipe cross sectional area		
h: WSE - outlet pipe centerline elevation		
Example: WSE @ 1113.23 ft		
Q_{net} $= C \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$		
C		0.6
A (ft^2) = πr^2		0.35
WSE (ft)		2,994.00
Outlet Centerline (ft)		2986.583333
h (ft)		7.416666667
$Q_{out,bottom}$ (cfs)		0.34
Q_{net}	=	**4.92**

HUITT-ZOLLARS

COVINGTON - MIP UNIT HYDROGRAPH AND STORM WATER MITIGATION SUMMARY									
	EXISTING Q TRIBUTARY TO STREAM (CFS) (47 AC)		PROPOSED Q PRIOR TO MITIGATION (CFS)		PROPOSED Q AFTER MITIGATION (CFS)		Q_{out} DUE TO INFILTRATION (CFS)	PROPOSED Q AFTER MITIGATION TO PUBLIC SD (CFS)	
	10 YR	100 YR	10 YR	100 YR	10 YR	100 YR		10 YR	100 YR
BUILDING 1 (6.2 AC)			10.19	17.79	1.20	3.19	0.30	0.90	2.89
BUILDING 2 (5.7 AC)			9.84	17.18	1.03	3.39	0.34	0.69	3.05
BUILDING 3 (61.1 AC)			93.04	169.07	8.27	26.38	2.27	6.00	24.11
TOTAL	14.29	33.24	113.07	204.04	10.5	32.96		7.59	30.05
IS Q AFTER ROUTING LESS THAN OR EQUAL TO EXISTING Q TRIBUTARY TO STREAM?								YES	YES

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

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Study date 04/28/23

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

Program License Serial Number 6145

COVINGTON - MIP
10 YEAR STORM EVENT EXISTING TRIBUTARY TO OUTLET
5712Q10E
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
47.00	1	0.62
Rainfall data for year 10		
47.00	6	1.27
Rainfall data for year 10		
47.00	24	2.32

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
86.0	86.0	47.00	1.000	0.265	1.000	0.265

Area-averaged adjusted loss rate Fm (In/Hr) = 0.265

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
47.00	1.000	86.0	86.0	1.63	0.473

Area-averaged catchment yield fraction, Y = 0.473
Area-averaged low loss fraction, Yb = 0.527
++
Watercourse length = 2070.00(Ft.)
Length from concentration point to centroid = 1190.00(Ft.)
Elevation difference along watercourse = 22.40(Ft.)
Mannings friction factor along watercourse = 0.350
Watershed area = 47.00(Ac.)
Catchment Lag time = 1.549 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 5.3799
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.265(In/Hr)
Average low loss rate fraction (Yb) = 0.527 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.295(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.621(In)
Computed peak 3-hour rainfall = 0.963(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.320(In)

Rainfall depth area reduction factors:
Using a total area of 47.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.294(In)
30-minute factor = 0.998 Adjusted rainfall = 0.503(In)
1-hour factor = 0.998 Adjusted rainfall = 0.620(In)
3-hour factor = 1.000 Adjusted rainfall = 0.963(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.320(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 568.41 (CFS))		
1	0.237	1.346
2	0.710	2.691
3	1.282	3.251
4	2.163	5.009
5	3.094	5.290
6	4.338	7.072
7	5.673	7.585
8	7.257	9.008
9	9.065	10.275
10	11.281	12.593
11	14.653	19.170
12	18.248	20.431
13	23.363	29.077
14	28.871	31.305
15	33.876	28.449
16	38.481	26.176
17	42.772	24.388
18	46.255	19.802
19	49.644	19.259

20	52.553	16.535
21	55.347	15.885
22	57.717	13.468
23	59.783	11.743
24	61.735	11.097
25	63.424	9.601
26	65.078	9.397
27	66.538	8.302
28	67.957	8.068
29	69.299	7.624
30	70.590	7.339
31	71.813	6.952
32	72.894	6.142
33	73.955	6.034
34	74.920	5.484
35	75.867	5.379
36	76.786	5.226
37	77.690	5.137
38	78.528	4.763
39	79.241	4.053
40	79.951	4.037
41	80.661	4.037
42	81.369	4.025
43	81.994	3.551
44	82.575	3.303
45	83.156	3.303
46	83.737	3.303
47	84.309	3.251
48	84.833	2.976
49	85.349	2.936
50	85.866	2.936
51	86.382	2.936
52	86.865	2.744
53	87.296	2.450
54	87.726	2.446
55	88.157	2.446
56	88.584	2.429
57	88.938	2.013
58	89.261	1.835
59	89.584	1.835
60	89.906	1.835
61	90.225	1.813
62	90.529	1.723
63	90.830	1.712
64	91.131	1.712
65	91.432	1.712
66	91.714	1.604
67	91.973	1.468
68	92.231	1.468
69	92.489	1.468
70	92.747	1.462
71	92.989	1.376
72	93.225	1.346
73	93.462	1.346
74	93.699	1.346
75	93.924	1.281
76	94.110	1.058
77	94.293	1.040
78	94.476	1.040
79	94.659	1.040
80	94.842	1.040
81	95.025	1.040
82	95.208	1.040

83	95.391	1.040
84	95.571	1.024
85	95.720	0.846
86	95.860	0.795
87	95.999	0.795
88	96.139	0.795
89	96.279	0.795
90	96.419	0.795
91	96.559	0.795
92	96.699	0.795
93	96.839	0.795
94	96.954	0.658
95	97.051	0.550
96	97.148	0.550
97	97.245	0.550
98	97.342	0.550
99	97.439	0.550
100	97.535	0.550
101	97.632	0.550
102	97.729	0.550
103	97.813	0.478
104	97.868	0.312
105	97.922	0.306
106	97.976	0.306
107	98.030	0.306
108	98.083	0.306
109	98.137	0.306
110	98.191	0.306
111	98.245	0.306
112	98.300	0.313
113	98.363	0.359
114	98.427	0.367
115	98.492	0.367
116	98.557	0.367
117	98.621	0.367
118	98.686	0.367
119	98.750	0.367
120	98.815	0.367
121	98.879	0.367
122	98.944	0.367
123	99.009	0.367
124	99.073	0.367
125	99.138	0.367
126	99.202	0.367
127	99.267	0.367
128	99.331	0.367
129	99.396	0.367
130	99.460	0.367
131	99.513	0.298
132	99.547	0.192
133	99.580	0.191
134	99.614	0.191
135	99.648	0.191
136	99.681	0.191
137	99.715	0.191
138	99.748	0.191
139	99.782	0.191
140	99.816	0.191
141	99.849	0.191
142	99.883	0.191
143	99.917	0.191
144	99.950	0.191
145	100.000	0.096

Total soil rain loss = 1.07(In)
Total effective rainfall = 1.25(In)
Peak flow rate in flood hydrograph = 14.29(CFS)

++

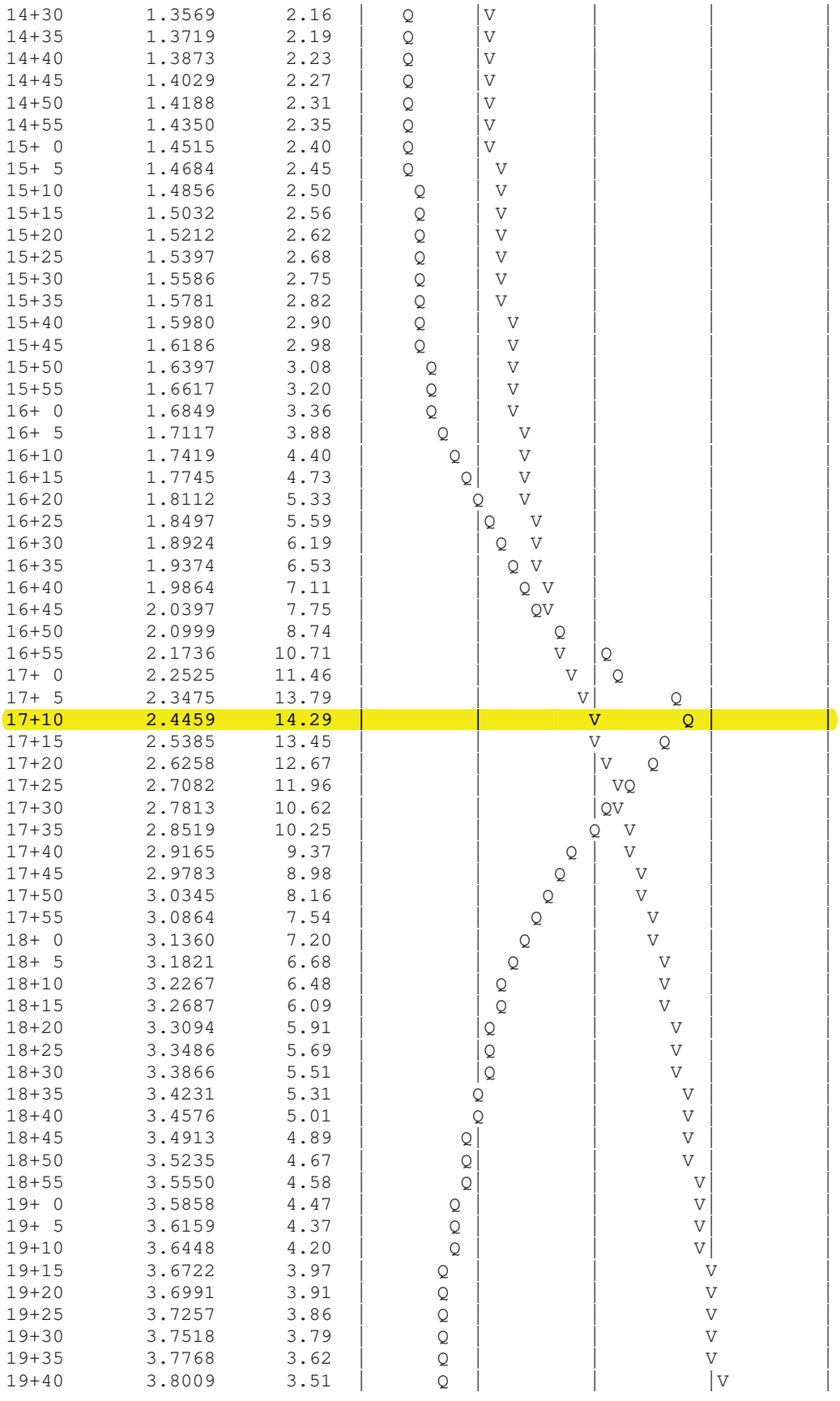
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0001	0.01	Q				
0+20	0.0003	0.02	Q				
0+25	0.0005	0.03	Q				
0+30	0.0008	0.04	Q				
0+35	0.0011	0.05	Q				
0+40	0.0016	0.07	Q				
0+45	0.0022	0.09	Q				
0+50	0.0029	0.11	Q				
0+55	0.0039	0.14	Q				
1+ 0	0.0051	0.17	Q				
1+ 5	0.0066	0.22	Q				
1+10	0.0085	0.28	Q				
1+15	0.0108	0.32	Q				
1+20	0.0133	0.37	Q				
1+25	0.0161	0.41	Q				
1+30	0.0192	0.44	Q				
1+35	0.0224	0.48	Q				
1+40	0.0259	0.51	VQ				
1+45	0.0296	0.53	VQ				
1+50	0.0334	0.56	VQ				
1+55	0.0374	0.58	VQ				
2+ 0	0.0415	0.60	VQ				
2+ 5	0.0458	0.62	VQ				
2+10	0.0501	0.63	VQ				
2+15	0.0546	0.65	VQ				
2+20	0.0592	0.66	VQ				
2+25	0.0639	0.68	VQ				
2+30	0.0686	0.69	VQ				
2+35	0.0735	0.71	VQ				
2+40	0.0785	0.72	VQ				
2+45	0.0835	0.73	VQ				
2+50	0.0886	0.74	VQ				
2+55	0.0939	0.76	VQ				
3+ 0	0.0991	0.77	VQ				
3+ 5	0.1045	0.78	VQ				
3+10	0.1099	0.79	VQ				
3+15	0.1154	0.80	VQ				
3+20	0.1210	0.81	VQ				
3+25	0.1266	0.82	|Q				
3+30	0.1323	0.83	|Q				
3+35	0.1380	0.83	|Q				
3+40	0.1438	0.84	|Q				
3+45	0.1497	0.85	|Q				
3+50	0.1556	0.86	|Q				
3+55	0.1616	0.87	|Q				

4+ 0	0.1676	0.88	Q				
4+ 5	0.1737	0.88	Q				
4+10	0.1798	0.89	Q				
4+15	0.1860	0.90	Q				
4+20	0.1923	0.91	Q				
4+25	0.1985	0.91	Q				
4+30	0.2049	0.92	Q				
4+35	0.2113	0.93	Q				
4+40	0.2177	0.94	Q				
4+45	0.2242	0.94	Q				
4+50	0.2308	0.95	Q				
4+55	0.2374	0.96	Q				
5+ 0	0.2440	0.96	Q				
5+ 5	0.2507	0.97	QV				
5+10	0.2574	0.98	QV				
5+15	0.2642	0.98	QV				
5+20	0.2710	0.99	QV				
5+25	0.2778	1.00	QV				
5+30	0.2847	1.00	Q				
5+35	0.2917	1.01	Q				
5+40	0.2987	1.01	Q				
5+45	0.3057	1.02	Q				
5+50	0.3128	1.03	Q				
5+55	0.3199	1.03	Q				
6+ 0	0.3271	1.04	Q				
6+ 5	0.3343	1.05	Q				
6+10	0.3415	1.05	Q				
6+15	0.3488	1.06	Q				
6+20	0.3562	1.07	Q				
6+25	0.3636	1.07	Q				
6+30	0.3710	1.08	QV				
6+35	0.3784	1.08	QV				
6+40	0.3860	1.09	QV				
6+45	0.3935	1.10	QV				
6+50	0.4011	1.10	QV				
6+55	0.4088	1.11	QV				
7+ 0	0.4164	1.12	QV				
7+ 5	0.4242	1.12	QV				
7+10	0.4320	1.13	QV				
7+15	0.4398	1.14	QV				
7+20	0.4476	1.14	QV				
7+25	0.4556	1.15	QV				
7+30	0.4635	1.15	QV				
7+35	0.4715	1.16	QV				
7+40	0.4795	1.17	QV				
7+45	0.4876	1.17	QV				
7+50	0.4958	1.18	Q V				
7+55	0.5040	1.19	Q V				
8+ 0	0.5122	1.19	Q V				
8+ 5	0.5205	1.20	Q V				
8+10	0.5288	1.21	Q V				
8+15	0.5371	1.21	Q V				
8+20	0.5456	1.22	Q V				
8+25	0.5540	1.23	Q V				
8+30	0.5625	1.24	Q V				
8+35	0.5711	1.24	Q V				
8+40	0.5797	1.25	Q V				
8+45	0.5884	1.26	Q V				
8+50	0.5971	1.26	Q V				
8+55	0.6058	1.27	Q V				
9+ 0	0.6146	1.28	Q V				
9+ 5	0.6235	1.29	Q V				
9+10	0.6324	1.29	Q V				

9+15	0.6413	1.30	Q V			
9+20	0.6503	1.31	Q V			
9+25	0.6594	1.32	Q V			
9+30	0.6685	1.32	Q V			
9+35	0.6777	1.33	Q V			
9+40	0.6869	1.34	Q V			
9+45	0.6962	1.35	Q V			
9+50	0.7056	1.36	Q V			
9+55	0.7150	1.37	Q V			
10+ 0	0.7245	1.37	Q V			
10+ 5	0.7340	1.38	Q V			
10+10	0.7436	1.39	Q V			
10+15	0.7532	1.40	Q V			
10+20	0.7630	1.41	Q V			
10+25	0.7727	1.42	Q V			
10+30	0.7826	1.43	Q V			
10+35	0.7925	1.44	Q V			
10+40	0.8025	1.45	Q V			
10+45	0.8126	1.46	Q V			
10+50	0.8227	1.47	Q V			
10+55	0.8329	1.48	Q V			
11+ 0	0.8432	1.49	Q V			
11+ 5	0.8536	1.50	Q V			
11+10	0.8640	1.51	Q V			
11+15	0.8745	1.53	Q V			
11+20	0.8851	1.54	Q V			
11+25	0.8957	1.55	Q V			
11+30	0.9065	1.56	Q V			
11+35	0.9173	1.57	Q V			
11+40	0.9282	1.58	Q V			
11+45	0.9392	1.60	Q V			
11+50	0.9503	1.61	Q V			
11+55	0.9615	1.62	Q V			
12+ 0	0.9728	1.64	Q V			
12+ 5	0.9842	1.65	Q V			
12+10	0.9956	1.66	Q V			
12+15	1.0072	1.68	Q V			
12+20	1.0188	1.69	Q V			
12+25	1.0305	1.70	Q V			
12+30	1.0423	1.72	Q V			
12+35	1.0543	1.73	Q V			
12+40	1.0663	1.74	Q V			
12+45	1.0784	1.76	Q V			
12+50	1.0906	1.77	Q V			
12+55	1.1028	1.78	Q V			
13+ 0	1.1152	1.79	Q V			
13+ 5	1.1276	1.80	Q V			
13+10	1.1401	1.81	Q V			
13+15	1.1527	1.83	Q V			
13+20	1.1653	1.84	Q V			
13+25	1.1781	1.85	Q V			
13+30	1.1909	1.87	Q V			
13+35	1.2039	1.88	Q V			
13+40	1.2170	1.90	Q V			
13+45	1.2302	1.92	Q V			
13+50	1.2436	1.94	Q V			
13+55	1.2571	1.96	Q V			
14+ 0	1.2708	1.99	Q V			
14+ 5	1.2847	2.01	Q V			
14+10	1.2987	2.04	Q V			
14+15	1.3129	2.07	Q V			
14+20	1.3274	2.09	Q V			
14+25	1.3420	2.13	Q V			

14+30	1.3569	2.16	
14+35	1.3719	2.19	
14+40	1.3873	2.23	
14+45	1.4029	2.27	
14+50	1.4188	2.31	
14+55	1.4350	2.35	
15+ 0	1.4515	2.40	
15+ 5	1.4684	2.45	
15+10	1.4856	2.50	
15+15	1.5032	2.56	
15+20	1.5212	2.62	
15+25	1.5397	2.68	
15+30	1.5586	2.75	
15+35	1.5781	2.82	
15+40	1.5980	2.90	
15+45	1.6186	2.98	
15+50	1.6397	3.08	
15+55	1.6617	3.20	
16+ 0	1.6849	3.36	
16+ 5	1.7117	3.88	
16+10	1.7419	4.40	
16+15	1.7745	4.73	
16+20	1.8112	5.33	
16+25	1.8497	5.59	
16+30	1.8924	6.19	
16+35	1.9374	6.53	
16+40	1.9864	7.11	
16+45	2.0397	7.75	
16+50	2.0999	8.74	
16+55	2.1736	10.71	
17+ 0	2.2525	11.46	
17+ 5	2.3475	13.79	
17+10	2.4459	14.29	
17+15	2.5385	13.45	
17+20	2.6258	12.67	
17+25	2.7082	11.96	
17+30	2.7813	10.62	
17+35	2.8519	10.25	
17+40	2.9165	9.37	
17+45	2.9783	8.98	
17+50	3.0345	8.16	
17+55	3.0864	7.54	
18+ 0	3.1360	7.20	
18+ 5	3.1821	6.68	
18+10	3.2267	6.48	
18+15	3.2687	6.09	
18+20	3.3094	5.91	
18+25	3.3486	5.69	
18+30	3.3866	5.51	
18+35	3.4231	5.31	
18+40	3.4576	5.01	
18+45	3.4913	4.89	
18+50	3.5235	4.67	
18+55	3.5550	4.58	
19+ 0	3.5858	4.47	
19+ 5	3.6159	4.37	
19+10	3.6448	4.20	
19+15	3.6722	3.97	
19+20	3.6991	3.91	
19+25	3.7257	3.86	
19+30	3.7518	3.79	
19+35	3.7768	3.62	
19+40	3.8009	3.51	

19+45	3.8248	3.47	Q		V	
19+50	3.8484	3.43	Q		V	
19+55	3.8716	3.37	Q		V	
20+ 0	3.8940	3.26	Q		V	
20+ 5	3.9161	3.21	Q		V	
20+10	3.9379	3.17	Q		V	
20+15	3.9595	3.13	Q		V	
20+20	3.9804	3.03	Q		V	
20+25	4.0005	2.92	Q		V	
20+30	4.0203	2.88	Q		V	
20+35	4.0399	2.85	Q		V	
20+40	4.0592	2.80	Q		V	
20+45	4.0774	2.65	Q		V	
20+50	4.0952	2.57	Q		V	
20+55	4.1127	2.54	Q		V	
21+ 0	4.1300	2.52	Q		V	
21+ 5	4.1471	2.48	Q		V	
21+10	4.1638	2.43	Q		V	
21+15	4.1804	2.40	Q		V	
21+20	4.1968	2.38	Q		V	
21+25	4.2130	2.35	Q		V	
21+30	4.2288	2.29	Q		V	
21+35	4.2442	2.24	Q		V	
21+40	4.2594	2.21	Q		V	
21+45	4.2745	2.19	Q		V	
21+50	4.2894	2.17	Q		V	
21+55	4.3040	2.12	Q		V	
22+ 0	4.3184	2.09	Q		V	
22+ 5	4.3327	2.07	Q		V	
22+10	4.3468	2.05	Q		V	
22+15	4.3606	2.00	Q		V	
22+20	4.3738	1.93	Q		V	
22+25	4.3869	1.90	Q		V	
22+30	4.3999	1.88	Q		V	
22+35	4.4128	1.87	Q		V	
22+40	4.4255	1.85	Q		V	
22+45	4.4381	1.83	Q		V	
22+50	4.4507	1.82	Q		V	
22+55	4.4630	1.80	Q		V	
23+ 0	4.4752	1.77	Q		V	
23+ 5	4.4870	1.71	Q		V	
23+10	4.4985	1.68	Q		V	
23+15	4.5100	1.66	Q		V	
23+20	4.5213	1.65	Q		V	
23+25	4.5326	1.63	Q		V	
23+30	4.5438	1.62	Q		V	
23+35	4.5548	1.61	Q		V	
23+40	4.5658	1.59	Q		V	
23+45	4.5766	1.57	Q		V	
23+50	4.5870	1.52	Q		V	
23+55	4.5972	1.48	Q		V	
24+ 0	4.6072	1.46	Q		V	
24+ 5	4.6172	1.45	Q		V	
24+10	4.6271	1.43	Q		V	
24+15	4.6368	1.41	Q		V	
24+20	4.6464	1.39	Q		V	
24+25	4.6559	1.37	Q		V	
24+30	4.6651	1.34	Q		V	
24+35	4.6740	1.30	Q		V	
24+40	4.6825	1.23	Q		V	
24+45	4.6908	1.20	Q		V	
24+50	4.6988	1.17	Q		V	
24+55	4.7066	1.13	Q		V	

25+ 0	4.7140	1.08	Q			V
25+ 5	4.7211	1.03	Q			V
25+10	4.7278	0.97	Q			V
25+15	4.7341	0.92	Q			V
25+20	4.7401	0.87	Q			V
25+25	4.7459	0.84	Q			V
25+30	4.7514	0.80	Q			V
25+35	4.7566	0.76	Q			V
25+40	4.7617	0.73	Q			V
25+45	4.7665	0.70	Q			V
25+50	4.7711	0.67	Q			V
25+55	4.7756	0.65	Q			V
26+ 0	4.7799	0.63	Q			V
26+ 5	4.7841	0.61	Q			V
26+10	4.7881	0.59	Q			V
26+15	4.7920	0.57	Q			V
26+20	4.7958	0.55	Q			V
26+25	4.7995	0.53	Q			V
26+30	4.8030	0.52	Q			V
26+35	4.8065	0.50	Q			V
26+40	4.8098	0.49	Q			V
26+45	4.8131	0.47	Q			V
26+50	4.8162	0.45	Q			V
26+55	4.8191	0.42	Q			V
27+ 0	4.8217	0.38	Q			V
27+ 5	4.8242	0.36	Q			V
27+10	4.8266	0.35	Q			V
27+15	4.8289	0.34	Q			V
27+20	4.8312	0.33	Q			V
27+25	4.8334	0.32	Q			V
27+30	4.8356	0.31	Q			V
27+35	4.8376	0.30	Q			V
27+40	4.8396	0.29	Q			V
27+45	4.8416	0.28	Q			V
27+50	4.8435	0.27	Q			V
27+55	4.8453	0.26	Q			V
28+ 0	4.8470	0.25	Q			V
28+ 5	4.8485	0.21	Q			V
28+10	4.8498	0.18	Q			V
28+15	4.8510	0.17	Q			V
28+20	4.8521	0.17	Q			V
28+25	4.8532	0.16	Q			V
28+30	4.8543	0.15	Q			V
28+35	4.8553	0.15	Q			V
28+40	4.8562	0.14	Q			V
28+45	4.8572	0.14	Q			V
28+50	4.8581	0.13	Q			V
28+55	4.8590	0.13	Q			V
29+ 0	4.8598	0.12	Q			V
29+ 5	4.8606	0.12	Q			V
29+10	4.8614	0.11	Q			V
29+15	4.8621	0.11	Q			V
29+20	4.8629	0.11	Q			V
29+25	4.8636	0.10	Q			V
29+30	4.8642	0.10	Q			V
29+35	4.8649	0.09	Q			V
29+40	4.8655	0.09	Q			V
29+45	4.8661	0.09	Q			V
29+50	4.8667	0.08	Q			V
29+55	4.8673	0.08	Q			V
30+ 0	4.8678	0.08	Q			V
30+ 5	4.8684	0.08	Q			V
30+10	4.8689	0.07	Q			V

30+15	4.8693	0.07	Q	|	|	|	V|
30+20	4.8698	0.07	Q	|	|	|	V|
30+25	4.8703	0.07	Q	|	|	|	V|
30+30	4.8707	0.06	Q	|	|	|	V|
30+35	4.8711	0.06	Q	|	|	|	V|
30+40	4.8715	0.06	Q	|	|	|	V|
30+45	4.8719	0.06	Q	|	|	|	V|
30+50	4.8723	0.05	Q	|	|	|	V|
30+55	4.8726	0.05	Q	|	|	|	V|
31+ 0	4.8730	0.05	Q	|	|	|	V|
31+ 5	4.8733	0.05	Q	|	|	|	V|
31+10	4.8736	0.05	Q	|	|	|	V|
31+15	4.8739	0.04	Q	|	|	|	V|
31+20	4.8742	0.04	Q	|	|	|	V|
31+25	4.8745	0.04	Q	|	|	|	V|
31+30	4.8748	0.04	Q	|	|	|	V|
31+35	4.8750	0.04	Q	|	|	|	V|
31+40	4.8753	0.04	Q	|	|	|	V|
31+45	4.8755	0.03	Q	|	|	|	V|
31+50	4.8758	0.03	Q	|	|	|	V|
31+55	4.8760	0.03	Q	|	|	|	V|
32+ 0	4.8762	0.03	Q	|	|	|	V|
32+ 5	4.8764	0.03	Q	|	|	|	V|
32+10	4.8766	0.03	Q	|	|	|	V|
32+15	4.8768	0.03	Q	|	|	|	V|
32+20	4.8770	0.03	Q	|	|	|	V|
32+25	4.8771	0.03	Q	|	|	|	V|
32+30	4.8773	0.02	Q	|	|	|	V|
32+35	4.8775	0.02	Q	|	|	|	V|
32+40	4.8776	0.02	Q	|	|	|	V|
32+45	4.8778	0.02	Q	|	|	|	V|
32+50	4.8779	0.02	Q	|	|	|	V|
32+55	4.8781	0.02	Q	|	|	|	V|
33+ 0	4.8782	0.02	Q	|	|	|	V|
33+ 5	4.8783	0.02	Q	|	|	|	V|
33+10	4.8785	0.02	Q	|	|	|	V|
33+15	4.8786	0.02	Q	|	|	|	V|
33+20	4.8787	0.02	Q	|	|	|	V|
33+25	4.8788	0.02	Q	|	|	|	V|
33+30	4.8789	0.02	Q	|	|	|	V|
33+35	4.8790	0.02	Q	|	|	|	V|
33+40	4.8791	0.01	Q	|	|	|	V|
33+45	4.8792	0.01	Q	|	|	|	V|
33+50	4.8793	0.01	Q	|	|	|	V|
33+55	4.8794	0.01	Q	|	|	|	V|
34+ 0	4.8795	0.01	Q	|	|	|	V|
34+ 5	4.8796	0.01	Q	|	|	|	V|
34+10	4.8796	0.01	Q	|	|	|	V|
34+15	4.8797	0.01	Q	|	|	|	V|
34+20	4.8798	0.01	Q	|	|	|	V|
34+25	4.8798	0.01	Q	|	|	|	V|
34+30	4.8799	0.01	Q	|	|	|	V|
34+35	4.8799	0.01	Q	|	|	|	V|
34+40	4.8800	0.01	Q	|	|	|	V|
34+45	4.8800	0.01	Q	|	|	|	V|
34+50	4.8800	0.00	Q	|	|	|	V|
34+55	4.8801	0.00	Q	|	|	|	V|
35+ 0	4.8801	0.00	Q	|	|	|	V|
35+ 5	4.8801	0.00	Q	|	|	|	V|
35+10	4.8801	0.00	Q	|	|	|	V|
35+15	4.8802	0.00	Q	|	|	|	V|
35+20	4.8802	0.00	Q	|	|	|	V|
35+25	4.8802	0.00	Q	|	|	|	V|

35+30	4.8802	0.00	Q	|	|	|	V|
35+35	4.8802	0.00	Q	|	|	|	V|
35+40	4.8802	0.00	Q	|	|	|	V|
35+45	4.8802	0.00	Q	|	|	|	V|
35+50	4.8802	0.00	Q	|	|	|	V|
35+55	4.8803	0.00	Q	|	|	|	V|
36+ 0	4.8803	0.00	Q	|	|	|	V

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

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Study date 05/16/23

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

Program License Serial Number 6145

COVINGTON - MIP BUILDING 2
10 YEAR STORM EVENT PROPOSED UNIT HYDROGRAPH BUILDING 2
5712Q10PUH2
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
5.70	1	0.62
Rainfall data for year 10		
5.70	6	1.27
Rainfall data for year 10		
5.70	24	2.32

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	5.70	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
0.57	0.100	69.0	69.0	4.49	0.147
5.13	0.900	98.0	98.0	0.20	0.902

Area-averaged catchment yield fraction, Y = 0.826
Area-averaged low loss fraction, Yb = 0.174
User entry of time of concentration = 0.158 (hours)
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Watershed area = 5.70(Ac.)
Catchment Lag time = 0.126 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 65.9283
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.055(In/Hr)
Average low loss rate fraction (Yb) = 0.174 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.295(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.621(In)
Computed peak 3-hour rainfall = 0.963(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.320(In)

Rainfall depth area reduction factors:
Using a total area of 5.70(Ac.) (Ref: fig. E-4)

5-minute factor = 1.000 Adjusted rainfall = 0.295(In)
30-minute factor = 1.000 Adjusted rainfall = 0.504(In)
1-hour factor = 1.000 Adjusted rainfall = 0.621(In)
3-hour factor = 1.000 Adjusted rainfall = 0.963(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.320(In)

U n i t H y d r o g r a p h
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Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 68.93 (CFS))		
1	6.808	4.693
2	47.088	27.767
3	71.507	16.833
4	82.068	7.280
5	88.285	4.286
6	92.167	2.676
7	94.861	1.857
8	96.710	1.275
9	97.873	0.801
10	98.616	0.513
11	99.379	0.526
12	100.000	0.428

Total soil rain loss = 0.34(In)
Total effective rainfall = 1.98(In)
Peak flow rate in flood hydrograph = 9.84(CFS)

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24 - H O U R S T O R M

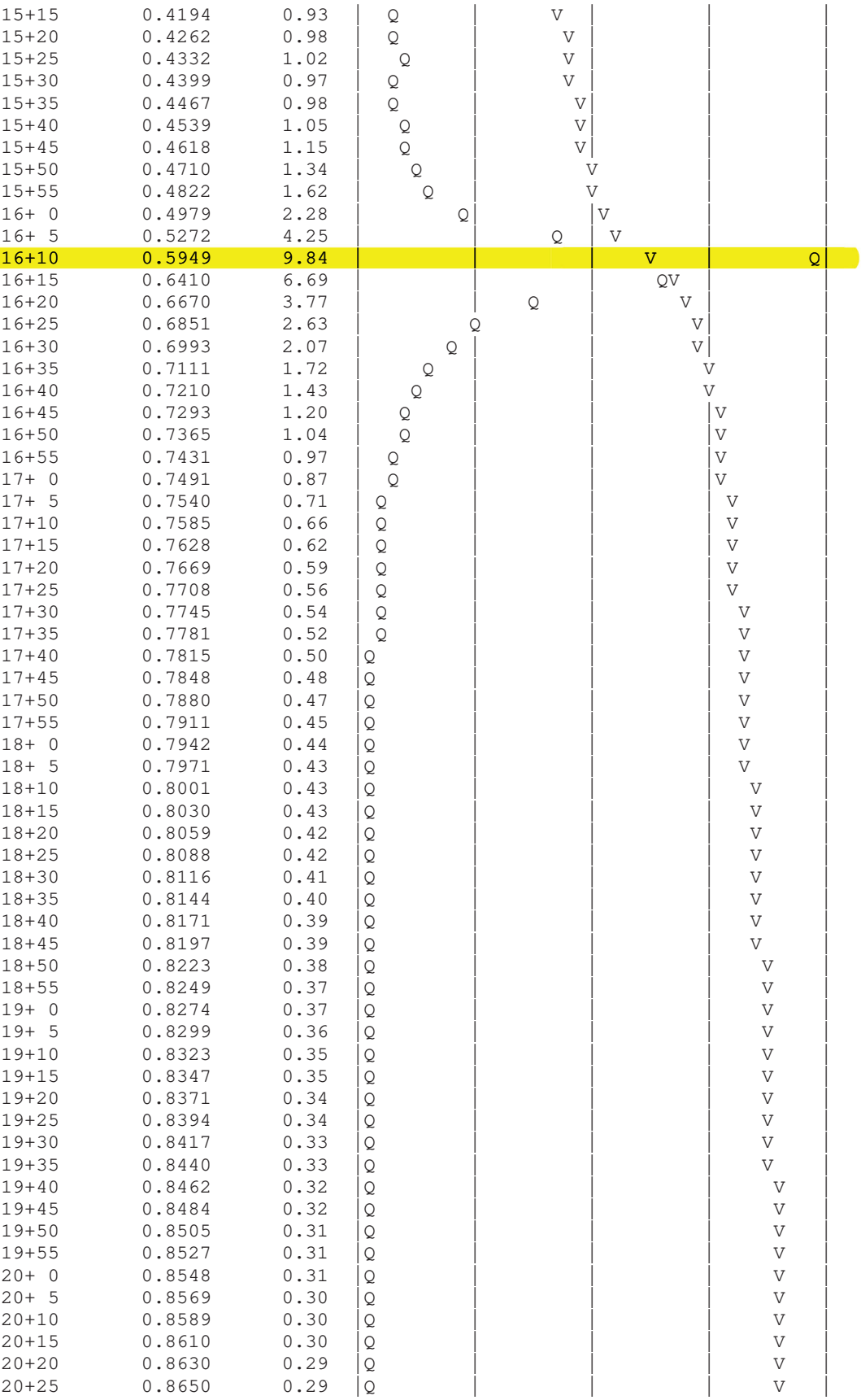
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	2.5	5.0	7.5	10.0
0+ 5	0.0001	0.01	Q				
0+10	0.0007	0.09	Q				
0+15	0.0017	0.14	Q				
0+20	0.0029	0.16	Q				
0+25	0.0041	0.18	Q				
0+30	0.0054	0.19	Q				
0+35	0.0067	0.19	Q				
0+40	0.0080	0.20	Q				
0+45	0.0094	0.20	Q				
0+50	0.0108	0.20	Q				
0+55	0.0122	0.20	Q				
1+ 0	0.0136	0.20	Q				
1+ 5	0.0150	0.21	Q				
1+10	0.0164	0.21	Q				
1+15	0.0178	0.21	Q				
1+20	0.0193	0.21	Q				
1+25	0.0207	0.21	Q				
1+30	0.0221	0.21	Q				
1+35	0.0236	0.21	QV				
1+40	0.0250	0.21	QV				
1+45	0.0265	0.21	QV				
1+50	0.0279	0.21	QV				
1+55	0.0294	0.21	QV				
2+ 0	0.0309	0.21	QV				
2+ 5	0.0323	0.21	QV				
2+10	0.0338	0.21	QV				
2+15	0.0353	0.21	QV				
2+20	0.0368	0.22	QV				
2+25	0.0383	0.22	QV				
2+30	0.0398	0.22	QV				
2+35	0.0413	0.22	QV				
2+40	0.0428	0.22	QV				
2+45	0.0443	0.22	QV				
2+50	0.0458	0.22	QV				
2+55	0.0473	0.22	Q V				
3+ 0	0.0489	0.22	Q V				
3+ 5	0.0504	0.22	Q V				
3+10	0.0519	0.22	Q V				
3+15	0.0535	0.22	Q V				
3+20	0.0550	0.23	Q V				
3+25	0.0566	0.23	Q V				
3+30	0.0581	0.23	Q V				
3+35	0.0597	0.23	Q V				
3+40	0.0613	0.23	Q V				
3+45	0.0629	0.23	Q V				
3+50	0.0644	0.23	Q V				
3+55	0.0660	0.23	Q V				
4+ 0	0.0676	0.23	Q V				
4+ 5	0.0692	0.23	Q V				
4+10	0.0708	0.23	Q V				
4+15	0.0725	0.23	Q V				
4+20	0.0741	0.24	Q V				
4+25	0.0757	0.24	Q V				
4+30	0.0773	0.24	Q V				
4+35	0.0790	0.24	Q V				
4+40	0.0806	0.24	Q V				

4+45	0.0823	0.24	Q V	|	|	|
4+50	0.0840	0.24	Q V	|	|	|
4+55	0.0856	0.24	Q V	|	|	|
5+ 0	0.0873	0.24	Q V	|	|	|
5+ 5	0.0890	0.24	Q V	|	|	|
5+10	0.0907	0.25	Q V	|	|	|
5+15	0.0924	0.25	Q V	|	|	|
5+20	0.0941	0.25	Q V	|	|	|
5+25	0.0958	0.25	Q V	|	|	|
5+30	0.0975	0.25	Q V	|	|	|
5+35	0.0992	0.25	|Q V	|	|	|
5+40	0.1010	0.25	|Q V	|	|	|
5+45	0.1027	0.25	|Q V	|	|	|
5+50	0.1045	0.25	|Q V	|	|	|
5+55	0.1062	0.26	|Q V	|	|	|
6+ 0	0.1080	0.26	|Q V	|	|	|
6+ 5	0.1098	0.26	|Q V	|	|	|
6+10	0.1115	0.26	|Q V	|	|	|
6+15	0.1133	0.26	|Q V	|	|	|
6+20	0.1151	0.26	|Q V	|	|	|
6+25	0.1169	0.26	|Q V	|	|	|
6+30	0.1188	0.26	|Q V	|	|	|
6+35	0.1206	0.27	|Q V	|	|	|
6+40	0.1224	0.27	|Q V	|	|	|
6+45	0.1243	0.27	|Q V	|	|	|
6+50	0.1261	0.27	|Q V	|	|	|
6+55	0.1280	0.27	|Q V	|	|	|
7+ 0	0.1298	0.27	|Q V	|	|	|
7+ 5	0.1317	0.27	|Q V	|	|	|
7+10	0.1336	0.27	|Q V	|	|	|
7+15	0.1355	0.28	|Q V	|	|	|
7+20	0.1374	0.28	|Q V	|	|	|
7+25	0.1393	0.28	|Q V	|	|	|
7+30	0.1413	0.28	|Q V	|	|	|
7+35	0.1432	0.28	|Q V	|	|	|
7+40	0.1452	0.28	|Q V	|	|	|
7+45	0.1471	0.29	|Q V	|	|	|
7+50	0.1491	0.29	|Q V	|	|	|
7+55	0.1511	0.29	|Q V	|	|	|
8+ 0	0.1531	0.29	|Q V	|	|	|
8+ 5	0.1551	0.29	|Q V	|	|	|
8+10	0.1571	0.29	|Q V	|	|	|
8+15	0.1592	0.29	|Q V	|	|	|
8+20	0.1612	0.30	|Q V	|	|	|
8+25	0.1633	0.30	|Q V	|	|	|
8+30	0.1653	0.30	|Q V	|	|	|
8+35	0.1674	0.30	|Q V	|	|	|
8+40	0.1695	0.30	|Q V	|	|	|
8+45	0.1716	0.31	|Q V	|	|	|
8+50	0.1737	0.31	|Q V	|	|	|
8+55	0.1759	0.31	|Q V	|	|	|
9+ 0	0.1780	0.31	|Q V	|	|	|
9+ 5	0.1802	0.31	|Q V	|	|	|
9+10	0.1823	0.32	|Q V	|	|	|
9+15	0.1845	0.32	|Q V	|	|	|
9+20	0.1867	0.32	|Q V	|	|	|
9+25	0.1890	0.32	|Q V	|	|	|
9+30	0.1912	0.32	|Q V	|	|	|
9+35	0.1935	0.33	|Q V	|	|	|
9+40	0.1957	0.33	|Q V	|	|	|
9+45	0.1980	0.33	|Q V	|	|	|
9+50	0.2003	0.33	|Q V	|	|	|
9+55	0.2026	0.34	|Q V	|	|	|

10+ 0	0.2050	0.34	Q V	|	|	|	|
10+ 5	0.2073	0.34	Q V	|	|	|	|
10+10	0.2097	0.34	Q V	|	|	|	|
10+15	0.2121	0.35	Q V	|	|	|	|
10+20	0.2145	0.35	Q V	|	|	|	|
10+25	0.2169	0.35	Q V	|	|	|	|
10+30	0.2194	0.36	Q V	|	|	|	|
10+35	0.2218	0.36	Q V	|	|	|	|
10+40	0.2243	0.36	Q V	|	|	|	|
10+45	0.2268	0.36	Q V	|	|	|	|
10+50	0.2294	0.37	Q V	|	|	|	|
10+55	0.2319	0.37	Q V	|	|	|	|
11+ 0	0.2345	0.37	Q V	|	|	|	|
11+ 5	0.2371	0.38	Q V	|	|	|	|
11+10	0.2397	0.38	Q V	|	|	|	|
11+15	0.2424	0.38	Q V	|	|	|	|
11+20	0.2451	0.39	Q V	|	|	|	|
11+25	0.2478	0.39	Q V	|	|	|	|
11+30	0.2505	0.40	Q V	|	|	|	|
11+35	0.2532	0.40	Q V	|	|	|	|
11+40	0.2560	0.40	Q V	|	|	|	|
11+45	0.2588	0.41	Q | V	|	|	|	|
11+50	0.2617	0.41	Q | V	|	|	|	|
11+55	0.2646	0.42	Q | V	|	|	|	|
12+ 0	0.2675	0.42	Q | V	|	|	|	|
12+ 5	0.2704	0.42	Q | V	|	|	|	|
12+10	0.2732	0.41	Q | V	|	|	|	|
12+15	0.2761	0.41	Q | V	|	|	|	|
12+20	0.2789	0.41	Q | V	|	|	|	|
12+25	0.2818	0.42	Q | V	|	|	|	|
12+30	0.2847	0.42	Q | V	|	|	|	|
12+35	0.2876	0.42	Q | V	|	|	|	|
12+40	0.2905	0.43	Q | V	|	|	|	|
12+45	0.2935	0.44	Q | V	|	|	|	|
12+50	0.2966	0.44	Q | V	|	|	|	|
12+55	0.2997	0.45	Q | V	|	|	|	|
13+ 0	0.3028	0.45	Q | V	|	|	|	|
13+ 5	0.3060	0.46	Q | V	|	|	|	|
13+10	0.3092	0.47	Q | V	|	|	|	|
13+15	0.3125	0.48	Q | V	|	|	|	|
13+20	0.3158	0.49	Q | V	|	|	|	|
13+25	0.3192	0.49	Q | V	|	|	|	|
13+30	0.3227	0.50	| Q | V	|	|	|	|
13+35	0.3262	0.51	| Q | V	|	|	|	|
13+40	0.3298	0.52	| Q | V	|	|	|	|
13+45	0.3335	0.53	| Q | V	|	|	|	|
13+50	0.3372	0.54	| Q | V	|	|	|	|
13+55	0.3410	0.55	| Q | V	|	|	|	|
14+ 0	0.3449	0.57	| Q | V	|	|	|	|
14+ 5	0.3489	0.58	| Q | V	|	|	|	|
14+10	0.3530	0.59	| Q | V	|	|	|	|
14+15	0.3572	0.61	| Q | V	|	|	|	|
14+20	0.3615	0.63	| Q | V	|	|	|	|
14+25	0.3660	0.64	| Q | V	|	|	|	|
14+30	0.3705	0.66	| Q | V	|	|	|	|
14+35	0.3752	0.68	| Q | V	|	|	|	|
14+40	0.3800	0.70	| Q | V	|	|	|	|
14+45	0.3850	0.72	| Q | V	|	|	|	|
14+50	0.3902	0.75	| Q | V	|	|	|	|
14+55	0.3955	0.78	| Q | V	|	|	|	|
15+ 0	0.4011	0.81	| Q | V	|	|	|	|
15+ 5	0.4069	0.84	| Q | V	|	|	|	|
15+10	0.4131	0.89	| Q | V	|	|	|	|

15+15	0.4194	0.93	
15+20	0.4262	0.98	
15+25	0.4332	1.02	
15+30	0.4399	0.97	
15+35	0.4467	0.98	
15+40	0.4539	1.05	
15+45	0.4618	1.15	
15+50	0.4710	1.34	
15+55	0.4822	1.62	
16+ 0	0.4979	2.28	
16+ 5	0.5272	4.25	
16+10	0.5949	9.84	
16+15	0.6410	6.69	
16+20	0.6670	3.77	
16+25	0.6851	2.63	
16+30	0.6993	2.07	
16+35	0.7111	1.72	
16+40	0.7210	1.43	
16+45	0.7293	1.20	
16+50	0.7365	1.04	
16+55	0.7431	0.97	
17+ 0	0.7491	0.87	
17+ 5	0.7540	0.71	
17+10	0.7585	0.66	
17+15	0.7628	0.62	
17+20	0.7669	0.59	
17+25	0.7708	0.56	
17+30	0.7745	0.54	
17+35	0.7781	0.52	
17+40	0.7815	0.50	
17+45	0.7848	0.48	
17+50	0.7880	0.47	
17+55	0.7911	0.45	
18+ 0	0.7942	0.44	
18+ 5	0.7971	0.43	
18+10	0.8001	0.43	
18+15	0.8030	0.43	
18+20	0.8059	0.42	
18+25	0.8088	0.42	
18+30	0.8116	0.41	
18+35	0.8144	0.40	
18+40	0.8171	0.39	
18+45	0.8197	0.39	
18+50	0.8223	0.38	
18+55	0.8249	0.37	
19+ 0	0.8274	0.37	
19+ 5	0.8299	0.36	
19+10	0.8323	0.35	
19+15	0.8347	0.35	
19+20	0.8371	0.34	
19+25	0.8394	0.34	
19+30	0.8417	0.33	
19+35	0.8440	0.33	
19+40	0.8462	0.32	
19+45	0.8484	0.32	
19+50	0.8505	0.31	
19+55	0.8527	0.31	
20+ 0	0.8548	0.31	
20+ 5	0.8569	0.30	
20+10	0.8589	0.30	
20+15	0.8610	0.30	
20+20	0.8630	0.29	
20+25	0.8650	0.29	

20+30	0.8669	0.29	Q				V
20+35	0.8689	0.28	Q				V
20+40	0.8708	0.28	Q				V
20+45	0.8727	0.28	Q				V
20+50	0.8746	0.27	Q				V
20+55	0.8765	0.27	Q				V
21+ 0	0.8783	0.27	Q				V
21+ 5	0.8801	0.27	Q				V
21+10	0.8820	0.26	Q				V
21+15	0.8837	0.26	Q				V
21+20	0.8855	0.26	Q				V
21+25	0.8873	0.26	Q				V
21+30	0.8890	0.25	Q				V
21+35	0.8908	0.25	Q				V
21+40	0.8925	0.25	Q				V
21+45	0.8942	0.25	Q				V
21+50	0.8959	0.24	Q				V
21+55	0.8975	0.24	Q				V
22+ 0	0.8992	0.24	Q				V
22+ 5	0.9008	0.24	Q				V
22+10	0.9025	0.24	Q				V
22+15	0.9041	0.23	Q				V
22+20	0.9057	0.23	Q				V
22+25	0.9073	0.23	Q				V
22+30	0.9089	0.23	Q				V
22+35	0.9104	0.23	Q				V
22+40	0.9120	0.23	Q				V
22+45	0.9135	0.22	Q				V
22+50	0.9151	0.22	Q				V
22+55	0.9166	0.22	Q				V
23+ 0	0.9181	0.22	Q				V
23+ 5	0.9196	0.22	Q				V
23+10	0.9211	0.22	Q				V
23+15	0.9226	0.22	Q				V
23+20	0.9241	0.21	Q				V
23+25	0.9255	0.21	Q				V
23+30	0.9270	0.21	Q				V
23+35	0.9284	0.21	Q				V
23+40	0.9298	0.21	Q				V
23+45	0.9313	0.21	Q				V
23+50	0.9327	0.21	Q				V
23+55	0.9341	0.20	Q				V
24+ 0	0.9355	0.20	Q				V
24+ 5	0.9368	0.19	Q				V
24+10	0.9375	0.11	Q				V
24+15	0.9379	0.06	Q				V
24+20	0.9382	0.04	Q				V
24+25	0.9383	0.02	Q				V
24+30	0.9384	0.02	Q				V
24+35	0.9385	0.01	Q				V
24+40	0.9386	0.01	Q				V
24+45	0.9386	0.00	Q				V
24+50	0.9386	0.00	Q				V
24+55	0.9386	0.00	Q				V

FLOOD HYDROGRAPH ROUTING PROGRAM
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Study date: 05/16/23

COVINGTON - MIP BUILDING 2
10 YEAR STORM EVENT BASIN ROUTING BUILDING 2
5712Q10ROUTING2
DS

Program License Serial Number 6145

********** HYDROGRAPH INFORMATION **********

From study/file name: 5712Q10PUH2.rte
**********HYDROGRAPH DATA**********
Number of intervals = 299
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 9.842 (CFS)
Total volume = 0.939 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

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Process from Point/Station 0.000 to Point/Station 0.000
**** RETARDING BASIN ROUTING ****

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 299
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.027	0.340	0.026	0.028
1.500	0.107	0.340	0.106	0.108
2.500	0.205	0.340	0.204	0.206
3.000	0.258	0.340	0.257	0.259
3.250	0.285	0.340	0.284	0.286
4.250	0.395	1.720	0.389	0.401

5.250	0.506	2.510	0.497	0.515
7.500	0.691	3.670	0.678	0.704
8.000	0.782	3.880	0.769	0.795
9.000	0.845	4.250	0.830	0.860
10.000	0.846	4.600	0.830	0.862
11.000	0.847	4.920	0.830	0.864
12.000	0.848	5.220	0.830	0.866

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0 2.5 4.92 7.38 9.84	Depth (Ft.)
0.083	0.01	0.00	0.000	O	0.00
0.167	0.09	0.00	0.000	O	0.01
0.250	0.14	0.01	0.001	O	0.02
0.333	0.16	0.03	0.002	O	0.04
0.417	0.18	0.04	0.003	O	0.06
0.500	0.19	0.05	0.004	O	0.07
0.583	0.19	0.06	0.005	O	0.09
0.667	0.20	0.07	0.006	O	0.11
0.750	0.20	0.08	0.007	O	0.12
0.833	0.20	0.09	0.007	O	0.14
0.917	0.20	0.10	0.008	O	0.15
1.000	0.20	0.11	0.009	O	0.16
1.083	0.21	0.12	0.009	O	0.17
1.167	0.21	0.13	0.010	O	0.18
1.250	0.21	0.13	0.010	O	0.19
1.333	0.21	0.14	0.011	O	0.20
1.417	0.21	0.14	0.011	O	0.21
1.500	0.21	0.15	0.012	O	0.22
1.583	0.21	0.15	0.012	O	0.23
1.667	0.21	0.16	0.013	O	0.23
1.750	0.21	0.16	0.013	O	0.24
1.833	0.21	0.17	0.013	O	0.25
1.917	0.21	0.17	0.014	O	0.25
2.000	0.21	0.17	0.014	O	0.26
2.083	0.21	0.18	0.014	O	0.26
2.167	0.21	0.18	0.014	O	0.27
2.250	0.21	0.18	0.015	O	0.27
2.333	0.22	0.19	0.015	O	0.27
2.417	0.22	0.19	0.015	O	0.28
2.500	0.22	0.19	0.015	O	0.28
2.583	0.22	0.19	0.015	O	0.28
2.667	0.22	0.20	0.016	O	0.29
2.750	0.22	0.20	0.016	O	0.29
2.833	0.22	0.20	0.016	O	0.29
2.917	0.22	0.20	0.016	O	0.30
3.000	0.22	0.20	0.016	O	0.30
3.083	0.22	0.20	0.016	O	0.30
3.167	0.22	0.21	0.016	O	0.30
3.250	0.22	0.21	0.016	O	0.30
3.333	0.23	0.21	0.017	O	0.31
3.417	0.23	0.21	0.017	O	0.31
3.500	0.23	0.21	0.017	O	0.31
3.583	0.23	0.21	0.017	O	0.31
3.667	0.23	0.21	0.017	O	0.31
3.750	0.23	0.22	0.017	O	0.32
3.833	0.23	0.22	0.017	O	0.32
3.917	0.23	0.22	0.017	O	0.32
4.000	0.23	0.22	0.017	O	0.32

4.083	0.23	0.22	0.017	O				0.32
4.167	0.23	0.22	0.018	O				0.33
4.250	0.23	0.22	0.018	O				0.33
4.333	0.24	0.22	0.018	O				0.33
4.417	0.24	0.22	0.018	O				0.33
4.500	0.24	0.23	0.018	O				0.33
4.583	0.24	0.23	0.018	O				0.33
4.667	0.24	0.23	0.018	O				0.33
4.750	0.24	0.23	0.018	O				0.34
4.833	0.24	0.23	0.018	O				0.34
4.917	0.24	0.23	0.018	O				0.34
5.000	0.24	0.23	0.018	O				0.34
5.083	0.24	0.23	0.018	O				0.34
5.167	0.25	0.23	0.019	O				0.34
5.250	0.25	0.23	0.019	O				0.34
5.333	0.25	0.24	0.019	O				0.35
5.417	0.25	0.24	0.019	O				0.35
5.500	0.25	0.24	0.019	O				0.35
5.583	0.25	0.24	0.019	O				0.35
5.667	0.25	0.24	0.019	O				0.35
5.750	0.25	0.24	0.019	O				0.35
5.833	0.25	0.24	0.019	O				0.36
5.917	0.26	0.24	0.019	O				0.36
6.000	0.26	0.24	0.019	O				0.36
6.083	0.26	0.25	0.019	O				0.36
6.167	0.26	0.25	0.020	O				0.36
6.250	0.26	0.25	0.020	O				0.36
6.333	0.26	0.25	0.020	O				0.37
6.417	0.26	0.25	0.020	O				0.37
6.500	0.26	0.25	0.020	O				0.37
6.583	0.27	0.25	0.020	O				0.37
6.667	0.27	0.25	0.020	O				0.37
6.750	0.27	0.25	0.020	O				0.37
6.833	0.27	0.26	0.020	O				0.38
6.917	0.27	0.26	0.020	O				0.38
7.000	0.27	0.26	0.020	O				0.38
7.083	0.27	0.26	0.021	O				0.38
7.167	0.27	0.26	0.021	O				0.38
7.250	0.28	0.26	0.021	O				0.38
7.333	0.28	0.26	0.021	O				0.39
7.417	0.28	0.26	0.021	O				0.39
7.500	0.28	0.27	0.021	O				0.39
7.583	0.28	0.27	0.021	O				0.39
7.667	0.28	0.27	0.021	O				0.39
7.750	0.29	0.27	0.021	O				0.40
7.833	0.29	0.27	0.021	O				0.40
7.917	0.29	0.27	0.022	O				0.40
8.000	0.29	0.27	0.022	O				0.40
8.083	0.29	0.27	0.022	O				0.40
8.167	0.29	0.28	0.022	O				0.41
8.250	0.29	0.28	0.022	O				0.41
8.333	0.30	0.28	0.022	O				0.41
8.417	0.30	0.28	0.022	O				0.41
8.500	0.30	0.28	0.022	O				0.42
8.583	0.30	0.28	0.023	O				0.42
8.667	0.30	0.29	0.023	O				0.42
8.750	0.31	0.29	0.023	O				0.42
8.833	0.31	0.29	0.023	OI				0.42
8.917	0.31	0.29	0.023	OI				0.43
9.000	0.31	0.29	0.023	OI				0.43
9.083	0.31	0.29	0.023	OI				0.43
9.167	0.32	0.30	0.023	OI				0.43
9.250	0.32	0.30	0.024	OI				0.44

9.333	0.32	0.30	0.024	OI					0.44
9.417	0.32	0.30	0.024	OI					0.44
9.500	0.32	0.30	0.024	OI					0.45
9.583	0.33	0.30	0.024	OI					0.45
9.667	0.33	0.31	0.024	OI					0.45
9.750	0.33	0.31	0.025	O					0.45
9.833	0.33	0.31	0.025	O					0.46
9.917	0.34	0.31	0.025	O					0.46
10.000	0.34	0.31	0.025	O					0.46
10.083	0.34	0.32	0.025	O					0.47
10.167	0.34	0.32	0.025	O					0.47
10.250	0.35	0.32	0.026	O					0.47
10.333	0.35	0.32	0.026	O					0.48
10.417	0.35	0.33	0.026	O					0.48
10.500	0.36	0.33	0.026	O					0.48
10.583	0.36	0.33	0.026	O					0.49
10.667	0.36	0.33	0.026	O					0.49
10.750	0.36	0.34	0.027	O					0.49
10.833	0.37	0.34	0.027	O					0.50
10.917	0.37	0.34	0.027	O					0.50
11.000	0.37	0.34	0.027	O					0.50
11.083	0.38	0.34	0.028	O					0.51
11.167	0.38	0.34	0.028	O					0.51
11.250	0.38	0.34	0.028	O					0.51
11.333	0.39	0.34	0.028	O					0.52
11.417	0.39	0.34	0.029	O					0.52
11.500	0.40	0.34	0.029	O					0.53
11.583	0.40	0.34	0.030	O					0.53
11.667	0.40	0.34	0.030	O					0.54
11.750	0.41	0.34	0.030	O					0.54
11.833	0.41	0.34	0.031	O					0.55
11.917	0.42	0.34	0.031	O					0.56
12.000	0.42	0.34	0.032	O					0.56
12.083	0.42	0.34	0.033	O					0.57
12.167	0.41	0.34	0.033	O					0.58
12.250	0.41	0.34	0.034	O					0.58
12.333	0.41	0.34	0.034	O					0.59
12.417	0.42	0.34	0.035	O					0.60
12.500	0.42	0.34	0.035	O					0.60
12.583	0.42	0.34	0.036	O					0.61
12.667	0.43	0.34	0.036	O					0.62
12.750	0.44	0.34	0.037	O					0.62
12.833	0.44	0.34	0.038	O					0.63
12.917	0.45	0.34	0.038	O					0.64
13.000	0.45	0.34	0.039	O					0.65
13.083	0.46	0.34	0.040	O					0.66
13.167	0.47	0.34	0.041	O					0.67
13.250	0.48	0.34	0.042	O					0.68
13.333	0.49	0.34	0.043	O					0.70
13.417	0.49	0.34	0.044	O					0.71
13.500	0.50	0.34	0.045	O					0.72
13.583	0.51	0.34	0.046	O					0.74
13.667	0.52	0.34	0.047	O					0.75
13.750	0.53	0.34	0.048	O					0.77
13.833	0.54	0.34	0.050	O					0.79
13.917	0.55	0.34	0.051	O					0.80
14.000	0.57	0.34	0.053	O					0.82
14.083	0.58	0.34	0.054	O					0.84
14.167	0.59	0.34	0.056	O					0.86
14.250	0.61	0.34	0.058	O					0.89
14.333	0.63	0.34	0.060	OI					0.91
14.417	0.64	0.34	0.062	OI					0.94
14.500	0.66	0.34	0.064	OI					0.96

14.583	0.68	0.34	0.066	OI				0.99
14.667	0.70	0.34	0.069	OI				1.02
14.750	0.72	0.34	0.071	OI				1.05
14.833	0.75	0.34	0.074	OI				1.09
14.917	0.78	0.34	0.077	OI				1.12
15.000	0.81	0.34	0.080	OI				1.16
15.083	0.84	0.34	0.083	OI				1.20
15.167	0.89	0.34	0.087	OI				1.25
15.250	0.93	0.34	0.091	O I				1.30
15.333	0.98	0.34	0.095	O I				1.35
15.417	1.02	0.34	0.100	O I				1.41
15.500	0.97	0.34	0.104	O I				1.47
15.583	0.98	0.34	0.109	O I				1.52
15.667	1.05	0.34	0.113	O I				1.56
15.750	1.15	0.34	0.118	O I				1.62
15.833	1.34	0.34	0.125	O I				1.68
15.917	1.62	0.34	0.133	O I				1.76
16.000	2.28	0.34	0.144	O I				1.87
16.083	4.25	0.34	0.164	O	I			2.08
16.167	9.84	0.34	0.210	O			I	2.55
16.250	6.69	0.34	0.265	O		I		3.06
16.333	3.77	0.50	0.298	O	I			3.36
16.417	2.63	0.72	0.316	O	I			3.53
16.500	2.07	0.86	0.326	O I				3.62
16.583	1.72	0.94	0.333	O I				3.69
16.667	1.43	1.00	0.337	OI				3.72
16.750	1.20	1.02	0.339	O				3.74
16.833	1.04	1.03	0.340	O				3.75
16.917	0.97	1.03	0.340	O				3.75
17.000	0.87	1.02	0.339	IO				3.74
17.083	0.71	1.00	0.338	IO				3.73
17.167	0.66	0.97	0.335	IO				3.71
17.250	0.62	0.95	0.333	IO				3.69
17.333	0.59	0.92	0.331	IO				3.67
17.417	0.56	0.89	0.329	IO				3.65
17.500	0.54	0.86	0.327	IO				3.63
17.583	0.52	0.83	0.324	IO				3.61
17.667	0.50	0.81	0.322	IO				3.59
17.750	0.48	0.78	0.320	IO				3.57
17.833	0.47	0.76	0.318	IO				3.55
17.917	0.45	0.73	0.316	IO				3.53
18.000	0.44	0.71	0.314	IO				3.52
18.083	0.43	0.68	0.312	IO				3.50
18.167	0.43	0.66	0.311	IO				3.48
18.250	0.43	0.64	0.309	IO				3.47
18.333	0.42	0.63	0.308	IO				3.46
18.417	0.42	0.61	0.306	O				3.44
18.500	0.41	0.59	0.305	O				3.43
18.583	0.40	0.58	0.304	O				3.42
18.667	0.39	0.56	0.303	O				3.41
18.750	0.39	0.55	0.302	O				3.40
18.833	0.38	0.53	0.300	O				3.39
18.917	0.37	0.52	0.299	O				3.38
19.000	0.37	0.51	0.298	O				3.37
19.083	0.36	0.50	0.297	O				3.36
19.167	0.35	0.48	0.297	O				3.35
19.250	0.35	0.47	0.296	O				3.35
19.333	0.34	0.46	0.295	O				3.34
19.417	0.34	0.45	0.294	O				3.33
19.500	0.33	0.44	0.293	O				3.32
19.583	0.33	0.43	0.292	O				3.32
19.667	0.32	0.42	0.292	O				3.31
19.750	0.32	0.42	0.291	O				3.31

19.833	0.31	0.41	0.290	|O	|	|	|	3.30
19.917	0.31	0.40	0.290	|O	|	|	|	3.29
20.000	0.31	0.39	0.289	IO	|	|	|	3.29
20.083	0.30	0.39	0.289	IO	|	|	|	3.28
20.167	0.30	0.38	0.288	IO	|	|	|	3.28
20.250	0.30	0.37	0.288	IO	|	|	|	3.27
20.333	0.29	0.37	0.287	IO	|	|	|	3.27
20.417	0.29	0.36	0.287	IO	|	|	|	3.26
20.500	0.29	0.35	0.286	IO	|	|	|	3.26
20.583	0.28	0.35	0.286	IO	|	|	|	3.26
20.667	0.28	0.34	0.285	IO	|	|	|	3.25
20.750	0.28	0.34	0.285	IO	|	|	|	3.25
20.833	0.27	0.34	0.284	IO	|	|	|	3.24
20.917	0.27	0.34	0.284	IO	|	|	|	3.24
21.000	0.27	0.34	0.283	IO	|	|	|	3.23
21.083	0.27	0.34	0.283	IO	|	|	|	3.23
21.167	0.26	0.34	0.282	IO	|	|	|	3.22
21.250	0.26	0.34	0.282	IO	|	|	|	3.22
21.333	0.26	0.34	0.281	IO	|	|	|	3.21
21.417	0.26	0.34	0.281	IO	|	|	|	3.21
21.500	0.25	0.34	0.280	IO	|	|	|	3.20
21.583	0.25	0.34	0.279	IO	|	|	|	3.20
21.667	0.25	0.34	0.279	IO	|	|	|	3.19
21.750	0.25	0.34	0.278	IO	|	|	|	3.19
21.833	0.24	0.34	0.278	IO	|	|	|	3.18
21.917	0.24	0.34	0.277	IO	|	|	|	3.17
22.000	0.24	0.34	0.276	IO	|	|	|	3.17
22.083	0.24	0.34	0.275	IO	|	|	|	3.16
22.167	0.24	0.34	0.275	IO	|	|	|	3.16
22.250	0.23	0.34	0.274	IO	|	|	|	3.15
22.333	0.23	0.34	0.273	IO	|	|	|	3.14
22.417	0.23	0.34	0.273	IO	|	|	|	3.14
22.500	0.23	0.34	0.272	IO	|	|	|	3.13
22.583	0.23	0.34	0.271	IO	|	|	|	3.12
22.667	0.23	0.34	0.270	IO	|	|	|	3.11
22.750	0.22	0.34	0.269	IO	|	|	|	3.11
22.833	0.22	0.34	0.269	IO	|	|	|	3.10
22.917	0.22	0.34	0.268	IO	|	|	|	3.09
23.000	0.22	0.34	0.267	IO	|	|	|	3.08
23.083	0.22	0.34	0.266	IO	|	|	|	3.08
23.167	0.22	0.34	0.265	IO	|	|	|	3.07
23.250	0.22	0.34	0.265	IO	|	|	|	3.06
23.333	0.21	0.34	0.264	IO	|	|	|	3.05
23.417	0.21	0.34	0.263	IO	|	|	|	3.04
23.500	0.21	0.34	0.262	IO	|	|	|	3.04
23.583	0.21	0.34	0.261	IO	|	|	|	3.03
23.667	0.21	0.34	0.260	IO	|	|	|	3.02
23.750	0.21	0.34	0.259	IO	|	|	|	3.01
23.833	0.21	0.34	0.258	IO	|	|	|	3.00
23.917	0.20	0.34	0.257	IO	|	|	|	2.99
24.000	0.20	0.34	0.256	IO	|	|	|	2.99
24.083	0.19	0.34	0.255	IO	|	|	|	2.98
24.167	0.11	0.34	0.254	IO	|	|	|	2.96
24.250	0.06	0.34	0.252	IO	|	|	|	2.95
24.333	0.04	0.34	0.250	IO	|	|	|	2.93
24.417	0.02	0.34	0.248	IO	|	|	|	2.91
24.500	0.02	0.34	0.246	IO	|	|	|	2.89
24.583	0.01	0.34	0.244	IO	|	|	|	2.87
24.667	0.01	0.34	0.241	IO	|	|	|	2.84
24.750	0.00	0.34	0.239	IO	|	|	|	2.82
24.833	0.00	0.34	0.237	IO	|	|	|	2.80
24.917	0.00	0.34	0.234	IO	|	|	|	2.78
25.000	0.00	0.34	0.232	IO	|	|	|	2.76

25.083	0.00	0.34	0.230	IO				2.73
25.167	0.00	0.34	0.227	IO				2.71
25.250	0.00	0.34	0.225	IO				2.69
25.333	0.00	0.34	0.223	IO				2.67
25.417	0.00	0.34	0.220	IO				2.65
25.500	0.00	0.34	0.218	IO				2.62
25.583	0.00	0.34	0.216	IO				2.60
25.667	0.00	0.34	0.213	IO				2.58
25.750	0.00	0.34	0.211	IO				2.56
25.833	0.00	0.34	0.209	IO				2.54
25.917	0.00	0.34	0.206	IO				2.51
26.000	0.00	0.34	0.204	IO				2.49
26.083	0.00	0.34	0.202	IO				2.47
26.167	0.00	0.34	0.199	IO				2.44
26.250	0.00	0.34	0.197	IO				2.42
26.333	0.00	0.34	0.195	IO				2.39
26.417	0.00	0.34	0.192	IO				2.37
26.500	0.00	0.34	0.190	IO				2.35
26.583	0.00	0.34	0.188	IO				2.32
26.667	0.00	0.34	0.185	IO				2.30
26.750	0.00	0.34	0.183	IO				2.28
26.833	0.00	0.34	0.181	IO				2.25
26.917	0.00	0.34	0.178	IO				2.23
27.000	0.00	0.34	0.176	IO				2.20
27.083	0.00	0.34	0.174	IO				2.18
27.167	0.00	0.34	0.171	IO				2.16
27.250	0.00	0.34	0.169	IO				2.13
27.333	0.00	0.34	0.167	IO				2.11
27.417	0.00	0.34	0.164	IO				2.08
27.500	0.00	0.34	0.162	IO				2.06
27.583	0.00	0.34	0.160	IO				2.04
27.667	0.00	0.34	0.157	IO				2.01
27.750	0.00	0.34	0.155	IO				1.99
27.833	0.00	0.34	0.153	IO				1.96
27.917	0.00	0.34	0.150	IO				1.94
28.000	0.00	0.34	0.148	IO				1.92
28.083	0.00	0.34	0.146	IO				1.89
28.167	0.00	0.34	0.143	IO				1.87
28.250	0.00	0.34	0.141	IO				1.85
28.333	0.00	0.34	0.138	IO				1.82
28.417	0.00	0.34	0.136	IO				1.80
28.500	0.00	0.34	0.134	IO				1.77
28.583	0.00	0.34	0.131	IO				1.75
28.667	0.00	0.34	0.129	IO				1.73
28.750	0.00	0.34	0.127	IO				1.70
28.833	0.00	0.34	0.124	IO				1.68
28.917	0.00	0.34	0.122	IO				1.65
29.000	0.00	0.34	0.120	IO				1.63
29.083	0.00	0.34	0.117	IO				1.61
29.167	0.00	0.34	0.115	IO				1.58
29.250	0.00	0.34	0.113	IO				1.56
29.333	0.00	0.34	0.110	IO				1.53
29.417	0.00	0.34	0.108	IO				1.51
29.500	0.00	0.34	0.106	IO				1.48
29.583	0.00	0.34	0.103	IO				1.45
29.667	0.00	0.34	0.101	IO				1.43
29.750	0.00	0.34	0.099	IO				1.40
29.833	0.00	0.34	0.096	IO				1.37
29.917	0.00	0.34	0.094	IO				1.34
30.000	0.00	0.34	0.092	IO				1.31
30.083	0.00	0.34	0.089	IO				1.28
30.167	0.00	0.34	0.087	IO				1.25
30.250	0.00	0.34	0.085	IO				1.22

30.333	0.00	0.34	0.082	IO				1.19
30.417	0.00	0.34	0.080	IO				1.16
30.500	0.00	0.34	0.078	IO				1.13
30.583	0.00	0.34	0.075	IO				1.10
30.667	0.00	0.34	0.073	IO				1.07
30.750	0.00	0.34	0.071	IO				1.04
30.833	0.00	0.34	0.068	IO				1.02
30.917	0.00	0.34	0.066	IO				0.99
31.000	0.00	0.34	0.064	IO				0.96
31.083	0.00	0.34	0.061	IO				0.93
31.167	0.00	0.34	0.059	IO				0.90
31.250	0.00	0.34	0.057	IO				0.87
31.333	0.00	0.34	0.054	IO				0.84
31.417	0.00	0.34	0.052	IO				0.81
31.500	0.00	0.34	0.049	IO				0.78
31.583	0.00	0.34	0.047	IO				0.75
31.667	0.00	0.34	0.045	IO				0.72
31.750	0.00	0.34	0.042	IO				0.69
31.833	0.00	0.34	0.040	IO				0.66
31.917	0.00	0.34	0.038	IO				0.63
32.000	0.00	0.34	0.035	IO				0.61
32.083	0.00	0.34	0.033	IO				0.58
32.167	0.00	0.34	0.031	IO				0.55
32.250	0.00	0.34	0.028	IO				0.52
32.333	0.00	0.33	0.026	IO				0.48
32.417	0.00	0.30	0.024	O				0.44
32.500	0.00	0.28	0.022	O				0.41
32.583	0.00	0.25	0.020	O				0.37
32.667	0.00	0.23	0.018	O				0.34
32.750	0.00	0.21	0.017	O				0.31
32.833	0.00	0.20	0.016	O				0.29
32.917	0.00	0.18	0.014	O				0.26
33.000	0.00	0.16	0.013	O				0.24
33.083	0.00	0.15	0.012	O				0.22
33.167	0.00	0.14	0.011	O				0.20
33.250	0.00	0.13	0.010	O				0.19
33.333	0.00	0.12	0.009	O				0.17
33.417	0.00	0.11	0.008	O				0.16
33.500	0.00	0.10	0.008	O				0.14
33.583	0.00	0.09	0.007	O				0.13
33.667	0.00	0.08	0.007	O				0.12
33.750	0.00	0.08	0.006	O				0.11
33.833	0.00	0.07	0.005	O				0.10
33.917	0.00	0.06	0.005	O				0.09
34.000	0.00	0.06	0.005	O				0.09
34.083	0.00	0.05	0.004	O				0.08
34.167	0.00	0.05	0.004	O				0.07
34.250	0.00	0.04	0.004	O				0.07
34.333	0.00	0.04	0.003	O				0.06
34.417	0.00	0.04	0.003	O				0.06
34.500	0.00	0.03	0.003	O				0.05
34.583	0.00	0.03	0.003	O				0.05
34.667	0.00	0.03	0.002	O				0.04
34.750	0.00	0.03	0.002	O				0.04
34.833	0.00	0.02	0.002	O				0.04
34.917	0.00	0.02	0.002	O				0.03
35.000	0.00	0.02	0.002	O				0.03
35.083	0.00	0.02	0.001	O				0.03
35.167	0.00	0.02	0.001	O				0.03
35.250	0.00	0.02	0.001	O				0.02
35.333	0.00	0.01	0.001	O				0.02
35.417	0.00	0.01	0.001	O				0.02
35.500	0.00	0.01	0.001	O				0.02

35.583	0.00	0.01	0.001	O	|	|	|	|	0.02
35.667	0.00	0.01	0.001	O	|	|	|	|	0.02
35.750	0.00	0.01	0.001	O	|	|	|	|	0.01
35.833	0.00	0.01	0.001	O	|	|	|	|	0.01
35.917	0.00	0.01	0.001	O	|	|	|	|	0.01
36.000	0.00	0.01	0.001	O	|	|	|	|	0.01
36.083	0.00	0.01	0.001	O	|	|	|	|	0.01
36.167	0.00	0.01	0.000	O	|	|	|	|	0.01
36.250	0.00	0.01	0.000	O	|	|	|	|	0.01
36.333	0.00	0.01	0.000	O	|	|	|	|	0.01
36.417	0.00	0.00	0.000	O	|	|	|	|	0.01
36.500	0.00	0.00	0.000	O	|	|	|	|	0.01
36.583	0.00	0.00	0.000	O	|	|	|	|	0.01
36.667	0.00	0.00	0.000	O	|	|	|	|	0.01
36.750	0.00	0.00	0.000	O	|	|	|	|	0.00
36.833	0.00	0.00	0.000	O	|	|	|	|	0.00
36.917	0.00	0.00	0.000	O	|	|	|	|	0.00
37.000	0.00	0.00	0.000	O	|	|	|	|	0.00
37.083	0.00	0.00	0.000	O	|	|	|	|	0.00
37.167	0.00	0.00	0.000	O	|	|	|	|	0.00
37.250	0.00	0.00	0.000	O	|	|	|	|	0.00
37.333	0.00	0.00	0.000	O	|	|	|	|	0.00
37.417	0.00	0.00	0.000	O	|	|	|	|	0.00
37.500	0.00	0.00	0.000	O	|	|	|	|	0.00
37.583	0.00	0.00	0.000	O	|	|	|	|	0.00
37.667	0.00	0.00	0.000	O	|	|	|	|	0.00
37.750	0.00	0.00	0.000	O	|	|	|	|	0.00
37.833	0.00	0.00	0.000	O	|	|	|	|	0.00
37.917	0.00	0.00	0.000	O	|	|	|	|	0.00

**********HYDROGRAPH DATA**********

Number of intervals = 455
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 1.030 (CFS)
Total volume = 0.939 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

MOJAVE RIVER WATERSHED

Water Quality Management Plan

For:

COVINGTON - MIP - BUILDING 3

PERMIT NUMBERS: TBD

Prepared for:

Mojave 80 Gray, LLC

c/o Covington Development Partners, LLC

3 Corporate Plaza, Suite 230

Newport Beach, Ca 92660

949-514-0274

Prepared by:

Huitt-Zollars, Inc

3990 Concours, Suite 330

Ontario, CA 91764

909-941-7799

Project: R315712.01

Submittal Date: 05/08/2023

Revision No. and Date: 05/08/2023 using Mojave Template

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Revision No. and Date: TBD

Final Approval Date:_____

Project Owner's Certification

This Mojave River Watershed Water Quality Management Plan (WQMP) has been prepared for Covington Development Partners, LLC by Huitt-Zollars, Inc.. The WQMP is intended to comply with the requirements of the County of San Bernardino 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):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-02

Owner's Signature		
Owner Name: Dana Whitmer		
Title	Partner	
Company	Mojave 80 Gray, LLC, c/o Covington Development Partners, LLC	
Address	3 Corporate Development Plaza, Suite 230	
Email	dwhitmer@covingtongroupinc.com	
Telephone #	949-514-0274	
Signature	Date	

Preparer's Certification

Project Data			
Permit/Application Number(s):	TBD	Grading Permit Number(s):	TBD
Tract/Parcel Map Number(s):	TBD	Building Permit Number(s):	TBD
CUP, SUP, and/or APN (Specify Lot Numbers if Portions of Tract):			APN 3128-631-02

"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: Johnny Murad, PE		PE Stamp Below
Title	Project Manager	
Company	Huitt-Zollars, Inc	
Address	3990 Concours, Suite 330 Ontario, CA 91764	
Email	jmurad@huitt-zollars.com	
Telephone #	909-941-7799	
Signature		
Date	05/19/2023	

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Section I – Introduction

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

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

Section 1 Discretionary Permit(s)

Form 1-1 Project Information					
Project Name	Covington - MIP - Building 3				
Project Owner Contact Name:	Dana Whitmer				
Mailing Address:	3 Corporate Plaza, Suite 230 Newport Beach, ca 92660	E-mail Address:	dwhitmer@covingtongroupinc.com	Telephone:	949-514-0274
Permit/Application Number(s):	TBD		Tract/Parcel Map Number(s):	APN 3128-631-02	
Additional Information/ Comments:	N/A				
Description of Project:	The project is a new development of an industrial warehouse facility located between the northwest corner of Mojave Drive and Topaz Road, in the City of Victorville, California. The proposed building is approximately 1,160,000 square feet on approximately 61.1 acres of land.				
Provide summary of Conceptual WQMP conditions (if previously submitted and approved). Attach complete copy.	All on-site runoff for Building 3 will be collected by catch basins and coveyed to the infiltration/detention basin on the northeast corner of the property. Once WQMP DCV is reached the water will outlet to the proposed off-site storm drain system. Refer to the Hydrology Study for more calculations and details.				

Section 2 Project Description

2.1 Project Information

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

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

2.1.1 Project Sizing Categorization

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

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

Form 2.1-1 Description of Proposed Project

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

☒ #1 New development involving the creation of 5,000 ft^2 or more of impervious surface collectively over entire site	☐ #2 Significant re-development involving the addition or replacement of 5,000 ft^2 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):	2,659,467	**3** Number of Dwelling Units:	N/A	**4** SIC Code:	

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:

The property is being developed by Covington Development Partners, LLC. Covinton Development Partners, LLC, will be the entity responsible for long term maintenance of WQMP Storm Water Facilities throughout the site.

Name: Mojave 80 Gray, LLC, c/o Covington Development Partners, LLC
Address: 3 Corporate Plaza, Suite 230, Newport Beach, CA 92660
Contact Person: Dana Whitmer/ Partner
Phone: 949-514-0274

2.3 Potential Stormwater Pollutants

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

Determine and describe expected stormwater pollutants of concern based on land uses and site activities (refer to Table 3-2 in the TGD for WQMP).

Form 2.3-1 Pollutants of Concern

Pollutant	Please check: E=Expected, N=Not Expected		Additional Information and Comments
Pathogens (Bacterial / Virus)	E ☒	N ☐	Pathogens are typically caused by the transport of animal or human fecal wastes from the watershed.
Nutrients - Phosphorous	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Nutrients - Nitrogen	E ☒	N ☐	Primary sources of nutrients in urban runoff are fertilizers and eroded soils.
Noxious Aquatic Plants	E ☒	N ☐	Noxious aquatic plants are typically from animals or vehicle transport that grow aggressively, multiply quickly without natural controls (native herbivores, soil chemistry, etc.), and adversely affect native habitats.
Sediment	E ☒	N ☐	Sediments are solid materials that are eroded from the land surface.
Metals	E ☒	N ☐	The primary source of metal pollution in stormwater is typically commercially available metals and metal products, as well as emissions from brake pad and tire tread wear associated with driving.
Oil and Grease	E ☒	N ☐	Primary sources of oil and grease are petroleum hydrocarbon products, motor products from leaking vehicles, esters, oils, fats, waxes, and high molecular-weight fatty acids.
Trash/Debris	E ☒	N ☐	Trash (such as paper, plastic, polystyrene packing foam, and aluminum materials) and biodegradable organic matter (such as leaves, grass cuttings, and food waste) are general waste from human or animals.
Pesticides / Herbicides	E ☒	N ☐	Pesticides and herbicides can be washed off urban landscapes during storm events.
Organic Compounds	E ☒	N ☐	Sources of organic compounds may include waste handling areas and vehicle or landscape maintenance areas.
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	
Other:	E ☐	N ☐	

Section 3 Site and Watershed Description

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

Form 3-1 Site Location and Hydrologic Features

Site coordinates *take GPS measurement at approximate center of site*	Latitude 34°31'53.96"N	Longitude 117°23'02.03"W	Thomas Bros Map page 4295
1 San Bernardino County climatic region: ☒ Desert			
2 Does the site have more than one drainage area (DA): Yes☐ No☒ *If no, proceed to Form 3-2. If yes, then use this form to show a conceptual schematic describing DMAs and hydrologic feature connecting DMAs to the site outlet(s). An example is provided below that can be modified for proposed project or a drawing clearly showing DMA and flow routing may be attached*			

Conveyance	Briefly describe on-site drainage features to convey runoff that is not retained within a DMA
DA1 DMA C flows to DA1 DMA A	*Ex. Bioretention overflow to vegetated bioswale with 4' bottom width, 5:1 side slopes and bed slope of 0.01. Conveys runoff for 1000' through DMA 1 to existing catch basin on SE corner of property*
DA1 DMA A to Outlet 1	Runoff from the project site will be directed to the proposed infiltration/ detention basin on the north side of the project site. After the DCV WQMP volume is reached then water will be outleted to the proposed storm drain system.
DA1 DMA B to Outlet 1	N/A
DA2 to Outlet 2	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA A	DMA B	DMA C	DMA D
1 DMA drainage area (ft^2)	2,659,467	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	0	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	AMC II	N/A	N/A	N/A
4 Hydrologic soil group *Refer to County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	C	N/A	N/A	N/A
5 Longest flowpath length (ft)	2,140	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	~0.0596	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	Barren	N/A	N/A	N/A
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	N/A	N/A	N/A

Form 3-2 Existing Hydrologic Characteristics for Drainage Area 1 (use only as needed for additional DMA w/in DA 1)

For Drainage Area 1's sub-watershed DMA, provide the following characteristics	DMA E	DMA F	DMA G	DMA H
1 DMA drainage area (ft^2)	N/A	N/A	N/A	N/A
2 Existing site impervious area (ft^2)	N/A	N/A	N/A	N/A
3 Antecedent moisture condition *For desert areas, use http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_map.pdf*	N/A	N/A	N/A	N/A
4 Hydrologic soil group *County Hydrology Manual Addendum for Arid Regions – http://www.sbcounty.gov/dpw/floodcontrol/pdf/20100412_addendum.pdf*	N/A	N/A	N/A	N/A
5 Longest flowpath length (ft)	N/A	N/A	N/A	N/A
6 Longest flowpath slope (ft/ft)	N/A	N/A	N/A	N/A
7 Current land cover type(s) *Select from Fig C-3 of Hydrology Manual*	N/A	N/A	N/A	N/A
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*	N/A	N/A	N/A	N/A

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	City Storm Drain Line T, City Master Plan Facility E-01, Mojave River, Soda Lake and Silver Lake
Applicable TMDLs *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	Per 2010 303(d) list, Mojave River: TMDLs still required. Soda Lake: TMDLs still required.
303(d) listed impairments *http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml*	The project expects to generate Pathogens, Nutrients (Soda Lake), metals and Other Inorganics (fluoride & sulfate) (Mojave River) which are listed for downstream receiving waters on the latest CWA 303(d) list.
Environmentally Sensitive Areas (ESA) *Refer to Watershed Mapping Tool –* *http://sbcounty.permitrack.com/WAP*	NO
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	☒	☐	Property owners shall review and become familiar with the site specific WQMP. Additional educational materials for day to day operations are contained in Attachment C. Additional materials can be obtained from the local water pollution prevention program. Education of property owners begin with the review/preparation of the site specific WQMP and continues through the review of additional educational material as it applies to their project.
N2	Activity Restrictions	☒	☐	Activity restriction shall be stated in the owners lease terms prior to occupancy; • Fuelling areas, air/water supply areas, maintenance bays, vehicle washing areas, outdoor material storage areas, outdoor work areas, outdoor processing areas, wash water from food preparation areas within the project site will not be allowed on the project site. • Storage of hazardous materials will not be allowed on the project site. • All pesticide applications shall be performed by a licensed contractor certified by the California Department of Pesticide Regulation. • All dumpster lids shall be kept closed at all times. • Blowing, Sweeping or hosing of debris (leaf, litter, grass clippings, trash or debris) into the streets, underground stormdrain facilities or other storm water conveyance areas shall be strictly prohibited
N3	Landscape Management BMPs	☒	☐	A landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate the use of native and drought tolerant trees and shrubs throughout the project site.
N4	BMP Maintenance	☒	☐	Property owners shall maintain the designated on-site BMP areas, see Section 5 for self inspection and maintenance form
N5	Title 22 CCR Compliance (How development will comply)	☐	☒	Industrial purposed warehouse does not apply to Title 22 CCR (California Code of Regulations). CCR licensing in child care, residential and family child care.

Form 4.1-1 Non-Structural Source Control BMPs				
N6	Local Water Quality Ordinances	☒	☐	Local Water Quality Ordinances will be addressed by implementation of this WQMP
N7	Spill Contingency Plan	☒	☐	Industrial Warehouse buildings and truck dock areas have potential for spills and therefore each tenant shall be required to prepare a spill contingency plan and it shall be implemented in accordance with section 6.95 of the California Health and Safety Code. The spill contingency plan shall identify responsible persons in the event of a spill, an action item list identifying how the spill should be contained, cleaned up and who should be contacted in the event of a spill. Documentation of any spill event and cleanup process shall be kept on site in perpetuity.
N8	Underground Storage Tank Compliance	☐	☒	No underground storage tanks are proposed for this site
N9	Hazardous Materials Disclosure Compliance	☐	☒	No hazardous materials are planned to be stored on this site.

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	☒	☐	Underground fire protection service and fire sprinklers will be provided per the uniform fire code and the requirements of the County of San Bernardino Fire Department.
N11	Litter/Debris Control Program	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
N12	Employee Training	☒	☐	The following shall be provided to the tentant by the onwer; an Employee Training/Education program shall be provided annually to help educate employees about storm water quality management and practices that help prevent storm water pollution. Documentation of such training/education program implementation shall be kept by the owner for a minimum of ten years. Sample education materials have been provided in Attachment D. Additional educational materials can be obtained from the County of San Bernardino storm water program.
N13	Housekeeping of Loading Docks	☒	☐	The project site will have truck docks. The truck docks shall be inspected on a weekly basis to help ensure that any trash and debris are collected prior to being washed into the underground storm drain system. All storm water runoff from the loading dock areas will be discharged into infiltration basins and/or underground infiltration chambers prior to conveyance to the public storm drain system. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
N14	Catch Basin Inspection Program	☒	☐	The on-site catch basins shall be inspected on a quarterly basis. Inspection of the on-site catch basins shall consist of visual inspection of any sediment, trash or debris collected in the bottom of each catch basin. Any sediment, trash or debris found shall be removed from the catch basins and disposed of in a legal manner. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

N15	Vacuum Sweeping of Private Streets and Parking Lots	☒	☐	The on-site parking lots, drive aisles, and loading dock areas shall be hand swept on a monthly basis. Documentation of such sweeping shall be kept by the owner in perpetuity. Frequency of sweeping shall be adjusted as needed to maintain a clean site.
N16	Other Non-structural Measures for Public Agency Projects	☐	☒	None, proposed BMP's satisfy requirements
N17	Comply with all other applicable NPDES permits	☒	☐	General construction permit "SWRCB Orders No. 2009-009-DWQ as amended by Order 2010-0014-DWQ"

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)	☒	☐	The on-site storm drain catch basins shall be stenciled with the phrase "Drains to River" or other approved language. The signage shall be inspected on an annual basis. Missing or faded signage shall be replaced. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S2	Design and construct outdoor material storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-34)	☐	☒	No outdoor material storage areas are proposed for this site
S3	Design and construct trash and waste storage areas to reduce pollution introduction (CASQA New Development BMP Handbook SD-32)	☒	☐	Trash storage areas will be designed to have adjacent areas drain away from the trash storage areas as well as have a permanent roof over them. The trash storage areas shall be inspected and maintained on a monthly basis. Collection of trash from the trash storage areas shall occur on a regular basis to ensure that the trash receptacles are not overflowing. Documentation of such inspection/maintenance and trash collection shall be kept by the owner in perpetuity. See the WQMP site map in Attachment A for anticipated location of trash storage areas.
S4	Use efficient irrigation systems & landscape design, water conservation, smart controllers, and source control (Statewide Model Landscape Ordinance; CASQA New Development BMP Handbook SD-12)	☒	☐	The landscape architect will follow CASQA SD-12 for design and provide design plans for the on-site irrigation system. The irrigation system shall be inspected on a monthly basis to ensure proper operation. Any broken sprinkler heads shall be repaired immediately to ensure that the system continues to operate efficiently. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.
S5	Finish grade of landscaped areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement	☒	☐	The landscape architect will provide design plans for the on-site landscaping and irrigation system. The design shall incorporate that finish grade of landsapced areas at a minimum of 1-2 inches below top of curb, sidewalk, or pavement throughout the project site.
S6	Protect slopes and channels and provide energy dissipation (CASQA New Development BMP Handbook SD-10)	☒	☐	Perimeter slopes and slopes to catch grade will have a maximum slope of 2:1. The slopes will be landscaped appropriately to also help ensure that erosion of the slopes does not occur. Slopes will be inspected and maintained bi-annually. Documentation of such inspection/maintenance shall be kept by the owner in perpetuity.

S7	Covered dock areas (CASQA New Development BMP Handbook SD-31)	☐	☒	Docks are not covered
S8	Covered maintenance bays with spill containment plans (CASQA New Development BMP Handbook SD-31)	☐	☒	No maintenance bays are planned for this site.
S9	Vehicle wash areas with spill containment plans (CASQA New Development BMP Handbook SD-33)	☐	☒	No vehicle wash area are planned for this site.
S10	Covered outdoor processing areas (CASQA New Development BMP Handbook SD-36)	☐	☒	No outdoor processing areas are planned for this site.

Form 4.1-2 Structural Source Control BMPs

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

4.1.2 Site Design BMPs

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

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

Describe site design and drainage plan including:

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

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

Form 4.1-3 Site Design Practices Checklist

Site Design Practices *If yes, explain how preventative site design practice is addressed in project site plan. If no, other LID BMPs must be selected to meet targets*
Minimize impervious areas: Yes ☐ No ☒ Explanation: The developer has chosen to maximize the building and parking footprint. However, the infiltration was oversized to accommodate more pervious areas.
Maximize natural infiltration capacity; Including improvement and maintenance of soil: Yes ☒ No ☐ Explanation: The entire site drains to the infiltration/ detention basin thereby maximizing the natural infiltration capacity.
Preserve existing drainage patterns and time of concentration: Yes ☒ No ☐ Explanation: The existing drainage pattern, south to north, will be preserved. The flood routing and controlled outlet in the infiltration/ detention Basin will lengthen the time of concentration thus mimicking the existing conditions.
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: The site layout does not allow for roof drains to discharge to previous areas.
Use of Porous Pavement.: Yes ☐ No ☒ Explanation: Porous pavement will not be used and is not practical for developments with heavy trucks.
Protect existing vegetation and sensitive areas: Yes ☐ No ☒ Explanation: The site has no existing vegetation to protect. Planting of new vegetation will occur throughout the site.
Re-vegetate disturbed areas. Including planting and preservation of drought tolerant vegetation. : Yes ☒ No ☐ Explanation: All landscape areas will be vegetated for stablization using drought tolerant plants and trees.
Minimize unnecessary compaction in stormwater retention/infiltration basin/trench areas: Yes ☒ No ☐ Explanation: The soils in the proposed infiltration system area will be uncompacted in-place native material.

Utilize naturalized/rock-lined drainage swales in place of underground piping or imperviously lined swales: Yes ☐ No ☒ Explanation: No rock-lined drainage swales are proposed, except for the pipe discharge areas in the basin.
Stake off areas that will be used for landscaping to minimize compaction during construction : Yes ☒ No ☐ Explanation: All landscaped areas will be staked by designation of curb throughout the project site.
Use of Rain Barrels and Cisterns, Including the use of on-site water collection systems.: Yes ☐ No ☒ Explanation: No rain barrels or cisterns are planned for this site.
Stream Setbacks. Includes a specified distance from an adjacent steam: : Yes ☐ No ☒ Explanation: There are no streams within or adjacent to the project.

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

San Bernardino County Special Districts:

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

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

Mojave Water Agency:

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

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

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

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

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

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

4.2 Treatment BMPs

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

4.2.1 Project Specific Hydrology Characterization

The purpose of this section of the Project WQMP is to establish targets for post-development hydrology based on performance criteria specified in Section E.12.e.ii.c and Section E.12.f of the Phase II Small MS4 Permit. These targets include runoff volume for water quality control (referred to as LID design capture volume), and runoff volume, time of concentration, and peak runoff for protection from hydromodification.

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

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

Methods applied in the following forms include:

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

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

Form 4.2-1 LID BMP Performance Criteria for Design Capture Volume (DA 1)		
[1] Project area DA 1 (ft^2): 2,659,467	[2] Imperviousness after applying preventative site design practices (Imp%): 0.86	[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): 0.361 *http://hdsc.nws.noaa.gov/hdsc/pfds/sa/sca_pfds.html*		
[5] Compute P_6, Mean 6-hr Precipitation (inches): 0.41 *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): 1/12*[2,659,467* 0.73* 0.41 * 1.963] = 130,209 CF *DCV = 1/12 * [Item 1* Item 3 *Item 5 * C_2], where C_2 is a function of drawdown rate (24-hr = 1.582; 48-hr = 1.963)* *Compute separate DCV for each outlet from the project site per schematic drawn in Form 3-1 Item 2*		

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

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

If "Yes", then complete Hydromodification assessment of site hydrology for 10yr storm event using Forms 4.2-3 through 4.2-5 and insert results below *(Forms 4.2-3 through 4.2-5 may be replaced by computer software analysis based on the San Bernardino County Hydrology Manual- Addendum 1)*

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

Condition	Runoff Volume (ft^3)	Time of Concentration (min)	Peak Runoff (cfs)
Pre-developed	[1] SEE CALCS *Form 4.2-3 Item 12*	[2] N/A *Form 4.2-4 Item 13*	[3] N/A *Form 4.2-5 Item 10*
Post-developed	[4] N/A *Form 4.2-3 Item 13*	[5] N/A *Form 4.2-4 Item 14*	[6] N/A *Form 4.2-5 Item 14*
Difference	[7] *N/A* *Item 4 – Item 1*	[8] *N/A* *Item 2 – Item 5*	[9] *N/A* *Item 6 – Item 3*
Difference (as % of pre-developed)	[10] *N/A%* *Item 7 / Item 1*	[11] *N/A%* *Item 8 / Item 2*	[12] *N/A%* *Item 9 / Item 3*

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

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

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

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

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

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

14 Volume Reduction needed to meet hydromodification requirement, (ft^3): SEE SEPARATE HYD CALCULATIONS IN APPENDIX B
*Vhydro = (Item 13 * 0.95) – Item 12*

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

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

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

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

Compute peak runoff for pre- and post-developed conditions

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

8 Pre-developed Q_p at T_c for DMA A: N/A *Q_p = Item 6_{DMAA} + [Item 6_{DMAB} * (Item 1_{DMAA} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAA/2}$] + [Item 6_{DMAC} * (Item 1_{DMAA} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAA/3}$]*	**9** Pre-developed Q_p at T_c for DMA B: N/A *Q_p = Item 6_{DMAB} + [Item 6_{DMAA} * (Item 1_{DMAB} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAB/1}$] + [Item 6_{DMAC} * (Item 1_{DMAB} - Item 5_{DMAC})/(Item 1_{DMAC} - Item 5_{DMAC})* Item $7_{DMAB/3}$]*	**10** Pre-developed Q_p at T_c for DMA C: N/A *Q_p = Item 6_{DMAC} + [Item 6_{DMAA} * (Item 1_{DMAC} - Item 5_{DMAA})/(Item 1_{DMAA} - Item 5_{DMAA})* Item $7_{DMAC/1}$] + [Item 6_{DMAB} * (Item 1_{DMAC} - Item 5_{DMAB})/(Item 1_{DMAB} - Item 5_{DMAB})* Item $7_{DMAC/2}$]*

10 Peak runoff from pre-developed condition confluence analysis (cfs): N/A *Maximum of Item 8, 9, and 10 (including additional forms as needed)*

11 Post-developed Q_p at T_c for DMA A: N/A *Same as Item 8 for post-developed values*	**12** Post-developed Q_p at T_c for DMA B: N/A *Same as Item 9 for post-developed values*	**13** Post-developed Q_p at T_c for DMA C: N/A *Same as Item 10 for post-developed values*

14 Peak runoff from post-developed condition confluence analysis (cfs): N/A *Maximum of Item 11, 12, and 13 (including additional forms as needed)*

15 Peak runoff reduction needed to meet Hydromodification Requirement (cfs): N/A *$Q_{p\text{-}hydro}$ = (Item 14 * 0.95) – Item 10*

4.3 BMP Selection and Sizing

Complete the following forms for each project site DA to document that the proposed treatment (LID/Bioretention) BMPs conform to the project DCV developed to meet performance criteria specified in the Phase II Small MS4 Permit (WQMP Template Section 4.2). For the LID DCV, the forms are ordered according to hierarchy of BMP selection as required by the Phase II Small MS4 Permit (see Section 5.3 in the TGD for WQMP). The forms compute the following for on-site LID BMP:

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

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

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

The first step in the analysis, using Section 5.3.2 of the TGD for WQMP, is to complete Forms 4.3-1 and 4.3-3) to determine if retention and infiltration BMPs are infeasible for the project. For each feasibility criterion in Form 4.3-1, if the answer is "Yes," provide all study findings that includes relevant calculations, maps, data sources, etc. used to make the determination of infeasibility.

Next, complete Form 4.3-2 to determine the feasibility of applicable Site Design BMPs, and, if their implementation is feasible, the extent of mitigation of the DCV.

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

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

4.3.1 Exceptions to Requirements for Bioretention Facilities

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

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

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

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

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

4.3.2 Site Design BMP

Section E.12.e. of the Small Phase II MS4 Permit emphasizes the use of LID preventative measures; and the use of Site Design Measures reduces the portion of the DCV that must be addressed in downstream BMPs. Therefore, all applicable Site Design Measures shall be provided except where they are mutually exclusive with each other, or with other BMPs. Mutual exclusivity may result from overlapping BMP footprints such that

either would be potentially feasible by itself, but both could not be implemented. Please note that while there are no numeric standards regarding the use of Site Design BMPs. If a project cannot feasibly meet BMP sizing requirements or cannot fully address hydromodification, feasibility of all applicable Site Design BMPs must be part of demonstrating that the BMP system has been designed to retain the maximum feasible portion of the DCV. Complete Form 4.3-2 to identify and calculate estimated retention volume from implementing site design BMP. Refer to Section 5.4 in the TGD for more detailed guidance.

Form 4.3-2 Site Design BMPs (DA 1)

1 Implementation of Impervious Area Dispersion BMP (i.e. routing runoff from impervious to pervious areas), excluding impervious areas planned for routing to on-lot infiltration BMP: Yes ☐ No ☒ *If yes, complete Items 2-5; If no, proceed to Item 6*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Total impervious area draining to pervious area (ft^2)	N/A	N/A	N/A
3 Ratio of pervious area receiving runoff to impervious area	N/A	N/A	N/A
4 Retention volume achieved from impervious area dispersion (ft^3) *V = Item2 * Item 3 * (0.5/12), assuming retention of 0.5 inches of runoff*	N/A	N/A	N/A
5 Sum of retention volume achieved from impervious area dispersion (ft^3): 0 *$V_{retention}$ =Sum of Item 4 for all BMPs*			
6 Implementation of Localized On-lot Infiltration BMPs (e.g. on-lot rain gardens): Yes ☐ No ☒ *If yes, complete Items 7-13 for aggregate of all on-lot infiltration BMP in each DA; If no, proceed to Item 14*	DA DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
7 Ponding surface area (ft^2)	N/A	N/A	N/A
8 Ponding depth (ft) (min. 0.5 ft.)	N/A	N/A	N/A
9 Surface area of amended soil/gravel (ft^2)	N/A	N/A	N/A
10 Average depth of amended soil/gravel (ft) (min. 1 ft.)	N/A	N/A	N/A
11 Average porosity of amended soil/gravel	N/A	N/A	N/A
12 Retention volume achieved from on-lot infiltration (ft^3) *$V_{retention}$ = (Item 7 *Item 8) + (Item 9 * Item 10 * Item 11)*	N/A	N/A	N/A
13 Runoff volume retention from on-lot infiltration (ft^3): 0 *$V_{retention}$ =Sum of Item 12 for all BMPs*			

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

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

4.3.3 Infiltration BMPs

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

If site constraints limit the use of BMPs to a single type and implementation of retention and infiltration BMPs mitigate no more than 40% of the DCV, then they are considered infeasible and the Project Proponent may evaluate the effectiveness of BMPs lower in the LID hierarchy of use (Section 5.5 of the TGD for WQMP)

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

4.3.3.1 Allowed Variations for Special Site Conditions

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

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

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

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

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

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

1 Remaining LID DCV not met by site design BMP (ft^3): 130,209 *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 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
2 Infiltration rate of underlying soils (in/hr) *See Section 5.4.2 and Appendix C of the TGD for WQMP for minimum requirements for assessment methods*	5.3	N/A	N/A
3 Infiltration safety factor *See TGD Section 5.4.2 and Appendix D*	3	N/A	N/A
4 Design percolation rate (in/hr) *P_{design} = Item 2 / Item 3*	1.77	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 in Form 4.2-1*	48	N/A	N/A
6 Maximum ponding depth (ft) *BMP specific, see Table 5-4 of the TGD for WQMP for BMP design details*	10	N/A	N/A
7 Ponding Depth (ft) *d_{BMP} = Minimum of (1/12*Item 4*Item 5) or Item 6*	10	N/A	N/A
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*	55,590	N/A	N/A
9 Amended soil depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 in the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity	N/A	N/A	N/A
11 Gravel depth, d_{media} (ft) *Only included in certain BMP types, see Table 5-4 of the TGD for WQMP for BMP design details*	0.5	N/A	N/A
12 Gravel porosity	0.4	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	3	N/A	N/A
14 Above Ground Retention Volume (ft^3) *$V_{retention}$ = Item 8 * [Item7 + (Item 9 * Item 10) + (Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	0	N/A	N/A
15 Underground Retention Volume (ft^3) *Volume determined using manufacturer's specifications and calculations*	163,541	N/A	N/A

16 Total Retention Volume from LID Infiltration BMPs: 163,541 *(Sum of Items 14 and 15 for all infiltration BMP included in plan)*

17 Fraction of DCV achieved with infiltration BMP: 126% *Retention% = Item 16 / Form 4.2-1 Item 7*

18 Is full LID DCV retained onsite with combination of hydrologic source control and LID retention/infiltration BMPs? Yes ☒ No ☐

If yes, demonstrate conformance using Form 4.3-10; If no, then reduce Item 3, Factor of Safety to 2.0 and increase Item 8, Infiltrating Surface Area, such that the portion of the site area used for retention and infiltration BMPs equals or exceeds the minimum effective area thresholds (Table 5-7 of the TGD for WQMP) for the applicable category of development and repeat all above calculations.

4.3.4 Biotreatment BMP

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

Use Form 4.3-4 to summarize the potential for volume based and/or flow based biotreatment options to biotreat the remaining unmet LID DCV. Biotreatment computations are included as follows:

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

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

1 Remaining LID DCV not met by site design , or infiltration, BMP for potential biotreatment (ft^3): 0, NA *Form 4.2-1 Item 7 - Form 4.3-2 Item 19 – Form 4.3-3 Item 16*	List pollutants of concern *Copy from Form 2.3-1.*	
2 Biotreatment BMP Selected *(Select biotreatment BMP(s) necessary to ensure all pollutants of concern are addressed through Unit Operations and Processes, described in Table 5-5 of the TGD for WQMP)*	Volume-based biotreatment *Use Forms 4.3-5 and 4.3-6 to compute treated volume*	Flow-based biotreatment *Use Form 4.3-7 to compute treated flow*
	☐ Bioretention with underdrain ☐ Planter box with underdrain ☐ Constructed wetlands ☐ Wet extended detention ☐ Dry extended detention	☐ Vegetated swale ☐ Vegetated filter strip ☐ Proprietary biotreatment
3 Volume biotreated in volume based biotreatment BMP (ft^3): *Form 4.3-5 Item 15 + Form 4.3-6 Item 13*	**4** Compute remaining LID DCV with implementation of volume based biotreatment BMP (ft^3): *Item 1 – Item 3*	**5** Remaining fraction of LID DCV for sizing flow based biotreatment BMP: % *Item 4 / Item 1*
6 Flow-based biotreatment BMP capacity provided (cfs): *Use Figure 5-2 of the TGD for WQMP to determine flow capacity required to provide biotreatment of remaining percentage of unmet LID DCV (Item 5), for the project's precipitation zone (Form 3-1 Item 1)*		
7 Metrics for MEP determination: • Provided a WQMP with the portion of site area used for suite of LID BMP equal to minimum thresholds in Table 5-7 of the TGD for WQMP for the proposed category of development: ☐ *If maximized on-site retention BMPs is feasible for partial capture, then LID BMP implementation must be optimized to retain and infiltrate the maximum portion of the DCV possible within the prescribed minimum effective area. The remaining portion of the DCV shall then be mitigated using biotreatment BMP.*		

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

Biotreatment BMP Type *(Bioretention w/underdrain, planter box w/underdrain, other comparable BMP)*	DA 0 DMA BMP Type	DA DMA BMP Type	DA DMA BMP Type *(Use additional forms for more BMPs)*
1 Pollutants addressed with BMP *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A
2 Amended soil infiltration rate *Typical ~ 5.0*	N/A	N/A	N/A
3 Amended soil infiltration safety factor *Typical ~ 2.0*	N/A	N/A	N/A
4 Amended soil design percolation rate (in/hr) P_{design} *= Item 2 / Item 3*	N/A	N/A	N/A
5 Ponded water drawdown time (hr) *Copy Item 6 from Form 4.2-1*	N/A	N/A	N/A
6 Maximum ponding depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
7 Ponding Depth (ft) d_{BMP} *= Minimum of (1/12 * Item 4 * Item 5) or Item 6*	N/A	N/A	N/A
8 Amended soil surface area (ft^2)	N/A	N/A	N/A
9 Amended soil depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
10 Amended soil porosity, *n*	N/A	N/A	N/A
11 Gravel depth (ft) *see Table 5-6 of the TGD for WQMP for reference to BMP design details*	N/A	N/A	N/A
12 Gravel porosity, *n*	N/A	N/A	N/A
13 Duration of storm as basin is filling (hrs) *Typical ~ 3hrs*	N/A	N/A	N/A
14 Biotreated Volume (ft^3) $V_{biotreated}$ *= Item 8 * [(Item 7/2) + (Item 9 * Item 10) +(Item 11 * Item 12) + (Item 13 * (Item 4 / 12))]*	N/A	N/A	N/A
15 Total biotreated volume from bioretention and/or planter box with underdrains BMP: 0 *Sum of Item 14 for all volume-based BMPs included in this form*			

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

Biotreatment BMP Type *Constructed wetlands, extended wet detention, extended dry detention, or other comparable proprietary BMP. If BMP includes multiple modules (E.g. forebay and main basin), provide separate estimates for storage and pollutants treated in each module.*	DA DMA BMP Type		DA DMA BMP Type *(Use additional forms for more BMPs)*	
	Forebay	Basin	Forebay	Basin
1 Pollutants addressed with BMP forebay and basin *List all pollutant of concern that will be effectively reduced through specific Unit Operations and Processes described in Table 5-5 of the TGD for WQMP*	N/A	N/A	N/A	N/A
2 Bottom width (ft)	N/A	N/A	N/A	N/A
3 Bottom length (ft)	N/A	N/A	N/A	N/A
4 Bottom area (ft^2) A_{bottom} = *Item 2 * Item 3*	N/A	N/A	N/A	N/A
5 Side slope (ft/ft)	N/A	N/A	N/A	N/A
6 Depth of storage (ft)	N/A	N/A	N/A	N/A
7 Water surface area (ft^2) $A_{surface}$ =*(Item 2 + (2 * Item 5 * Item 6)) * (Item 3 + (2 * Item 5 * Item 6))*	N/A	N/A	N/A	N/A
8 Storage volume (ft^3) *For BMP with a forebay, ensure fraction of total storage is within ranges specified in BMP specific fact sheets, see Table 5-6 of the TGD for WQMP for reference to BMP design details* V =*Item 6 / 3 * [Item 4 + Item 7 + (Item 4 * Item 7)^0.5]*	N/A	N/A	N/A	N/A
9 Drawdown Time (hrs) *Copy Item 6 from Form 2.1*	N/A		N/A	
10 Outflow rate (cfs) Q_{BMP} = *(Item $8_{forebay}$ + Item 8_{basin}) / (Item 9 * 3600)*	N/A		N/A	
11 Duration of design storm event (hrs)	N/A		N/A	
12 Biotreated Volume (ft^3) $V_{biotreated}$ = *(Item $8_{forebay}$ + Item 8_{basin}) +(Item 10 * Item 11 * 3600)*	N/A		N/A	
13 Total biotreated volume from constructed wetlands, extended dry detention, or extended wet detention : 0 *(Sum of Item 12 for all BMP included in plan)*				

Form 4.3-7 Flow Based Biotreatment (DA 1)

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

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): 130,209 *Copy Item 7 in Form 4.2-1*

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

3 On-site retention with LID infiltration BMP (ft^3): 163,541 *Copy Item 16 in Form 4.3-3*

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

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

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

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

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

- Combination of Site Design, retention and infiltration, , and biotreatment BMPs provide less than full LID DCV capture: ☐
  Checked yes if Form 4.3-4 Item 7is checked yes, Form 4.3-4 Item 6 is zero, and sum of Items 2, 3, 4, and 5 is less than Item 1. If so, apply water quality credits and calculate volume for alternative compliance, V_{alt} *= (Item 1 – Item 2 – Item 3 – Item 4 – Item 5) * (100 - Form 2.4-1 Item 2)%*

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

4.3.6 Hydromodification Control BMP

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

Form 4.3-9 Hydromodification Control BMPs (DA 1)

1 Volume reduction needed for hydromodification performance criteria (ft^3): 0 *(Form 4.2-2 Item 4 * 0.95) – Form 4.2-2 Item 1*	**2** On-site retention with site design and infiltration, BMP (ft^3): 2,659,467 *Sum of Form 4.3-8 Items 2, 3, and 4. Evaluate option to increase implementation of on-site retention in Forms 4.3-2, 4.3-3, and 4.3-4 in excess of LID DCV toward achieving hydromodification volume reduction*
3 Remaining volume for hydromodification volume capture (ft^3): 0 *Item 1 – Item 2*	**4** Volume capture provided by incorporating additional on-site BMPs (ft^3): 0

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

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

- Demonstrate increase in time of concentration achieved by proposed LID site design, LID BMP, and additional on-site BMP ☒
- Increase time of concentration by preserving pre-developed flow path and/or increase travel time by reducing slope and increasing cross-sectional area and roughness for proposed on-site conveyance facilities ☐

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

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

- Demonstrate reduction in peak runoff achieved by proposed LID site design, LID BMPs, and additional on-site retention BMPs ☒

For the 10-year storm event, the total Q allowed to be released for all 3 Buildings is being limited to the existing 10-year storm event Q which is Tributary to Line T.

4.4 Alternative Compliance Plan (if applicable)

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

Alternative Designs — Facilities, or a combination of facilities, of a different design than in Permit Section E.12.e.(ii)(f) may be permitted if all of the following measures of equivalent effectiveness are demonstrated:

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

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

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

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

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

Section 5 Inspection and Maintenance Responsibility for Post Construction BMP

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

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

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

BMP	Reponsible Party(s)	Inspection/ Maintenance Activities Required	Minimum Frequency of Activities
Under-ground Infiltrati-on Basin/ Treatment Unit (FDHC)	Owner	- Inspect/maintain underground infiltration systems -Isolator row for collected trash, sediments and/or debris. Remove trash, sediments and debris by jet-vac and pump and dispose of trash, sediemnts and debris in a legal manner -Inspect system for standing water. If system has standing water. If system has standing water, peform re-inspection within 48 hours. If system still has standing water then the system shall be jet-vaccumed and pumped and removed debris shall be disposed of in a legal manner. -Inspect Treatment Unit for sediment, floating trash, and debris	Bi-monthly and prior to storm event and 48 hours after storm has passed
Loading Dock and Parking Lot Sweeping	Owner	Sweep loading dock and parking lot and truck courts.	Monthly / As needed.

Catch Basin Filter	Owner	- Inspect and maintain catch basin filters as required. - Inspect catch basin bottom for debris / remove debris and dispose as required.	Quarterly
Truck Dock	Owner	Inspect loading dock for trash debris and sediments. Inspect loading dock for evidence of spills and broken containers. Clean up spills and dispose of collected material in a legal manner.	Weekly
Planting	Owner	Inspect helth of planting and erosion of landscape area. Trimming trees and bushes when needed.	Monthly
Efficient Irrigation	Owner	- Inspect irrigation system general operation and durations. - Repair damaged sprinkler and drip irrigation lines as needed. - Reduce durations during the winter season to prevent over irrigation.	Monthly
Storm drain system signage	Owner	Inspect Catch basin signage for faded or lost signs / repair or replace as needed.	Annually
Trash Storage Areas and Litter Control (SD-32)	Owner	Inspect trash container, lids, screens and clean trash storage areas..	Weekly

Section 6 WQMP Attachments

6.1. Site Plan and Drainage Plan

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

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

6.2 Electronic Data Submittal

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

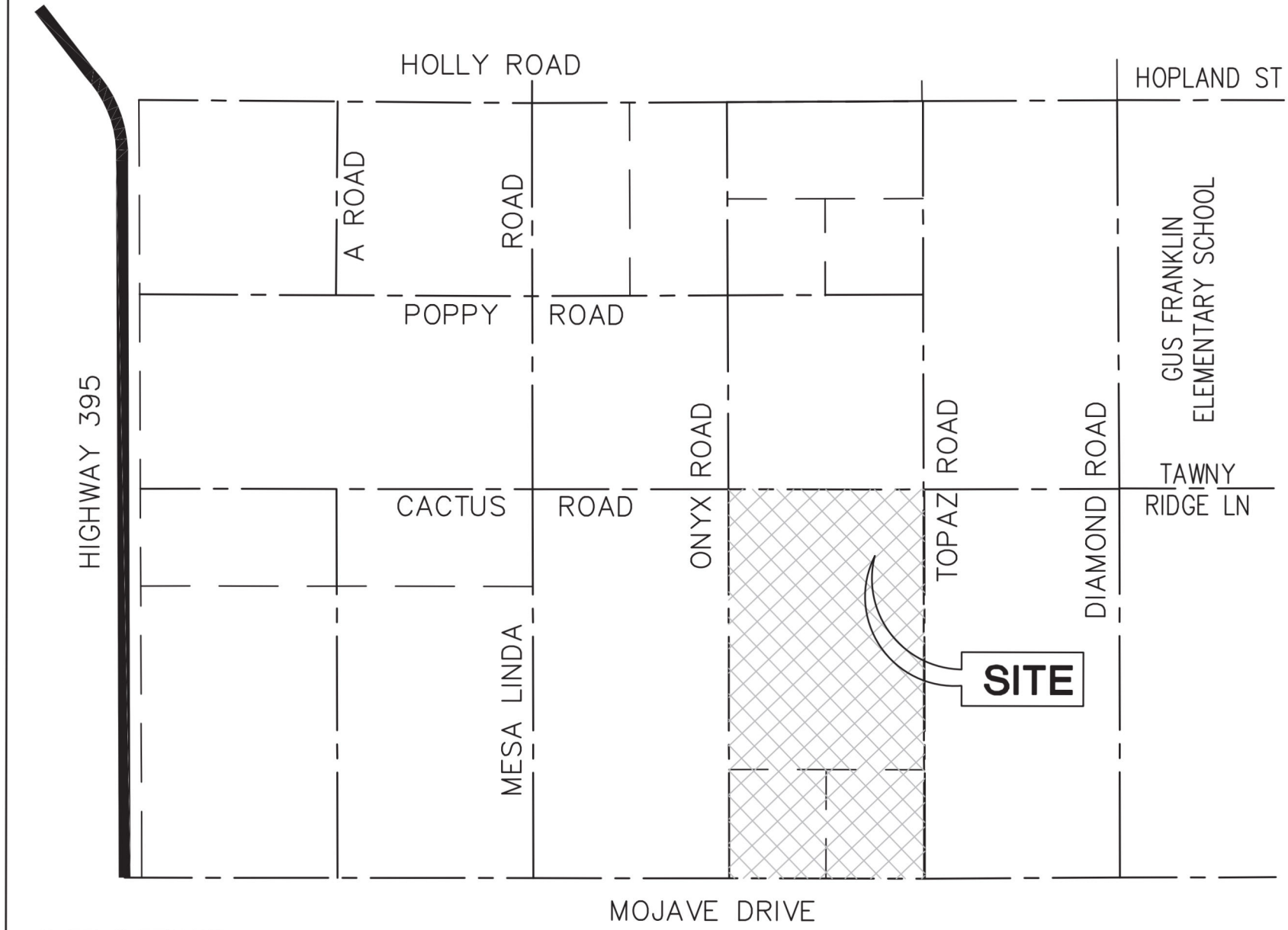
6.3 Post Construction

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

6.4 Other Supporting Documentation

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

Attachment A
WQMP Site Plan



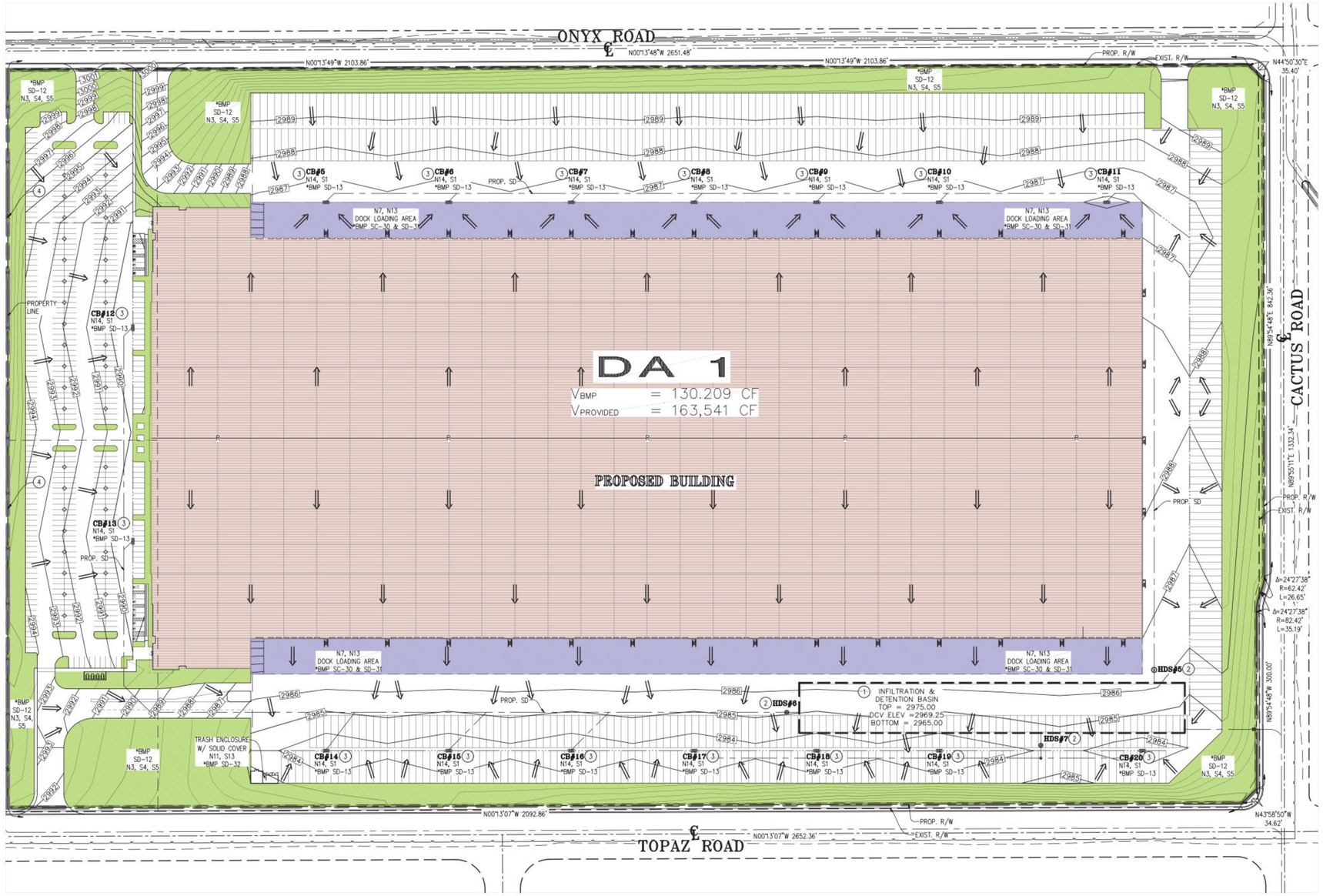
LEGEND

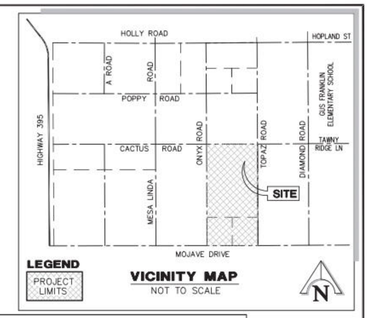
PROJECT LIMITS

VICINITY MAP

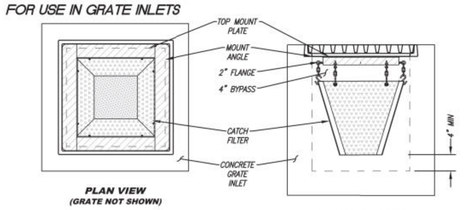
NOT TO SCALE

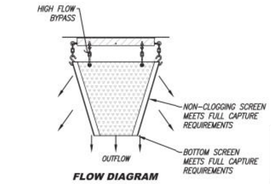
N





BIO CLEAN FULL CAPTURE FILTER
FOR USE IN GRATE INLETS





MODEL #	TREATMENT FLOW RATE (CFS)	BYPASS FLOW (CFS)	SOLIDS STORAGE CAPACITY (CF)
BIO-GRATE-FULL 12-12-12	1.04	1.24	0.15
BIO-GRATE-FULL 18-18-12	1.78	2.79	0.33
BIO-GRATE-FULL 24-24-12	2.70	4.96	0.59
BIO-GRATE-FULL 24-40-12	3.70	6.35	0.88
BIO-GRATE-FULL 24-24-24	3.31	4.96	1.22
BIO-GRATE-FULL 24-40-24	9.53	6.35	1.82
BIO-GRATE-FULL 36-36-24	11.93	7.74	2.73

INSTALLATION NOTES:

1. ALL HARDWARE, FLANGE, FRAME, SCREENS SHALL BE STAINLESS STEEL.
2. OPTIONAL HYDROCARBON BOOM SHALL BE 2" DIAMETER.
3. SEE PERFORMANCE REPORTS IN MANUFACTURES SPECIFICATIONS.
4. OTHER STANDARD AND CUSTOM MODEL SIZES AVAILABLE – CONTACT BIO CLEAN FOR MORE INFORMATION.
5. BASED ON 37% OPEN AREA.
6. CONSIDERS A SAFETY FACTOR OF 2.0.
7. CONSIDERS A LOCAL DEPRESSION PONDING DEPTH OF 6 INCHES.
8. STORAGE CAPACITY BASED ON THE BASKET HALF FULL.
9. CONCRETE STRUCTURES SOLD SEPARATELY.

NOT TO SCALE

PROPRIETARY AND CONFIDENTIAL:
THE INFORMATION CONTAINED IN THIS DOCUMENT IS THE SOLE PROPERTY OF CONTECH AND ITS COMPANIES. THIS DOCUMENT, NOR ANY PART THEREOF, MAY BE USED, REPRODUCED OR MODIFIED IN ANY MANNER WITH OUT THE WRITTEN CONSENT OF CONTECH.

CONTECH® ENGINEERED SOLUTIONS LLC www.ContechES.com

GRATE INLET FILTER FULL CAPTURE STANDARD DETAIL

GRATE INLET SYSTEM (3)
NOT TO SCALE

WQMP BMP NOTES

1. INSTALL CONTECH 108" CMP INFILTRATION/RETENTION SYSTEM OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION
2. INSTALL ADS HDS UNIT OR APPROVED EQUAL BY CITY ENGINEER PRIOR TO INSTALLATION OR CONSTRUCTION
3. INSTALL BIOCLEAN GRATE INLET FILTER, SEE DETAIL HEREON
4. INSTALL SILT FENCE PER CASQA BMP EC SE-1 (OR APPROVED EQUAL)

NAME	TOTAL AREA (SF)	IMPERVIOUS AREA (SF)	PERVIOUS AREA (SF)	i	C	V_{BMP} (CF)	BMP	$V_{PROVIDED}$ (CF) (RETENTION)	V_{TOTAL} (CF) (DETENTION)
DA 1	2,659,467	2,285,367	374,100	.86	0.73	130,209	INFILTRATION BASIN/ DETENTION BASIN	163,541	397,409

LEGEND

- PROPOSED STORM DRAIN
- WQMP & DA BOUNDARY
- PROPOSED CURB OPENING INLET W/ FILTER INSERT
- CB CATCH BASIN
- R BUILDING RIDGE LINE
- FLOW DIRECTION
- PROPOSED LANDSCAPING AREA – N3, S5, *BMP SD-10 & SD-12
- PROPOSED LOADING DOCK AREA – N7, N13, *BMP SC-30 & SC-31
- PROPOSED ROOF AREA
- PROPOSED IMPERVIOUS (PARKING, DRIVE LANE, SIDEWALKS, RAMPS)

SOURCE CONTROL BMPs INCLUDED ONSITE		
IDENTIFIER	DESCRIPTION OF BMP	RESPONSIBLE PARTY
N3	LANDSCAPE MAINTENANCE BMP'S	OWNER
N7	PROVIDE SPILL PLAN	OWNER
N11	LITTER/DEBRIS CONTROL PROGRAM	OWNER
N13	HOUSEKEEPING OF LOADING DOCKS	OWNER
N14	CATCH BASIN INSPECTION PROGRAM	OWNER
N15	VACUUM SWEEPING OF PARKING LOTS	OWNER
N17	NPDES COMPLIANCE	OWNER
S1	STORM DRAIN STENCILING	OWNER
S3	REDUCED WASTE STORAGE POLLUTION	OWNER
S4	EFFICIENT IRRIGATION SYSTEM	OWNER
S5	LANDSCAPING MIN. 1–2" BELOW CURB	OWNER

*SEE WQMP REPORT ATTACHMENT C FOR BMP FACT SHEET

OWNER/DEVELOPER
MOJAVE 80 GRAY, LLC
C/O COVINGTON DEVELOPMENT PARTNERS, LLC
3 CORPORATE PLAZA, SUITE 230
NEWPORT BEACH, CA 92660
OFFICE: 949-514-0274
CONTACT: DANA WHITMER

ENGINEER
HUITT-ZOLLARS
3990 CONCOURS, SUITE 330
ONTARIO, CALIFORNIA 91764
PHONE: (909) 941-7799
CONTACT: JOHNNY MURAD

N

0 40 80 160 240
SCALE 1" = 80'

BASIS OF BEARINGS:
BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN SOPAC STATION P581 AND SOPAC STATION AVRY BEING N85°20'40"W

BENCH MARK
V-215
NAVD29, ELEVATION=2998.27'
MOJAVE DR. @ TOPAZ RD., TC OF CENTER ISLAND NOSE 48' E/O INT.

BY	MARK	DESCRIPTION	APPR.	DATE
ENGINEER		REVISIONS	CITY	

DESIGNED BY: M.M.
DRAWN BY: H-Z STAFF
CHECKED BY: J.M.
SCALE: AS SHOWN

CITY CASE NO. (to be assigned at plan submittal)

CITY OF VICTORVILLE
ENGINEERING DEPARTMENT
14343 Civic Drive, Victorville, CA 92392 (760) 955-5000
Approved By:
Brian W. Gengler, RCE C44730
City Engineer
DATE

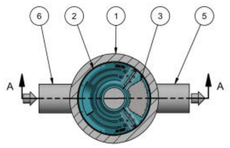
REGISTERED PROFESSIONAL ENGINEER JOHNNY MURAD NO. 67512 EXPIRATION 6-30-2025 CIVIL STATE OF CALIFORNIA

PREPARED BY:
REGISTERED CIVIL ENGINEER NO. 67512
EXPIRATION: 6-30-2025
DATE

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS • SUITE 330 • ONTARIO, CALIFORNIA 91764
PHONE (909) 941-7799 • FAX (909) 941-7789

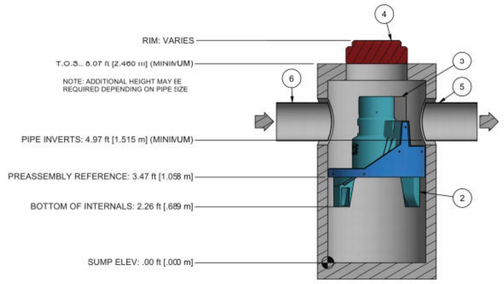
CITY OF VICTORVILLE
MOJAVE INDUSTRIAL PARK
WQMP MAP - PRELIMINARY CONDITION
BUILDING 3
FOR COVINGTON GROUP
M.O.
CITY FILE NO. .
SHEET 1 OF 2 SHEETS

Plotted: May 15, 2023 3:38pm – C:\Users\jmurad\Desktop\Covington - MDP Bldg 1-2-3 and 5\05 Design\05-4 WQMP\Mojave BLDG 3.dwg – Layout: 03



SECTION A-A
SCALE 1:40

HYDRO FRAME AND COVER (INCLUDED)
GRADE RINGS BY OTHERS AS REQUIRED



SECTION A-A
SCALE 1:30

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
12/13/2021	1:40

DRAWN BY:	CHECKED BY:	APPROVED BY:
EHR		

Title:
4-ft DIAMETER
FDHC FULL TRASH CAPTURE

GENERAL ARRANGEMENT

Hydro International
hydro-int.com
©2020 HYDRO INTERNATIONAL

WEIGHT	MATERIAL: Stainless Steel
STOCK NUMBER:	
DRAWING NO.: FDHC-FTC	
SHEET SIZE: B	SHEET: 1 OF 1 — Rev: -

PRODUCT SPECIFICATION:

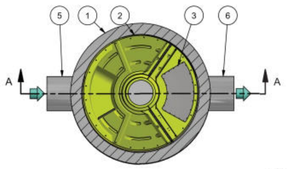
1. Peak Hydraulic Flow: 18.0 cfs (510 l/s)
2. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
3. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.

PARTS LIST

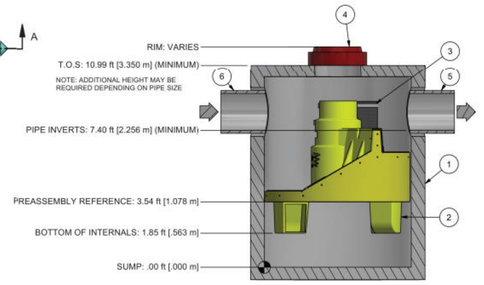
ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	48	1200	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1			5mm TRASH SCREEN (PRE-INSTALLED)
4	1	30	750	FRAME AND COVER (ROUND)
5	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
6	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

(2) HDS #5
NOT TO SCALE



PLAN VIEW
SCALE 1:50

HYDRO FRAME AND COVER (INCLUDED)
GRADE RINGS BY OTHERS AS REQUIRED



SECTION A-A
SCALE 1:40

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
12/13/2021	1:40

DRAWN BY:	CHECKED BY:	APPROVED BY:
EHR		

Title:
8-ft DIAMETER
FDHC FULL TRASH CAPTURE

GENERAL ARRANGEMENT

Hydro International
hydro-int.com
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WEIGHT	MATERIAL: Stainless Steel
STOCK NUMBER:	
DRAWING NO.: FDHC-FTC	
SHEET SIZE: B	SHEET: 1 OF 1 — Rev:

PRODUCT SPECIFICATION:

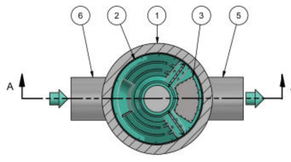
1. Peak Hydraulic Flow: 50.0 cfs (1415 l/s)
2. Maximum Inlet/Outlet Pipe Diameters: 48 in. (1200mm)
3. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 48".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	96	2400	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1			5mm TRASH SCREEN (PRE-INSTALLED)
4	1	30	750	FRAME AND COVER (ROUND)
5	1	48 (MAX)	1200 (MAX)	OUTLET PIPE (BY OTHERS)
6	1	48 (MAX)	1200 (MAX)	INLET PIPE (BY OTHERS)

(2) HDS #7
NOT TO SCALE



SECTION A-A
SCALE 1:40

HYDRO FRAME AND COVER (INCLUDED)
GRADE RINGS BY OTHERS AS REQUIRED

SECTION A-A
SCALE 1:30

1. MANHOLE WALL AND SLAB THICKNESSES ARE NOT TO SCALE.

2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING FIRST DEFENSE MANHOLE.

3. CONTRACTOR TO CONFIRM RIM, PIPE INVERTS, PIPE DIA AND PIPE ORIENTATION PRIOR TO RELEASE OF UNIT TO FABRICATION.

PROJECTION

IF IN DOUBT ASK

DATE:	SCALE:
12/13/2021	1:40

DRAWN BY:	CHECKED BY:	APPROVED BY:
EHR		

Title:
5-ft DIAMETER
FDHC FULL TRASH CAPTURE

GENERAL ARRANGEMENT

Hydro International
hydro-int.com
©2020 HYDRO INTERNATIONAL

WEIGHT	MATERIAL: Stainless Steel
STOCK NUMBER:	
DRAWING NO.: FDHC-FTC	
SHEET SIZE: B	SHEET: 1 OF 1 — Rev:

PRODUCT SPECIFICATION:

1. Peak Hydraulic Flow: 20.0 cfs (566 l/s)
2. Maximum Inlet/Outlet Pipe Diameters: 24 in. (600 mm)
3. For More Product Information Including Regulatory Acceptances, Please Visit https://hydro-int.com/en/products/first-defense

GENERAL NOTES:
1. General Arrangement drawings only. Contact Hydro International for site specific drawings.
2. The diameter of the inlet and outlet pipes may be no more than 24".
3. Multiple inlet pipes possible (refer to project plan).
4. Inlet/outlet pipe angle can vary to align with drainage network (refer to project plans).
5. Peak flow rate and minimum height limited by available cover and pipe diameter.

PARTS LIST

ITEM	QTY	SIZE (in)	SIZE (mm)	DESCRIPTION
1	1	60	1500	I.D. PRECAST MANHOLE
2	1			INTERNAL COMPONENTS (PRE-INSTALLED)
3	1			5mm TRASH SCREEN (PRE-INSTALLED)
4	1	30	750	FRAME AND COVER (ROUND)
5	1	24 (MAX)	600 (MAX)	OUTLET PIPE (BY OTHERS)
6	1	24 (MAX)	600 (MAX)	INLET PIPE (BY OTHERS)

(2) HDS #6
NOT TO SCALE

CITY CASE NO. (to be assigned at plan submittal)

BASIS OF BEARINGS:						DESIGNED BY: M.M.
BEARINGS SHOWN HEREON ARE BASED ON THE BEARING BETWEEN SOPAC STATION P581 AND SOPAC STATION AVRY BEING N85°20'40"W						DRAWN BY: H-Z STAFF
BENCH MARK						CHECKED BY: J.M.
V-215 NAVD29, ELEVATION=2998.27' MOJAVE DR. @ TOPAZ RD., TC OF CENTER ISLAND NOSE 48' E/O INT.	BY	MARK	DESCRIPTION	APPR.	DATE	SCALE: AS SHOWN
	ENGINEER		REVISIONS		CITY	

CITY OF VICTORVILLE
ENGINEERING DEPARTMENT
14343 Civic Drive, Victorville, CA 92392 (760) 955-5000

Approved By: _____ DATE _____
Brian W. Gengler, RCE C44730
City Engineer

REGISTERED PROFESSIONAL ENGINEER — NO. 67512 EXPIRATION 6-30-2025 — CIVIL — STATE OF CALIFORNIA

PREPARED BY: _____
REGISTERED CIVIL ENGINEER NO. 67512
EXPIRATION: 6-30-2025
DATE _____

HUITT-ZOLLARS
Huitt-Zollars, Inc. Ontario
3990 CONCOURS * SUITE 330 * ONTARIO, CALIFORNIA 91764
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CITY OF VICTORVILLE
MOJAVE INDUSTRIAL PARK
WQMP MAP - PRELIMINARY CONDITION
BUILDING 3

SHEET 2 OF 2 SHEETS

FOR **COVINGTON GROUP** | M.O. | CITY FILE NO. -

Date/Time: May 15, 2023 3:38pm
Layout: 2-1 Reg and Exp
Plotted By: Eric Hernandez
Drawing: C:\Users\ehernandez\Covington Dropbox\Projects\2021\21-0135 Victorville Mojave Industrial Park\Drawings\Preliminary\WQMP\Page BL_DC-3.dwg

Attachment B
BMP Details & Support Calc's

PROJECT SUMMARY

CALCULATION DETAILS
- LOADING = HS20/HS25
- APPROX. LINEAR FOOTAGE = 4,586 LF

STORAGE SUMMARY
- STORAGE VOLUME REQUIRED = N/A
- PIPE STORAGE VOLUME = 291,749 CF
- BACKFILL STORAGE VOLUME = 105,660 CF
- TOTAL STORAGE PROVIDED = 397,409 CF

PIPE DETAILS
- DIAMETER = 108"
- CORRUGATION = 5x1
- GAGE = 14
- COATING = ALT2
- WALL TYPE = PERFORATED
- BARREL SPACING = 36"

BACKFILL DETAILS
- WIDTH AT ENDS = 24"
- ABOVE PIPE = 6"
- WIDTH AT SIDES = 24"
- 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 $2\frac{2}{3}$" x $\frac{1}{2}$" 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" = 60'

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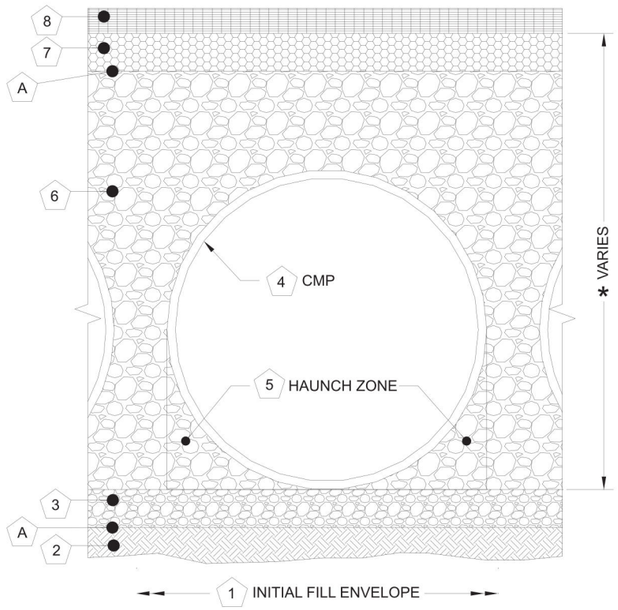
CONTECH® CMP DETENTION SYSTEMS
CONTECH **DYODS** DRAWING

DYO30949 Covington - Mojave Industrial Park
Building 3
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30949	5/1/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		



Infiltration Systems - CMP Infiltration & CMP Perforated Drainage Pipe			
Material Location	Description	Material Designation	Designation
8 Rigid or Flexible Pavement (if applicable)			
7 Road Base (if applicable			
A Geotextile Layer	Non-Woven Geotextile	CONTECH C-40 or C-45	Engineer Decision for consideration to prevent soil migration into varying soil types. Wrap the trench only.
6 Backfill	Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded, free draining stone, with a particle size of ½" – 2 ½" diameter is recommended.	AASHTO M 145-A-1 or AASHTO M 43 - 3, 4	Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, air-tamper, vibratory rod, or other effective methods. Compaction of all placed fill material is necessary and shall be considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the Project Engineer or his representative is satisfied with the level of compaction"
3 Bedding Stone	Well graded granular bedding material w/maximum particle size of 3"	AASHTO M43 - 3,357,4,467, 5, 56, 57	For soil aggregates larger than 3/8" a dedicated bedding layer is not required for CMP. Pipe may be placed on the trench bottom comprised of native suitable well graded & granular material. For Arch pipes it is recommended to be shaped to a relatively flat bottom or fine-grade the foundation to a slight v-shape. Soil aggregates less than 3/8" and unsuitable material should be over-excavated and re-placed with a 4"-6" layer of well graded & granular stone per the material designation.
A Geotextile Layer	None	None	Contech does not recommend geotextiles be placed under the invert of Infiltration systems due to the propensity for geotextiles to clog over time.
* Note: The listed AASHTO designations are for gradation only. The stone must also be angular and clean.			

1 MINIMUM WIDTH DEPENDS ON SITE CONDITIONS AND ENGINEERING JUDGEMENT.

FOUNDATION/BEDDING PREPARATION

2 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 BROUGHT BACK TO THE GRADE WITH A FILL MATERIAL AS APPROVED BY THE ENGINEER.

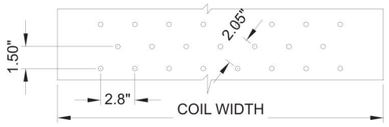
5 HAUNCH ZONE MATERIAL SHALL BE PLACED AND UNIFORMLY COMPACTED WITHOUT SOFT SPOTS.

BACKFILL
MATERIAL SHALL BE PLACED IN 8"-10" MAXIMUM LIFTS. INADEQUATE COMPACTION CAN LEAD TO EXCESSIVE DEFLECTIONS WITHIN THE SYSTEM AND SETTLEMENT OF THE SOILS OVER THE SYSTEM. BACKFILL SHALL BE PLACED SUCH THAT THERE IS NO MORE THAN A TWO-LIFT DIFFERENTIAL BETWEEN THE SIDES OF ANY PIPE IN THE SYSTEM AT ALL TIMES DURING THE BACKFILL PROCESS. BACKFILL SHALL BE ADVANCED ALONG THE LENGTH OF THE SYSTEM AT THE SAME RATE TO AVOID DIFFERENTIAL LOADING ON ANY PIPES IN THE SYSTEM.

EQUIPMENT USED TO PLACE AND COMPACT THE BACKFILL SHALL BE OF A SIZE AND TYPE SO AS NOT TO DISTORT, DAMAGE, OR DISPLACE THE PIPE. ATTENTION MUST BE GIVEN TO PROVIDING ADEQUATE MINIMUM COVER FOR SUCH EQUIPMENT. MAINTAIN BALANCED LOADING ON ALL PIPES IN THE SYSTEM DURING ALL SUCH OPERATIONS.

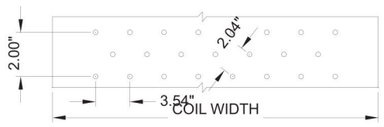
OTHER ALTERNATE BACKFILL MATERIAL MAY BE ALLOWED DEPENDING ON SITE SPECIFIC CONDITIONS. REFER TO TYPICAL BACKFILL DETAIL FOR MATERIAL REQUIRED.

2 2/3" x 1/2"
CORRUGATION - STEEL
AND ALUMINUM CMP
EDGE SPACING EQUAL
ON BOTH SIDES



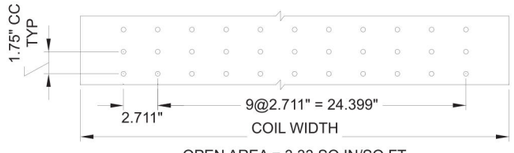
OPEN AREA = 3.76 SQ IN/SQ FT

3" x 1" CORRUGATION -
STEEL AND ALUMINUM
CMP
(COIL PROVIDED FROM
CONTECH LANTANA, FL
PLANT)



OPEN AREA = 4.16 SQ IN/SQ FT

5" x 1" CORRUGATION - STEEL ONLY
EDGE SPACING EQUAL ON BOTH SIDES



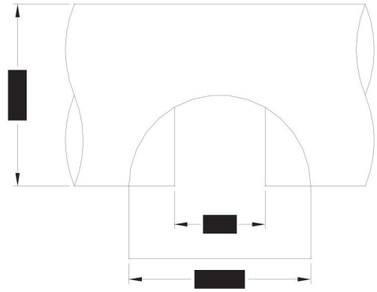
OPEN AREA = 3.33 SQ IN/SQ FT

NOTES:

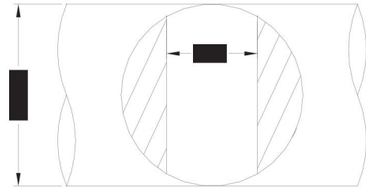
1. PERFORATIONS MEET AASHTO AND ASTM SPECIFICATIONS.
2. PERFORATION OPEN AREA PER SQUARE FOOT OF PIPE IS BASED ON THE NOMINAL DIAMETER AND LENGTH OF PIPE.
3. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
4. ALL HOLES ⌀3/8".

TYPICAL PERFORATION DETAIL

SCALE: N.T.S.



PLAN

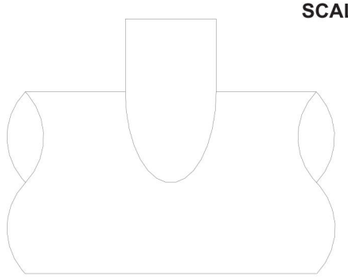


FRONT

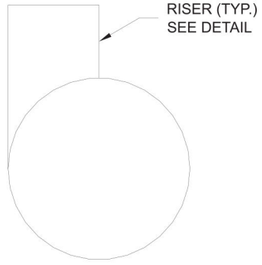
TYPICAL MANWAY DETAIL

SCALE: N.T.S.

NOTE:
MANWAY DETAIL APPLICABLE FOR CMP SYSTEMS WITH DIAMETERS 48" AND LARGER. MANWAYS MAY BE REQUIRED ON SMALLER SYSTEMS DEPENDING ON ACTUAL SITE SPECIFIC CONDITIONS.



ELEVATION

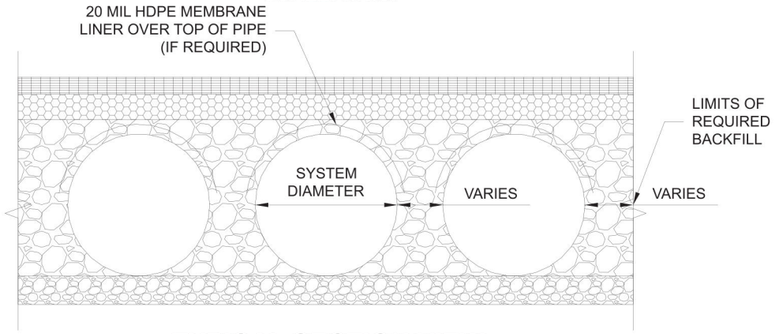


END

TYPICAL RISER DETAIL

SCALE: N.T.S.

NOTE:
LADDERS ARE OPTIONAL AND ARE NOT REQUIRED FOR ALL SYSTEMS.



TYPICAL SECTION VIEW

LINER OVER ROWS
SCALE: N.T.S.

NOTE: IF SALTING AGENTS FOR SNOW AND ICE REMOVAL ARE USED ON OR NEAR THE PROJECT, AN HDPE MEMBRANE LINER IS RECOMMENDED WITH THE SYSTEM. THE IMPERMEABLE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM A CHANGE IN THE SURROUNDING ENVIRONMENT OVER A PERIOD OF TIME. PLEASE REFER TO THE CORRUGATED METAL PIPE DETENTION DESIGN GUIDE FOR ADDITIONAL INFORMATION.

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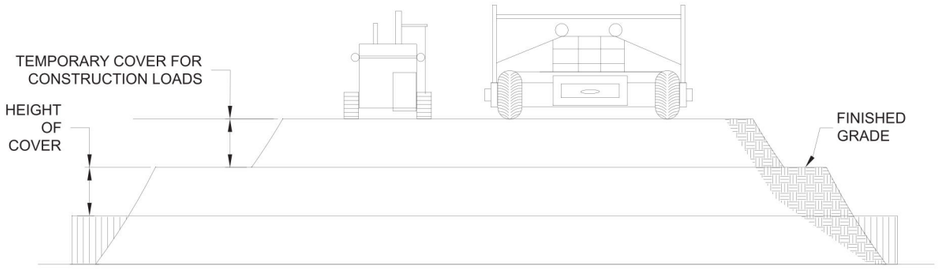

CONSTRUCTION LOADS

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.

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.

APPLICABLE 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.

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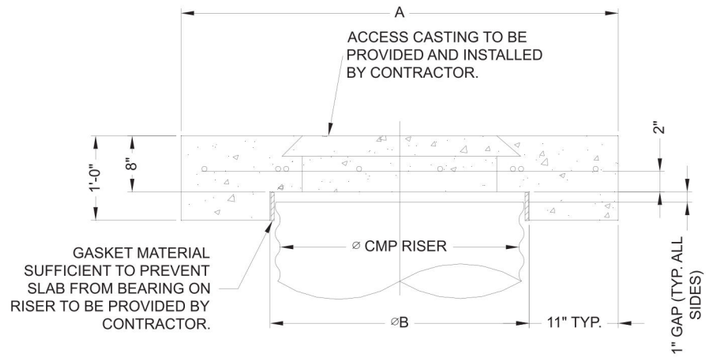
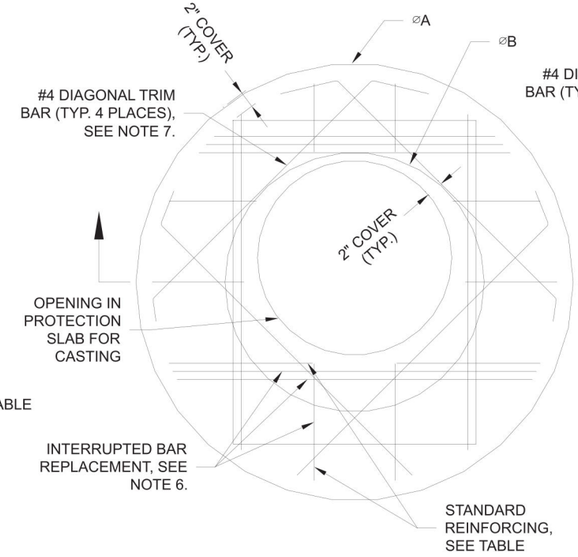


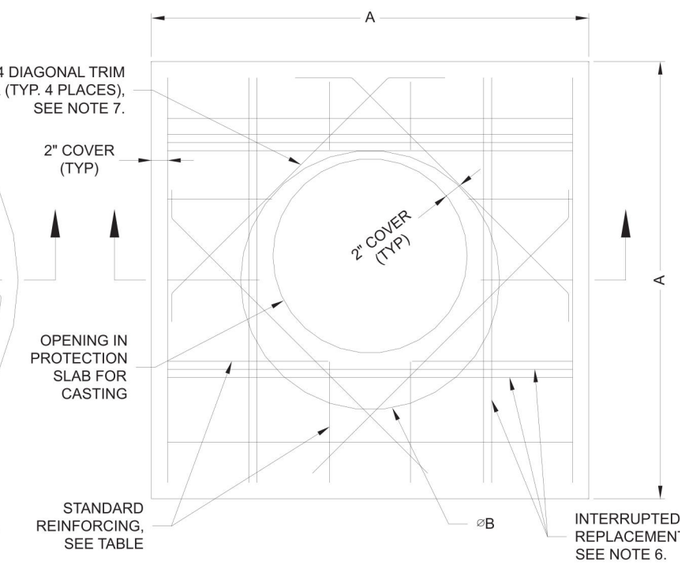
SECTION VIEW

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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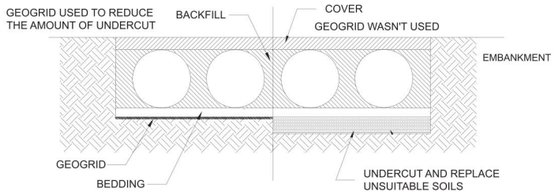
CMP DETENTION INSTALLATION GUIDE

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.

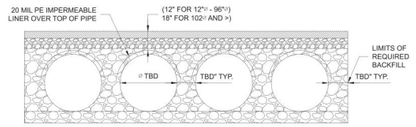


GRADE THE FOUNDATION SUBGRADE TO A UNIFORM OR SLIGHTLY SLOPING GRADE. IF THE SUBGRADE IS CLAY OR RELATIVELY NON-POROUS AND THE CONSTRUCTION SEQUENCE WILL LAST FOR AN EXTENDED PERIOD OF TIME, IT IS BEST TO SLOPE THE GRADE TO ONE END OF THE SYSTEM. THIS WILL ALLOW EXCESS WATER TO DRAIN QUICKLY, PREVENTING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

GEOMEMBRANE BARRIER

A SITE'S RESISTIVITY MAY CHANGE OVER TIME WHEN VARIOUS TYPES OF SALTING AGENTS ARE USED, SUCH AS ROAD SALTS FOR DEICING AGENTS. IF SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE, A GEOMEMBRANE BARRIER IS RECOMMENDED WITH THE SYSTEM. THE GEOMEMBRANE LINER IS INTENDED TO HELP PROTECT THE SYSTEM FROM THE POTENTIAL ADVERSE EFFECTS THAT MAY RESULT FROM THE USE OF SUCH AGENTS INCLUDING PREMATURE CORROSION AND REDUCED ACTUAL SERVICE LIFE.

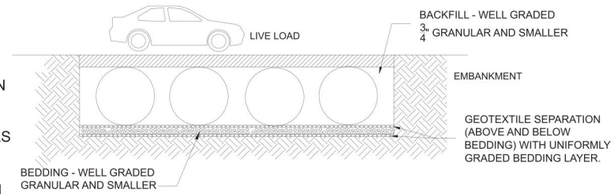
THE PROJECT'S ENGINEER OF RECORD IS TO EVALUATE WHETHER SALTING AGENTS WILL BE USED ON OR NEAR THE PROJECT SITE, AND USE HIS/HER BEST JUDGEMENT TO DETERMINE IF ANY ADDITIONAL PROTECTIVE MEASURES ARE REQUIRED. BELOW IS A TYPICAL DETAIL SHOWING THE PLACEMENT OF A GEOMEMBRANE BARRIER FOR PROJECTS WHERE SALTING AGENTS ARE USED ON OR NEAR THE PROJECT SITE.



IN-SITU TRENCH WALL

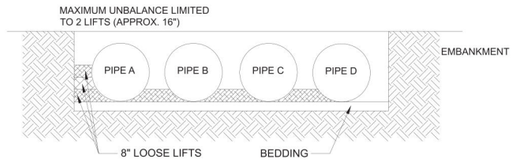
IF EXCAVATION IS REQUIRED, THE TRENCH WALL NEEDS TO BE CAPABLE OF SUPPORTING THE LOAD THAT THE PIPE SHEDS AS THE SYSTEM IS LOADED. IF SOILS ARE NOT CAPABLE OF SUPPORTING THESE LOADS, THE PIPE CAN DEFLECT. PERFORM A SIMPLE SOIL PRESSURE CHECK USING THE APPLIED LOADS TO DETERMINE THE LIMITS OF EXCAVATION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



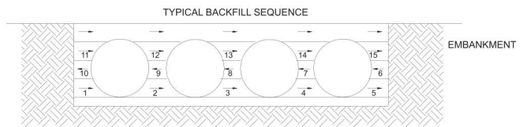
BACKFILL PLACEMENT

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

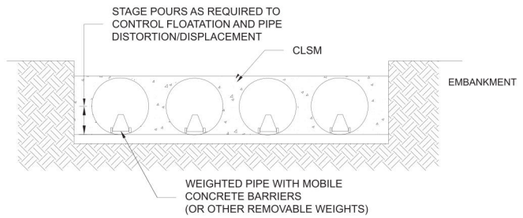


IF AASHTO T99 PROCEDURES ARE DETERMINED INFEASIBLE BY THE GEOTECHNICAL ENGINEER OF RECORD, COMPACTION IS CONSIDERED ADEQUATE WHEN NO FURTHER YIELDING OF THE MATERIAL IS OBSERVED UNDER THE COMPACTOR, OR UNDER FOOT, AND THE GEOTECHNICAL ENGINEER OF RECORD (OR REPRESENTATIVE THEREOF) IS SATISFIED WITH THE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

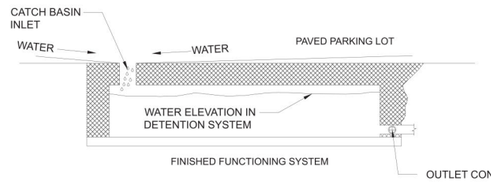


CONSTRUCTION LOADING

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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CONTECH® CMP DETENTION SYSTEMS
CONTECH DYODS DRAWING

DYO30949 Covington - Mojave Industrial Park
Building 3
Victorville, CA
DETENTION SYSTEM

PROJECT No.:	SEQ. No.:	DATE:
20866	30949	5/1/2023
DESIGNED: DYO	DRAWN: DYO	
CHECKED: DYO	APPROVED: DYO	
SHEET NO.: 1		

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Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 3
Location: HDS#5

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 27.0 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 4.5 $\frac{ft^3}{s}$	***(12)***

Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 3
Location: HDS#6

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 18.6 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 3.1 $\frac{ft^3}{s}$	***(12)***

Worksheet 2

Design Procedure Form for Design Flow

Uniform Intensity Design Flow

Designer: Brandon Pop
Company: Huitt-Zollars, Inc
Date: 05/02/2023
Project: Covington - MIP - Building 3
Location: HDS#7

1. Determine Impervious Percentage		
a. Determine total tributary area	A_{total} = 15.5 acres	***(1)***
b. Determine Impervious %	i = 90 %	***(2)***
2. Determine Runoff Coefficient Values Use **Table 4** and impervious % found in step 1		
a. A Soil Runoff Coefficient	C_a =	***(3)***
b. B Soil Runoff Coefficient	C_b =	***(4)***
c. C Soil Runoff Coefficient	C_c = 0.83	***(5)***
d. D Soil Runoff Coefficient	C_d =	***(6)***
3. Determine the Area decimal fraction of each soil type in tributary area		
a. Area of A Soil / ***(1)*** =	A_a =	***(7)***
b. Area of B Soil / ***(1)*** =	A_b =	***(8)***
c. Area of C Soil / ***(1)*** =	A_c = 1	***(9)***
d. Area of D Soil / ***(1)*** =	A_d =	***(10)***
4. Determine Runoff Coefficient		
a. C = ***(3)***x***(7)*** + ***(4)***x***(8)*** + ***(5)***x***(9)*** + ***(6)***x***(10)*** =	C = 0.83	***(11)***
5. Determine BMP Design flow		
a. Q_{BMP} = C x I x A = ***(11)*** x 0.2 x ***(1)***	Q_{BMP} = 2.6 $\frac{ft^3}{s}$	***(12)***

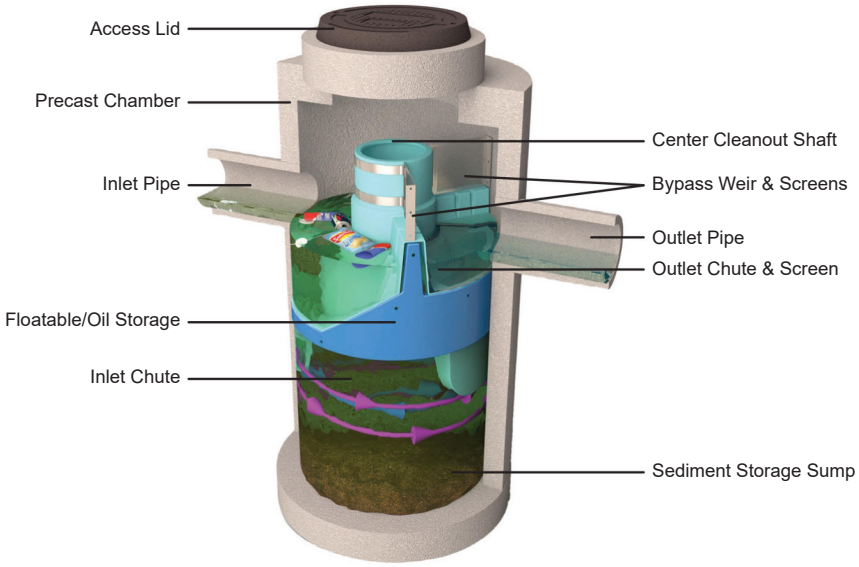
First Defense® FTC

Full Trash Capture Hydrodynamic Separator

Product Summary

First Defense Full Trash Capture (FTC) is an advanced hydrodynamic separator that combines enhanced vortex technology for total suspended solids (TSS) removal with a 5mm screen to meet full trash capture requirements set by the California Water Boards.*

Features



*One-hour, one-year design storm.

Applications

- Removal of Total Suspended Solids (TSS), floatable trash, and petroleum products from stormwater runoff
- New construction or redevelopment of commercial and residential sites
- Pre-treatment for green infrastructure and ponds
- Pollutant hotspots such as maintenance yards, parking lots, gas stations, streets, highways, airports and transportation hubs
- LEED® development projects
- Retrofitting existing systems

How It Works

1. Stormwater enters the Inlet Chute, where water is directed downwards and into a rotational motion around the Sediment Storage Sump.
2. Free floating trash is retained in the Inlet Chute area. Sediment and other settleable solids are retained in the Sediment Storage Sump as water follows a rotational path to the screened Outlet Chute.
3. Water then exits upward in the Outlet Chute where a horizontal screen prevents the loss of any suspended debris larger than 5mm. High flows can bypass directly to the outlet via the Bypass Weirs.
4. Two Bypass Screens continue to treat and retain the free floating debris. In extreme events water can crest the bypass screen and go directly to the outlet to prevent upstream flooding.

Model Number	Diameter	Maximum Pipe Diameter[1]	Trash Storage Capacity[2]	Flow Rate (cfs) for Screen Blinding Percentage[3]				Bypass Capacity	Typical TSS Treatment Rates	
Model	(ft / m)	(in / mm)	(yd^3 / m^3)	0%	25%	50%	75%	(cfs)	(cfs / L/s)	
FD-4 FTC	4 / 1.2	24 / 600	0.83 / 0.63	7.94	7.10	5.27	3.43	18	1.88 / 53.2	
FD-5 FTC	5 / 1.5	24 / 600	1.54 / 1.18	13.02	10.51	7.87	6.07	20	2.94 / 83.2	HDS #7
FD-6 FTC	6 / 1.8	30 / 750	2.22 / 1.70	25.60	21.50	16.01	10.66	32	4.23 / 119.8	HDS #6
FD-8 FTC	8 / 2.4	48 / 1219	5.28 / 4.00	34.16	33.75	26.29	16.88	50	7.52 / 212.9	HDS #5

[1]*Contact Hydro International when larger pipe sizes are required.*
[2]*Trash storage volume estimated as half the chamber volume from the base of the Inlet Chute to top of Bypass Weirs (not bypass screens). Actual volume of material stored will vary with size, density, and type. Larger volumes of trash may be retained.*
[3]*Calculated using HydroCAD modelling. A lower blinding factor can be applied to sites with lower anticipated loads.*

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200
Email: stormwaterinquiry@hydro-int.com
Web: www.hydro-int.com/firstdefense

FD-FTC_SS_E_2110

Download Drawings:

→ hydro-int.com/fddrawings

Operation & Maintenance Manual:

→ hydro-int.com/fd-om

Attachment C
Educational Materials

Outdoor Loading/Unloading SC-30

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Description

The loading/unloading of materials usually takes place outside on docks or terminals; therefore, materials spilled, leaked, or lost during loading/unloading may collect in the soil or on other surfaces and have the potential to be carried away by stormwater runoff or when the area is cleaned. Additionally, rainfall may wash pollutants from machinery used to unload or move materials. Implementation of the following protocols will prevent or reduce the discharge of pollutants to stormwater from outdoor loading/unloading of materials.

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Keep accurate maintenance logs to evaluate materials removed and improvements made.
- Park tank trucks or delivery vehicles in designated areas so that spills or leaks can be contained.
- Limit exposure of material to rainfall whenever possible.
- Prevent stormwater run-on.
- Check equipment regularly for leaks.

CASQA California Stormwater Quality Association

Suggested Protocols

Loading and Unloading – General Guidelines

- Develop an operations plan that describes procedures for loading and/or unloading.
- Conduct loading and unloading in dry weather if possible.
- Cover designated loading/unloading areas to reduce exposure of materials to rain.
- Consider placing a seal or door skirt between delivery vehicles and building to prevent exposure to rain.
- Design loading/unloading area to prevent stormwater run-on, which would include grading or berming the area, and position roof downspouts so they direct stormwater away from the loading/unloading areas.
- Have employees load and unload all materials and equipment in covered areas such as building overhangs at loading docks if feasible.
- Load/unload only at designated loading areas.
- Use drip pans underneath hose and pipe connections and other leak-prone spots during liquid transfer operations, and when making and breaking connections. Several drip pans should be stored in a covered location near the liquid transfer area so that they are always available, yet protected from precipitation when not in use. Drip pans can be made specifically for railroad tracks. Drip pans must be cleaned periodically, and drip collected materials must be disposed of properly.
- Pave loading areas with concrete instead of asphalt.
- Avoid placing storm drains in the area.
- Grade and/or berm the loading/unloading area to a drain that is connected to a deadend.

Inspection

- Check loading and unloading equipment regularly for leaks, including valves, pumps, flanges and connections.
- Look for dust or fumes during loading or unloading operations.

Training

- Train employees (e.g., fork lift operators) and contractors on proper spill containment and cleanup.
- Have employees trained in spill containment and cleanup present during loading/unloading.
- Train employees in proper handling techniques during liquid transfers to avoid spills.
- Make sure forklift operators are properly trained on loading and unloading procedures.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Contain leaks during transfer.
- Store and maintain appropriate spill cleanup materials in a location that is readily accessible and known to all and ensure that employees are familiar with the site's spill control plan and proper spill cleanup procedures.
- Have an emergency spill cleanup plan readily available.
- Use drip pans or comparable devices when transferring oils, solvents, and paints.

Other Considerations (Limitations and Regulations)

- Space and time limitations may preclude all transfers from being performed indoors or under cover.
- It may not be possible to conduct transfers only during dry weather.

Requirements

Costs

Costs should be low except when covering a large loading/unloading area.

Maintenance

- Conduct regular inspections and make repairs as necessary. The frequency of repairs will depend on the age of the facility.
- Check loading and unloading equipment regularly for leaks.
- Conduct regular broom dry-sweeping of area.

Supplemental Information

Further Detail of the BMP

Special Circumstances for Indoor Loading/Unloading of Materials

Loading or unloading of liquids should occur in the manufacturing building so that any spills that are not completely retained can be discharged to the sanitary sewer, treatment plant, or treated in a manner consistent with local sewer authorities and permit requirements.

- For loading and unloading tank trucks to above and below ground storage tanks, the following procedures should be used:
  - The area where the transfer takes place should be paved. If the liquid is reactive with the asphalt, Portland cement should be used to pave the area.
  - The transfer area should be designed to prevent run-on of stormwater from adjacent areas. Sloping the pad and using a curb, like a speed bump, around the uphill side of the transfer area should reduce run-on.

- The transfer area should be designed to prevent runoff of spilled liquids from the area. Sloping the area to a drain should prevent runoff. The drain should be connected to a dead-end sump or to the sanitary sewer. A positive control valve should be installed on the drain.

- For transfer from rail cars to storage tanks that must occur outside, use the following procedures:

  - Drip pans should be placed at locations where spillage may occur, such as hose connections, hose reels, and filler nozzles. Use drip pans when making and breaking connections.

  - Drip pan systems should be installed between the rails to collect spillage from tank cars.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

CASQA California Stormwater Quality Association

- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training

- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.
- Train employees and contractors in proper techniques for spill containment and cleanup.
- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.
- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.
- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.
- Clean up spills immediately.

Other Considerations

Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements

Costs

- Cost will vary depending on the type and size of facility.
- Overall costs should be low in comparison to other BMPs.

Maintenance

Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

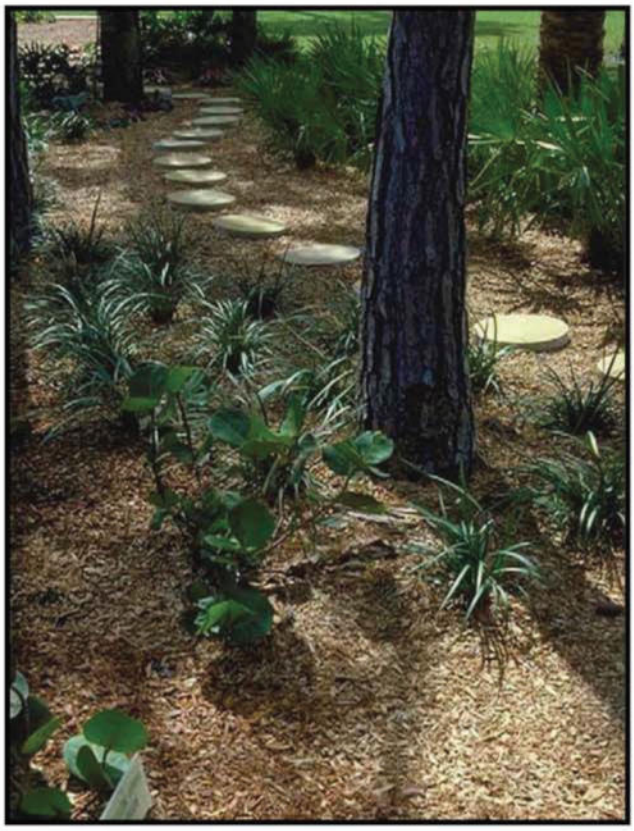
Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

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.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and

regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

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

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

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

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

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

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

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

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

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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

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– 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.

Maintenance Bays & Docks SD-31

Design Objectives

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

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

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

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.

- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.

- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.

- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.

- Other features may be 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.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources

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

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

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

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

Trash Storage Areas SD-32

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Design Objectives

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

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.
- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

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

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

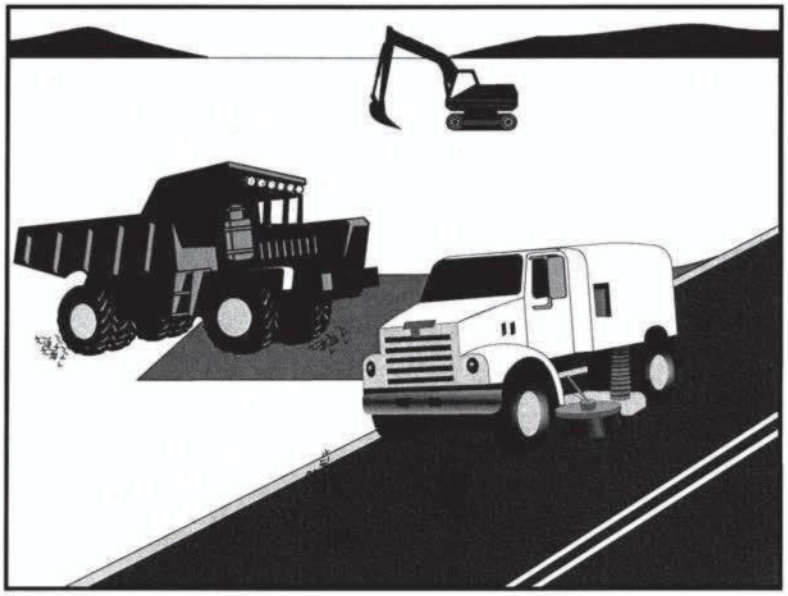
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

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

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

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

Street Sweeping and Vacuuming SE-7



Categories		
EC	Erosion Control	
SE	Sediment Control	☒
TC	Tracking Control	☑
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:
☑ **Primary Objective**
☒ **Secondary Objective**

Targeted Constituents	
Sediment	☑
Nutrients	
Trash	☑
Metals	
Bacteria	
Oil and Grease	☑
Organics	

Potential Alternatives

None

Description and Purpose

Street sweeping and vacuuming includes use of self-propelled and walk-behind equipment to remove sediment from streets and roadways, and to clean paved surfaces in preparation for final paving. Sweeping and vacuuming prevents sediment from the project site from entering storm drains or receiving waters.

Suitable Applications

Sweeping and vacuuming are suitable anywhere sediment is tracked from the project site onto public or private paved streets and roads, typically at points of egress. Sweeping and vacuuming are also applicable during preparation of paved surfaces for final paving.

Limitations

Sweeping and vacuuming may not be effective when sediment is wet or when tracked soil is caked (caked soil may need to be scraped loose).

Implementation

- Controlling the number of points where vehicles can leave the site will allow sweeping and vacuuming efforts to be focused, and perhaps save money.
- Inspect potential sediment tracking locations daily.
- Visible sediment tracking should be swept or vacuumed on a daily basis.
- Do not use kick brooms or sweeper attachments. These tend to spread the dirt rather than remove it.

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- If not mixed with debris or trash, consider incorporating the removed sediment back into the project

Costs

Rental rates for self-propelled sweepers vary depending on hopper size and duration of rental. Expect rental rates from $58/hour (3 yd^3 hopper) to $88/hour (9 yd^3 hopper), plus operator costs. Hourly production rates vary with the amount of area to be swept and amount of sediment. Match the hopper size to the area and expect sediment load to minimize time spent dumping.

Inspection and Maintenance

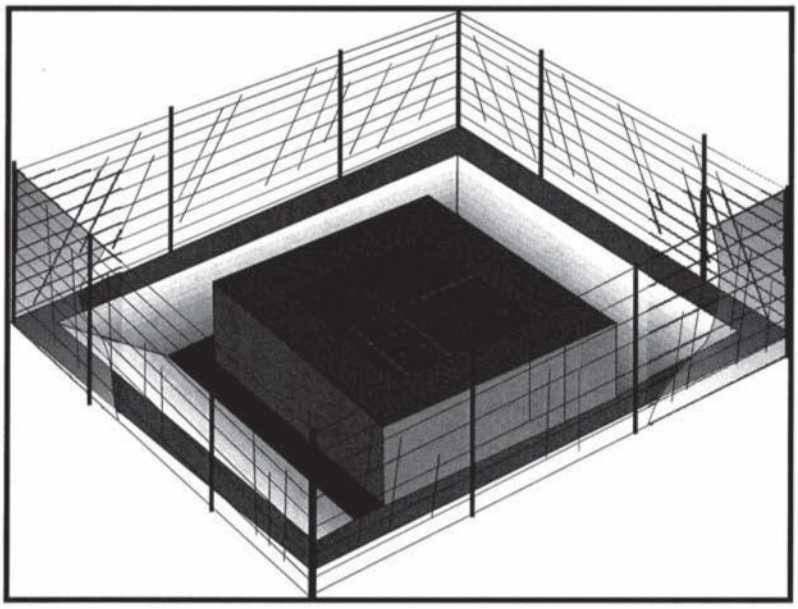
- Inspect BMPs in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- When actively in use, points of ingress and egress must be inspected daily.
- When tracked or spilled sediment is observed outside the construction limits, it must be removed at least daily. More frequent removal, even continuous removal, may be required in some jurisdictions.
- Be careful not to sweep up any unknown substance or any object that may be potentially hazardous.
- Adjust brooms frequently; maximize efficiency of sweeping operations.
- After sweeping is finished, properly dispose of sweeper wastes at an approved dumpsite.

References

Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), November 2000.

Labor Surcharge and Equipment Rental Rates, State of California Department of Transportation (Caltrans), April 1, 2002 – March 31, 2003.

Storm Drain Inlet Protection SE-10



Categories

EC	Erosion Control	
SE	Sediment Control	☑
TC	Tracking Control	
WE	Wind Erosion Control	
NS	Non-Stormwater Management Control	
WM	Waste Management and Materials Pollution Control	

Legend:

☑ **Primary Category**

☒ **Secondary Category**

Targeted Constituents

Sediment	☑
Nutrients	
Trash	☒
Metals	
Bacteria	
Oil and Grease	
Organics	

Potential Alternatives

SE-1 Silt Fence

SE-5 Fiber Rolls

SE-6 Gravel Bag Berm

SE-8 Sandbag Barrier

SE-14 Biofilter Bags

Description and Purpose

Storm drain inlet protection consists of a sediment filter or an impounding area in, around or upstream of a storm drain, drop inlet, or curb inlet. Storm drain inlet protection measures temporarily pond runoff before it enters the storm drain, allowing sediment to settle. Some filter configurations also remove sediment by filtering, but usually the ponding action results in the greatest sediment reduction. Temporary geotextile storm drain inserts attach underneath storm drain grates to capture and filter storm water.

Suitable Applications

Every storm drain inlet receiving runoff from unstabilized or otherwise active work areas should be protected. Inlet protection should be used in conjunction with other erosion and sediment controls to prevent sediment-laden stormwater and non-stormwater discharges from entering the storm drain system.

Limitations

- Drainage area should not exceed 1 acre.
- In general straw bales should not be used as inlet protection.
- Requires an adequate area for water to pond without encroaching into portions of the roadway subject to traffic.

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- Sediment removal may be inadequate to prevent sediment discharges in high flow conditions or if runoff is heavily sediment laden. If high flow conditions are expected, use other onsite sediment trapping techniques in conjunction with inlet protection.
- Frequent maintenance is required.
- Limit drainage area to 1 acre maximum. For drainage areas larger than 1 acre, runoff should be routed to a sediment-trapping device designed for larger flows. See BMPs SE-2, Sediment Basin, and SE-3, Sediment Traps.
- Excavated drop inlet sediment traps are appropriate where relatively heavy flows are expected, and overflow capability is needed.

Implementation

General

Inlet control measures presented in this handbook should not be used for inlets draining more than one acre. Runoff from larger disturbed areas should be first routed through SE-2, Sediment Basin or SE-3, Sediment Trap and/or used in conjunction with other drainage control, erosion control, and sediment control BMPs to protect the site. Different types of inlet protection are appropriate for different applications depending on site conditions and the type of inlet. Alternative methods are available in addition to the methods described/shown herein such as prefabricated inlet insert devices, or gutter protection devices.

Design and Layout

Identify existing and planned storm drain inlets that have the potential to receive sediment-laden surface runoff. Determine if storm drain inlet protection is needed and which method to use.

- The key to successful and safe use of storm drain inlet protection devices is to know where runoff that is directed toward the inlet to be protected will pond or be diverted as a result of installing the protection device.
  - Determine the acceptable location and extent of ponding in the vicinity of the drain inlet. The acceptable location and extent of ponding will influence the type and design of the storm drain inlet protection device.
  - Determine the extent of potential runoff diversion caused by the storm drain inlet protection device. Runoff ponded by inlet protection devices may flow around the device and towards the next downstream inlet. In some cases, this is acceptable; in other cases, serious erosion or downstream property damage can be caused by these diversions. The possibility of runoff diversions will influence whether or not storm drain inlet protection is suitable; and, if suitable, the type and design of the device.
- The location and extent of ponding, and the extent of diversion, can usually be controlled through appropriate placement of the inlet protection device. In some cases, moving the inlet protection device a short distance upstream of the actual inlet can provide more efficient sediment control, limit ponding to desired areas, and prevent or control diversions.

- Six types of inlet protection are presented below. However, it is recognized that other effective methods and proprietary devices exist and may be selected.
  - Silt Fence: Appropriate for drainage basins with less than a 5% slope, sheet flows, and flows under 0.5 cfs.
  - Excavated Drop Inlet Sediment Trap: An excavated area around the inlet to trap sediment (SE-3).
  - Gravel bag barrier: Used to create a small sediment trap upstream of inlets on sloped, paved streets. Appropriate for sheet flow or when concentrated flow may exceed 0.5 cfs, and where overtopping is required to prevent flooding.
  - Block and Gravel Filter: Appropriate for flows greater than 0.5 cfs.
  - Temporary Geotextile Storm drain Inserts: Different products provide different features. Refer to manufacturer details for targeted pollutants and additional features.
  - Biofilter Bag Barrier: Used to create a small retention area upstream of inlets and can be located on pavement or soil. Biofilter bags slowly filter runoff allowing sediment to settle out. Appropriate for flows under 0.5 cfs.
- Select the appropriate type of inlet protection and design as referred to or as described in this fact sheet.
- Provide area around the inlet for water to pond without flooding structures and property.
- Grates and spaces around all inlets should be sealed to prevent seepage of sediment-laden water.
- Excavate sediment sumps (where needed) 1 to 2 ft with 2:1 side slopes around the inlet.

Installation

- ***DI Protection Type 1 - Silt Fence*** - Similar to constructing a silt fence; see BMP SE-1, Silt Fence. Do not place fabric underneath the inlet grate since the collected sediment may fall into the drain inlet when the fabric is removed or replaced and water flow through the grate will be blocked resulting in flooding. See typical Type 1 installation details at the end of this fact sheet.
  1. Excavate a trench approximately 6 in. wide and 6 in. deep along the line of the silt fence inlet protection device.
  2. Place 2 in. by 2 in. wooden stakes around the perimeter of the inlet a maximum of 3 ft apart and drive them at least 18 in. into the ground or 12 in. below the bottom of the trench. The stakes should be at least 48 in.
  3. Lay fabric along bottom of trench, up side of trench, and then up stakes. See SE-1, Silt Fence, for details. The maximum silt fence height around the inlet is 24 in.
  4. Staple the filter fabric (for materials and specifications, see SE-1, Silt Fence) to wooden stakes. Use heavy-duty wire staples at least 1 in. in length.

5. Backfill the trench with gravel or compacted earth all the way around.

- ***DI Protection Type 2 - Excavated Drop Inlet Sediment Trap*** - Install filter fabric fence in accordance with DI Protection Type 1. Size excavated trap to provide a minimum storage capacity calculated at the rate 67 yd^3/acre of drainage area. See typical Type 2 installation details at the end of this fact sheet.

- ***DI Protection Type 3 - Gravel bag*** - Flow from a severe storm should not overtop the curb. In areas of high clay and silts, use filter fabric and gravel as additional filter media. Construct gravel bags in accordance with SE-6, Gravel Bag Berm. Gravel bags should be used due to their high permeability. See typical Type 3 installation details at the end of this fact sheet.

  1. Construct on gently sloping street.
  2. Leave room upstream of barrier for water to pond and sediment to settle.
  3. Place several layers of gravel bags – overlapping the bags and packing them tightly together.
  4. Leave gap of one bag on the top row to serve as a spillway. Flow from a severe storm (e.g., 10 year storm) should not overtop the curb.

- ***DI Protection Type 4 – Block and Gravel Filter*** - Block and gravel filters are suitable for curb inlets commonly used in residential, commercial, and industrial construction. See typical Type 4 installation details at the end of this fact sheet.

  1. Place hardware cloth or comparable wire mesh with 0.5 in. openings over the drop inlet so that the wire extends a minimum of 1 ft beyond each side of the inlet structure. If more than one strip is necessary, overlap the strips. Place woven geotextile over the wire mesh.
  2. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, so that the open ends face outward, not upward. The ends of adjacent blocks should abut. The height of the barrier can be varied, depending on design needs, by stacking combinations of blocks that are 4 in., 8 in., and 12 in. wide. The row of blocks should be at least 12 in. but no greater than 24 in. high.
  3. Place wire mesh over the outside vertical face (open end) of the concrete blocks to prevent stone from being washed through the blocks. Use hardware cloth or comparable wire mesh with 0.5 in. opening.
  4. Pile washed stone against the wire mesh to the top of the blocks. Use 0.75 to 3 in.

- ***DI Protection Type 5 – Temporary Geotextile Insert (proprietary)*** – Many types of temporary inserts are available. Most inserts fit underneath the grate of a drop inlet or inside of a curb inlet and are fastened to the outside of the grate or curb. These inserts are removable and many can be cleaned and reused. Installation of these inserts differs between manufacturers. Please refer to manufacturer instruction for installation of proprietary devices.

- ***DI Protection Type 6 - Biofilter bags*** – Biofilter bags may be used as a substitute for gravel bags in low-flow situations. Biofilter bags should conform to specifications detailed in SE-14, Biofilter bags.

    1. Construct in a gently sloping area.
    2. Biofilter bags should be placed around inlets to intercept runoff flows.
    3. All bag joints should overlap by 6 in.
    4. Leave room upstream for water to pond and for sediment to settle out.
    5. Stake bags to the ground as described in the following detail. Stakes may be omitted if bags are placed on a paved surface.

Costs

- Average annual cost for installation and maintenance of DI Type 1-4 and 6 (one year useful life) is $200 per inlet.
- Temporary geotextile inserts are proprietary and cost varies by region. These inserts can often be reused and may have greater than 1 year of use if maintained and kept undamaged. Average cost per insert ranges from $50-75 plus installation, but costs can exceed $100. This cost does not include maintenance.

Inspection and Maintenance

- BMPs must be inspected in accordance with General Permit requirements for the associated project type and risk level. It is recommended that at a minimum, BMPs be inspected weekly, prior to forecasted rain events, daily during extended rain events, and after the conclusion of rain events.
- Silt Fences. If the fabric becomes clogged, torn, or degrades, it should be replaced. Make sure the stakes are securely driven in the ground and are in good shape (i.e., not bent, cracked, or splintered, and are reasonably perpendicular to the ground). Replace damaged stakes. At a minimum, remove the sediment behind the fabric fence when accumulation reaches one-third the height of the fence or barrier height.
- Gravel Filters. If the gravel becomes clogged with sediment, it should be carefully removed from the inlet and either cleaned or replaced. Since cleaning gravel at a construction site may be difficult, consider using the sediment-laden stone as fill material and put fresh stone around the inlet. Inspect bags for holes, gashes, and snags, and replace bags as needed. Check gravel bags for proper arrangement and displacement.
- Sediment that accumulates in the BMP should be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height.
- Inspect and maintain temporary geotextile insert devices according to manufacturer's specifications.
- Remove storm drain inlet protection once the drainage area is stabilized.

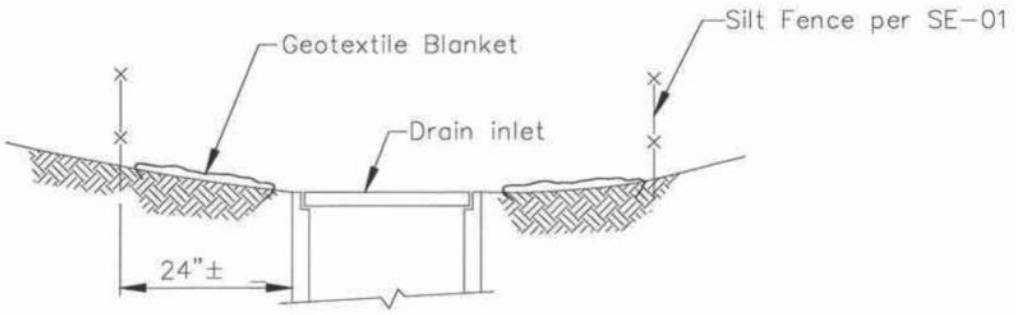
- Clean and regrade area around the inlet and clean the inside of the storm drain inlet, as it should be free of sediment and debris at the time of final inspection.

References

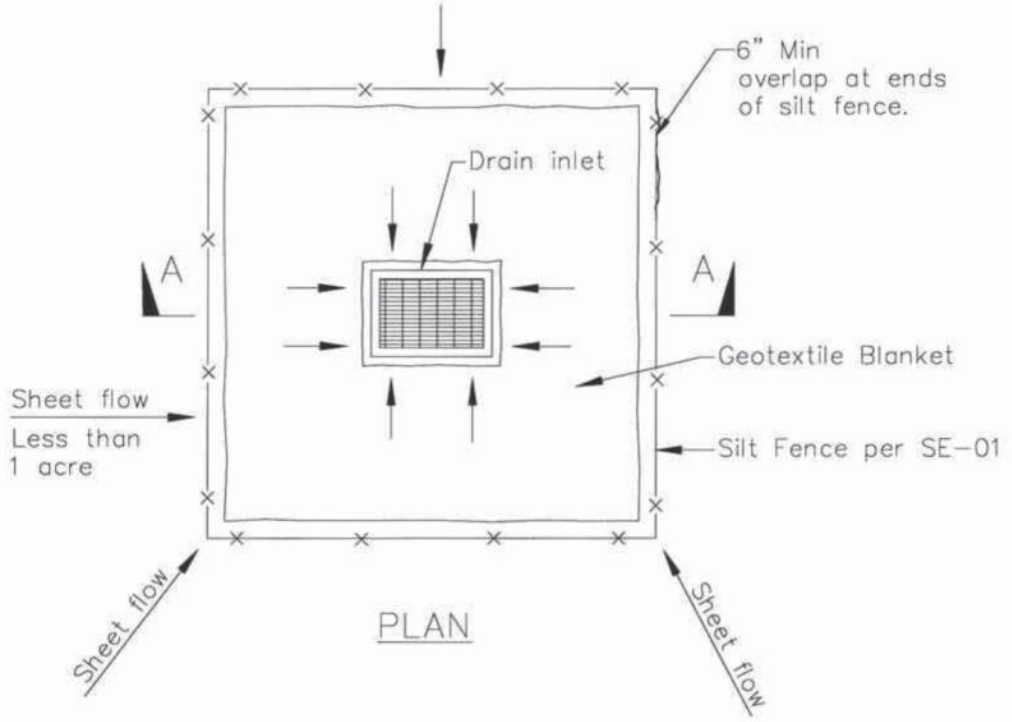
Stormwater Quality Handbooks - Construction Site Best Management Practices (BMPs) Manual, State of California Department of Transportation (Caltrans), March 2003.

Stormwater Management Manual for The Puget Sound Basin, Washington State Department of Ecology, Public Review Draft, 1991.

Erosion and Sediment Control Manual, Oregon Department of Environmental Quality, February 2005.



SECTION A–A

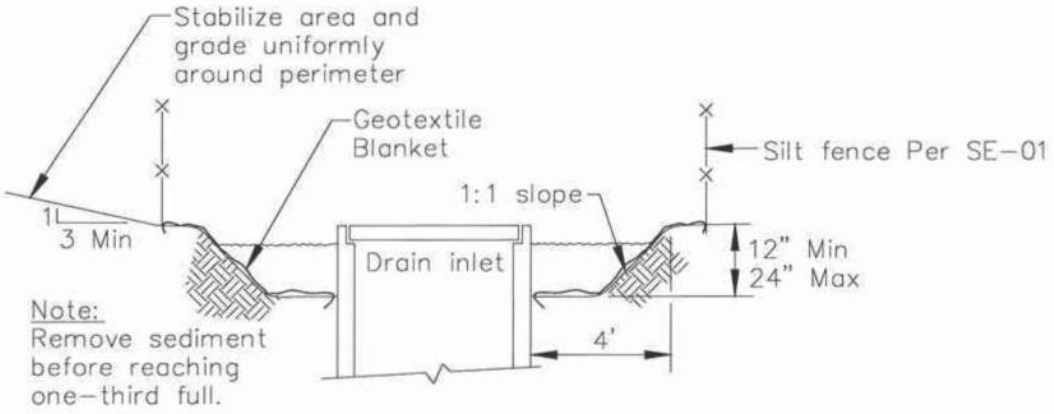


PLAN

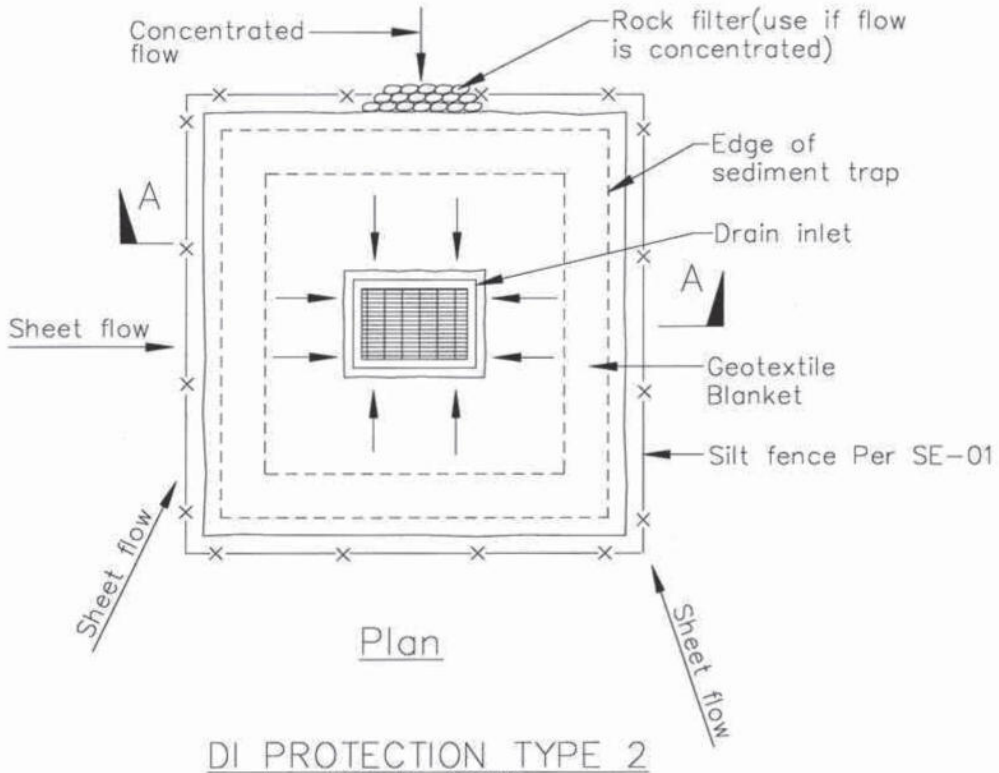
DI PROTECTION TYPE 1
NOT TO SCALE

NOTES:

1. For use in areas where grading has been completed and final soil stabilization and seeding are pending.
2. Not applicable in paved areas.
3. Not applicable with concentrated flows.



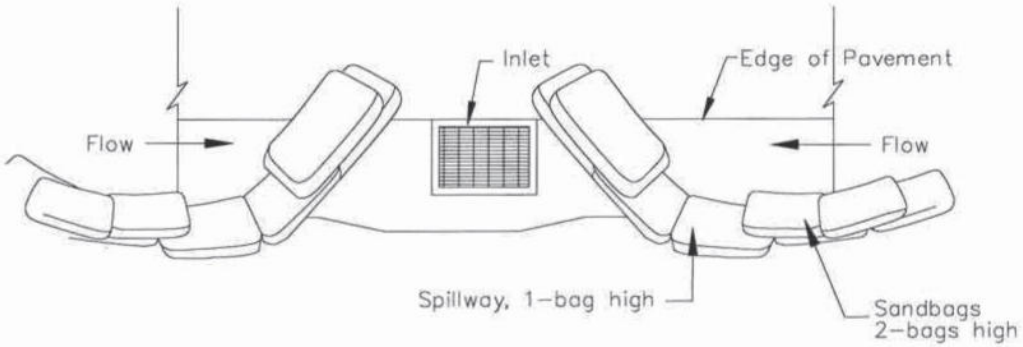
Section A-A



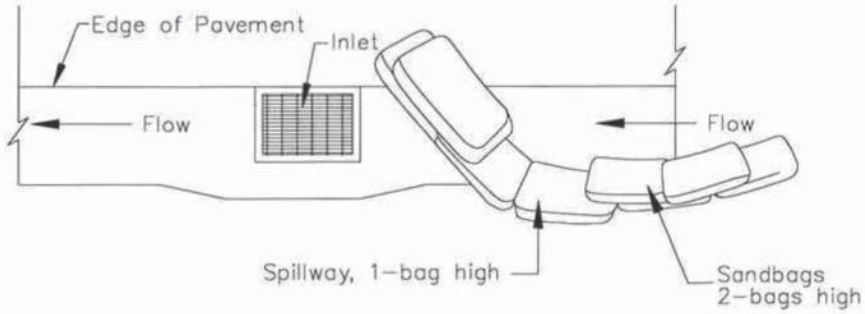
Plan

DI PROTECTION TYPE 2
NOT TO SCALE

Notes
1. For use in cleared and grubbed and in graded areas.
2. Shape basin so that longest inflow area faces longest length of trap.
3. For concentrated flows, shape basin in 2:1 ratio with length oriented towards direction of flow.



TYPICAL PROTECTION FOR INLET ON SUMP

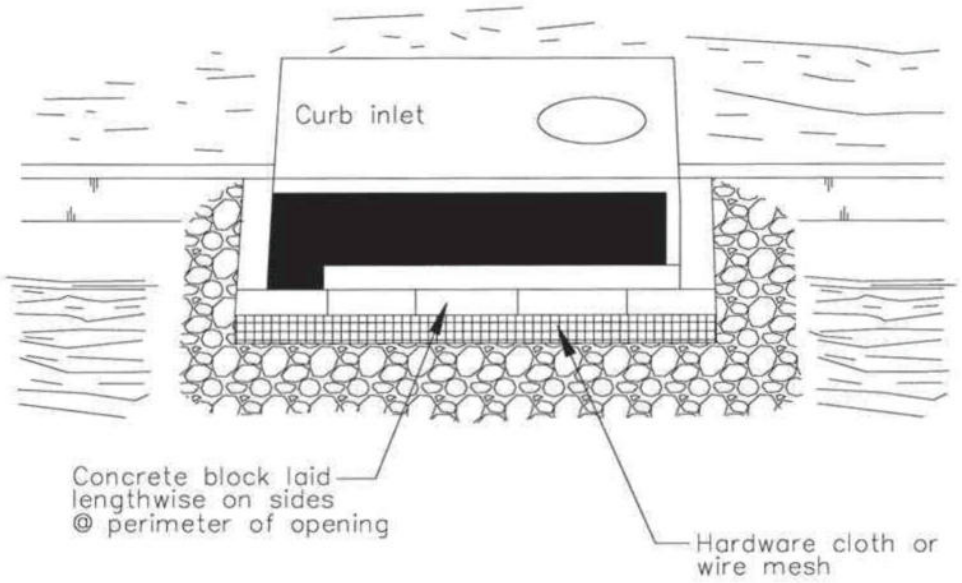


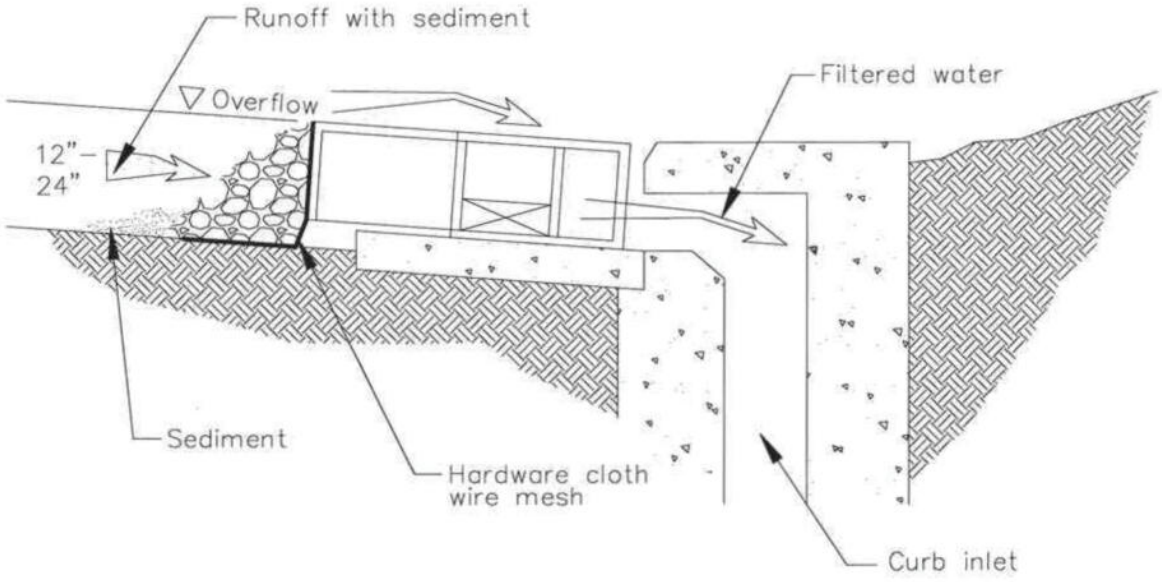
TYPICAL PROTECTION FOR INLET ON GRADE

NOTES:

1. Intended for short-term use.
2. Use to inhibit non-storm water flow.
3. Allow for proper maintenance and cleanup.
4. Bags must be removed after adjacent operation is completed
5. Not applicable in areas with high silts and clays without filter fabric.

DI PROTECTION TYPE 3
NOT TO SCALE





DI PROTECTION – TYPE 4
NOT TO SCALE

Drain Inserts MP-52

Description

Drain inserts are manufactured filters or fabric placed in a drop inlet to remove sediment and debris. There are a multitude of inserts of various shapes and configurations, typically falling into one of three different groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are one box; that is, the setting area and filtration through media occur in the same box. Some products consist of one or more trays or mesh grates. The trays may hold different types of media. Filtration media vary by manufacturer. Types include polypropylene, porous polymer, treated cellulose, and activated carbon.

California Experience

The number of installations is unknown but likely exceeds a thousand. Some users have reported that these systems require considerable maintenance to prevent plugging and bypass.

Advantages

- Does not require additional space as inserts as the drain inlets are already a component of the standard drainage systems.
- Easy access for inspection and maintenance.
- As there is no standing water, there is little concern for mosquito breeding.
- A relatively inexpensive retrofit option.

Limitations

Performance is likely significantly less than treatment systems that are located at the end of the drainage system such as ponds and vaults. Usually not suitable for large areas or areas with trash or leaves than can plug the insert.

Design and Sizing Guidelines

Refer to manufacturer's guidelines. Drain inserts come any many configurations but can be placed into three general groups: socks, boxes, and trays. The sock consists of a fabric, usually constructed of polypropylene. The fabric may be attached to a frame or the grate of the inlet holds the sock. Socks are meant for vertical (drop) inlets. Boxes are constructed of plastic or wire mesh. Typically a polypropylene "bag" is placed in the wire mesh box. The bag takes the form of the box. Most box products are

Design Considerations

- Use with other BMPs
- Fit and Seal Capacity within Inlet

Targeted Constituents

- ✓ Sediment
- ✓ Nutrients
- ✓ Trash
- ✓ Metals
- Bacteria
- ✓ Oil and Grease
- ✓ Organics

Removal Effectiveness

See New Development and Redevelopment Handbook-Section 5.

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one box; that is, the setting area and filtration through media occurs in the same box. One manufacturer has a double-box. Stormwater enters the first box where setting occurs. The stormwater flows into the second box where the filter media is located. Some products consist of one or more trays or mesh grates. The trays can hold different types of media. Filtration media vary with the manufacturer: types include polypropylene, porous polymer, treated cellulose, and activated carbon.

Construction/Inspection Considerations

Be certain that installation is done in a manner that makes certain that the stormwater enters the unit and does not leak around the perimeter. Leakage between the frame of the insert and the frame of the drain inlet can easily occur with vertical (drop) inlets.

Performance

Few products have performance data collected under field conditions.

Siting Criteria

It is recommended that inserts be used only for retrofit situations or as pretreatment where other treatment BMPs presented in this section area used.

Additional Design Guidelines

Follow guidelines provided by individual manufacturers.

Maintenance

Likely require frequent maintenance, on the order of several times per year.

Cost

- The initial cost of individual inserts ranges from less than $100 to about $2,000. The cost of using multiple units in curb inlet drains varies with the size of the inlet.
- The low cost of inserts may tend to favor the use of these systems over other, more effective treatment BMPs. However, the low cost of each unit may be offset by the number of units that are required, more frequent maintenance, and the shorter structural life (and therefore replacement).

References and Sources of Additional Information

Hrachovec, R., and G. Minton, 2001, Field testing of a sock-type catch basin insert, Planet CPR, Seattle, Washington

Interagency Catch Basin Insert Committee, Evaluation of Commercially-Available Catch Basin Inserts for the Treatment of Stormwater Runoff from Developed Sites, 1995

Larry Walker Associates, June 1998, NDMP Inlet/In-Line Control Measure Study Report

Manufacturers literature

Santa Monica (City), Santa Monica Bay Municipal Stormwater/Urban Runoff Project - Evaluation of Potential Catch basin Retrofits, Woodward Clyde, September 24, 1998

Woodward Clyde, June 11, 1996, Parking Lot Monitoring Report, Santa Clara Valley Nonpoint Source Pollution Control Program.

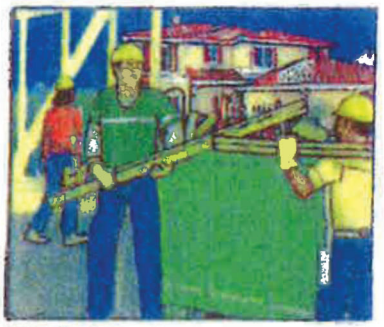
STORMWATER Pollution Prevention

CONSTRUCTION

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.

Store Materials Safely

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



Ordering Materials & Recycling Waste

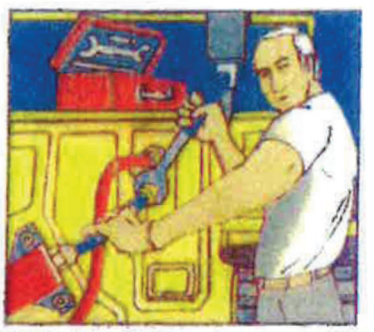
Reduce waste by ordering only the amounts of materials needed for the job. Use recycled or recyclable materials whenever possible. You can recycle broken asphalt, concrete, wood, and cleared vegetation. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling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

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. To report serious spills, call 911.

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation or add hydromulch on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff to a detention basin and around the construction site. Channels can be lined with grass or roughened pavement to reduce runoff velocity.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

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

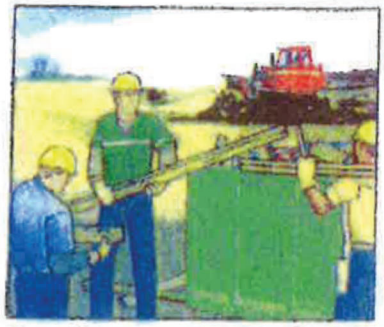
1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

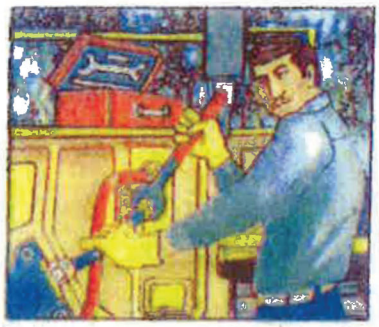
EXCAVATION AND GRADING

Sediment, cement wash, asphalt and vehicle fluids from soil excavation and grading 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.



Recycling Waste

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Non-recyclable materials should be taken to a landfill or disposed of as hazardous waste. For recycling and disposal information, call (909) 386-8401.



Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutters and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks. Use gravel approaches where truck traffic is heavy to reduce soil compaction and limit the tracking of sediment into the street.

Cleaning & Preventing Spills

Use a drip pan and funnel when draining or pouring fluids. Sweep up dry spills, instead of hosing. Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids. To report serious spills, call 911.

Storing Materials

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

Preventing Erosion

Avoid excavation or grading during wet weather. Plant temporary vegetation on slopes where construction is not immediately planned, and permanent vegetation once excavation and grading are complete. Construct diversion dikes to channel runoff. Channels can be lined with grass or roughened pavement to reduce runoff velocity.

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.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

ROADWORK AND PAVING

Asphalt, saw-cut slurry and excavated materials from road paving, surfacing and pavement removal 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.

Preventing Erosion

Schedule excavation and grading work during dry weather. Develop and implement erosion and sediment control plans for excavated embankments. Cover exposed stockpiles of soil, sand or gravel and excavated material with plastic sheeting, protected from rain, wind and runoff.

During Construction

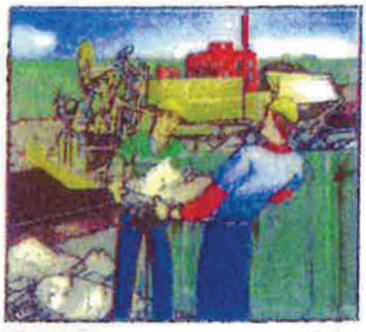
Cover catch basins and maintenance holes when applying seal coat, slurry seal or fog seal. Use check dams, ditches or berms around excavations, and avoid over applying water for dust control. Never wash excess materials from exposed aggregate or concrete into the street, gutter or a storm drain.

Maintaining Vehicles & Equipment

Maintain and refuel vehicles and equipment at a single location on-site, away from the street, gutter and storm drains. Perform major equipment repairs and washings off-site. Inspect vehicles and equipment frequently for leaks, and prevent leaks from stored vehicles by draining gas, hydraulic oil, transmission, brake and radiator fluids.

Asphalt & Concrete Removal

Barricade storm drain openings during saw-cutting, and recycle broken up pavement at a crushing company. For recycling information, call (909) 386-8401.



Cleaning & Preventing Spills

Be ready for spills by preparing and using spill containment and cleanup kits that include safety equipment and dry cleanup materials such as kitty litter or sawdust. Sweep up dry spills, instead of hosing. Prevent spills from paver machines by using drip pans, or by placing absorbent materials like cloths or rags under the machines when not in use. To report serious spills, call 911.

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

1 (800) CLEANUP

www.1800cleanup.org

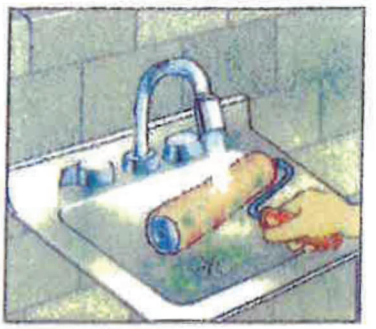
STORMWATER Pollution Prevention

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

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.

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

1 (800) CLEANUP

www.1800cleanup.org

STORMWATER Pollution Prevention

FOOD AND RESTAURANT

Food waste, grease, cleaning fluids, mop water and trash from restaurant operations 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.

Recycle Oil & Grease

Oil and grease wastes can be recycled. Look in the yellow pages for rendering companies, or call (909) 386-8401 for disposal information. Don't pour oil or grease into sinks, floor drains or onto a parking lot or street. Keep grease bins covered and contained. Keep your grease interceptor maintained to prevent sewer overflows or backups and keep records of grease waste hauling.

Dumpster Areas

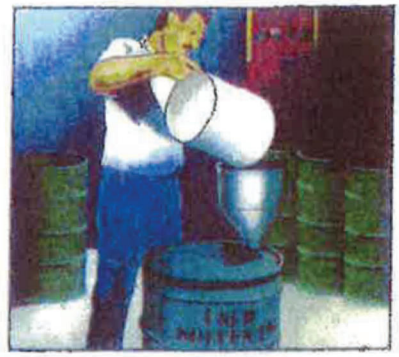
Keep dumpster lids closed and the areas around them clean. Do not fill with liquid waste or hose them out. Call your trash hauler to replace any dumpsters that are damaged or leak.

Cleaning & Maintenance

Clean equipment, floor mats, filters and garbage cans in a mop sink, wash rack or floor drain connected to the sewer through a grease trap. Don't wash them or pour wash water in a parking lot, alley, sidewalk or street. Sweep outside areas and put the debris in the garbage, instead of sweeping or hosing it into the parking lot or street.

Managing Spills

Clean food spills in loading and trash areas by using absorbent materials and sweeping then mopping, and discharge mop water into the sewer through a grease interceptor. Have spill containment and cleanup kits available. To report serious toxic spills, call 911.



Handling Toxic Chemicals

Dispose of all unwanted toxics materials like cleaners, solvents and detergents through a hazardous waste hauler. These items are not trash. For information on hazardous waste pickup, call (909) 386-8401. Use non-toxic cleaning products whenever possible.

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

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

RESTAURANTES

Desechos de comida, grasa, liquidos de limpieza, agua del trapiador y basura de un restaurant acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el rio de Santa Ana. Para prevenir esta contaminación y protejar la salud publica, siga estas practicas.

Reciclando Aceite & Grasa

El aceite y la grasa se pueden reciclar. Busca en las paginas amarillas compañias de reciclaje o llama al (909) 386-8401 para información. No los tires en los lavaderos, las coladeras, el estacionamiento o en la calle. Manten los recipientes de grasa cubiertos y guardados.

Areas de Basura

Manten el bote de basura cerrada y el área del basurero limpia. No lo llenes con desechos liquidos ni utilices la manguera para lavarlo. Llama al transportador de basura para reemplasar los botes de basura que esten dañados.

Controlando Derrames

Usa métodos secos para limpiar los derrames, barriendo y usando tierra para desechos de gato, no uses la manguera para limpiar los derrames. Manten un kit de limpieza de derramamientos en tu negocio. Para reportar derrames llama al 911.

Limpiando & Mantenimiento

Limpia los tapetes de piso, los filtros y los botes de basura en el contenedor para trapeadores, lavavo, o en la coladera aprupiado que llegue al drenaje. No los laves en el estacionamiento, los callejones, en la banqueta o en la calle. Barre el area de afuera y pon todo en la basura, en ves de dejarlo en la banqueta o en la calle.

Manejando Quimicos Toxicos

Deposita los desechos toxicos como limpiadores, solventes, detergentes a un bote para toxicos. Estos no son basura. Para mas información sobre desechos peligrosos, llama al (909) 386-8401. Usa productos de limpieza que no sean toxicos.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

TRABAJO DE CARRETERAS & PAVIMENTO

Asfalto, mezcle y materiales de excavaciones del pavimento acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigua estas practicas para prevenir la contaminación y protejer la salud publica.

Previniendo Erosiones

Planea las excavaciones trabajo de jardineria durante el clima seco. Desarrolla e implementa planes de embarcamientos de control de sedimento y excavaciones. Cubre montones de tierra, grava y otros materiales con un plastico para protejerlos de la lluvia, aire y desagüe.

Durante Construcción

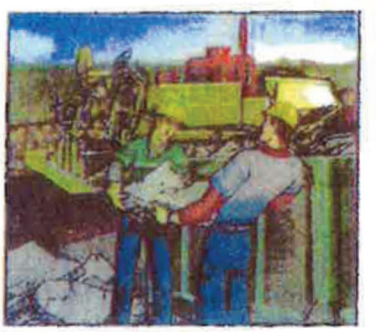
Cubre los lavados y de mantenimiento a los hoyos al aplicar selladura o mezcle. Revisa las areas de excavaciones, y evita pasarte de agua para proveenir polvadura. Nunca laves los materiales llenos de concreto en la calle, drenajes o en el desagüe.

Mantenimiento de Vehiculos & Herramientas

Has el mantenimiento y carga de vehiculos en el mismo lugar, lejos de la calle, las alcantarillas y los drenajes. Inspecciona los vehiculos y el equipo de cualquier goteadura y evita goteaduras de autos que no se usan vaciandoles la gasolina, aceite de transmision, frenos y liquidos del radiador.

Removiendo Asfalto & Concreto

Bloquea alrededor de los drenajes cuando estes usando las maquinas de sierra, tambien recicla todo el pavimento roto en la compañia demolidora. Para más información llama al (909) 386-8401.



Limpiando & Previniendo Derrames

Mantente siempre preparado para cualquier derrame, usa siempre las herramientas de seguridad al igual que materiales como, tierra para desechos de gato o aserrin Barre los derrames en ves de lavarlos con la manguera. Previene los derrames de las maquinas usando enbudos o colocanto garras para absorver cualquier liquido. Para reportar derrames llama al 911.

Para reportar actividades ilegales u obtener más información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

Prevención de Contaminación del Desagüe

PINTURA

Pintura, solventes y otros quimicos peligrosos que se usan al pintar acaban por llegar a los drenajes del Condado de San Bernardino y terminando en el Rio de Santa Ana. Esto contamina el agua que tomamos, haciendola peligorsa para la gente y la vida salvaje. Sigue estas practicas para prevenir la contaminación y protejer la salud publica.

Pinturas de Agua
Usa pinturas de agua cuando sea posible. Son menos toxicos que las pinturas de aceite y mas faciles para limpiar. Busca los productos "latex" or "cleans with water".

Removiendo Pintura
Residuos de pintura, polvo de pintura y pinturas que contienen plomo son peligrosas. Barrelos en ves de lavarlos con la manguera y desechalos en unlugar de colección de desechos peligrosos. Llama al (800) CLEANUP para un lugar en tu area.

Limpiando Pintura
Nunca laves las brochas ni los contenedores de pintura en la calle, coladeras o desagües. Las de pintura de agua limpialas en el labavo y las de pintura de aceite con thiner, y vuelvalas a guardar en un frasco, para un uso futuro. Envuelve los residuos de pintura en un periodico y tiralos a la basura.

Removiendo Pintura en Exteriores
Al despintar o lavar exteriores de los edificios con agua de alta presión bloquea los drenajes cercanos y desvia el desagüe. Pregunta las autoridades si puedes desecharla en las alcantarillas.

Reciclando Pintura
Recicla la pintura que sobra en un lugar de colección de materiales peligrosos, guardala para re-toques or regalela a alguien que la use, como a un teatro, a la escuela, una oraganizacion de la ciudad o de la comunidad.

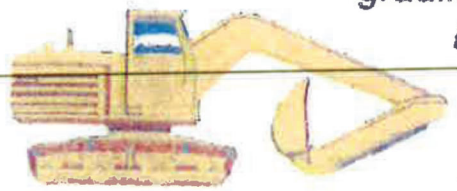
Para reportar actividades ilegales u obtener mas información de la prevención de contaminación llamar al:

1 (800) CLEANUP

www.1800cleanup.org

EXCAVATION & GRADING OPERATIONS

Sediment, cement wash, asphalt, and motor oil from soil excavation and grading operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.



Follow these practices to help prevent stormwater pollution...

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting

temporary vegetation on slopes where construction is not immediately planned. Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Recycling...

Recycle broken asphalt, concrete, wood, and cleared vegetation whenever possible. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling or disposal information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site. Finally, use gravel approaches where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into the streets.

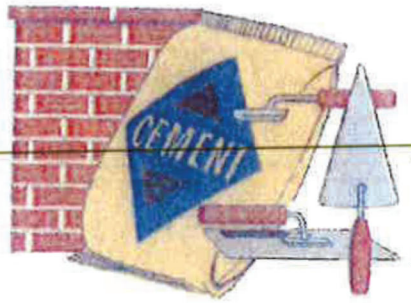
Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find

spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or commeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

FRESH CONCRETE & MORTAR APPLICATION



Cement, cement wash, gravel, asphalt, solvents, and motor oil from fresh concrete and mortar activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

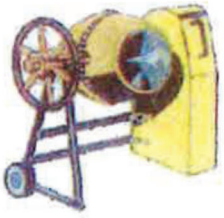
Follow these practices to help prevent stormwater pollution...

General Business Practices...

Schedule excavation and grading work during dry weather, and in case it rains, prevent materials from contacting stormwater by storing them under cover. Also, secure open bags of cement to keep wind-blown cement powder away from streets, gutters and storm drains.

During Construction...

Prevent mortar and cement from entering the storm drains by placing erosion controls (i.e., berms or temporary vegetation) down-slope to capture runoff. When breaking up paving, be sure to pick up all pieces and recycle them at a crushing company; small amounts of excess dry concrete, grout and mortar can be disposed of in the trash. Setup small mixers on tarps or heavy drop cloths to allow for easy cleanup of debris. REMEMBER: Never bury waste material -- recycle or dispose of it as hazardous waste. Call 386-8401 for recycling and disposal information.



Handling Materials & Wastes...

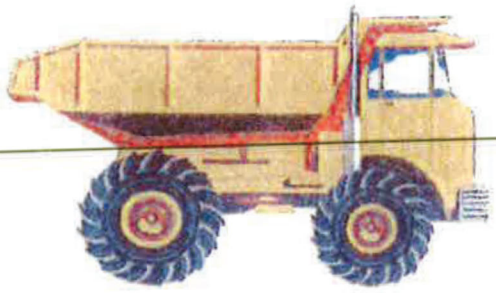
Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Cleaning up...

When cleaning up after driveway or sidewalk construction, wash concrete dust onto designated dirt areas, not down the driveway or into the street or storm drain. Also, wash out concrete mixers and equipment only in specified wash-out areas, where the water flows into containment ponds. Cement washwater can be recycled by pumping it back into cement mixers for reuse. REMEMBER: Never dispose of cement washout into driveways, streets, gutters, storm drains or drainage ditches.

For more information, call your city's stormwater representative

GENERAL CONSTRUCTION



Soil, cement wash, asphalt and motor oil 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. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

Erosion Prevention...

Reduce erosion by avoiding excavation or grading activities during wet weather, and by planting temporary vegetation on slopes where construction is not immediately planned.

Plant permanent vegetation as soon as possible, once excavation and grading activities are complete. Diversion dikes can be constructed to channel runoff around the site; channels can be lined with grass or roughened pavement to reduce runoff velocity. For information on erosion control, call 799-7407.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Handling Materials & Waste...

Minimize wastes when ordering materials by ordering only the amounts needed to complete the job. Whenever possible, use recycled or recyclable materials. Recycle broken asphalt, concrete, wood, and cleared vegetation. Unrecyclable materials must be taken to an appropriate landfill or disposed of as hazardous waste. For recycling and disposal information, call 386-8401.

Spills...

Avoid accidental spills by using a drip pan and funnel when draining or pouring fluids. Be ready for unexpected spills by preparing and using easy to find spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Furthermore, prevent leaks from stored vehicles by draining gas, hydraulic oil, and transmission, brake & radiator fluid. REMEMBER: Never hose down dirty surfaces; instead, sweep regularly. To report serious spills, call 1-800-33-TOXIC.

For more information, call your city's stormwater representative

HOME & GARDEN

Yard waste and household toxics such as paints, solvents, 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. These wastes pollute our drinking water and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

In Your Home...

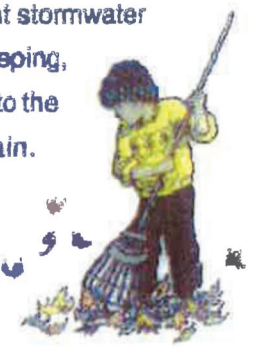
Household products such as paints, paint thinners, drain openers, motor oil, wood polishes, insecticides & herbicides, oven cleaners, and many other general cleaners frequently get dumped on the ground, or into a gutter, street or storm drain. Instead of polluting our stormwaters, take these items to a household hazardous waste collection facility. Call 1-800-OILY-CAT for a facility in your area.

Fertilizers and Pesticides...

Fertilizers and pesticides are often carried into our storm drains by sprinkler runoff. To minimize stormwater pollution, use organic or non-toxic pesticides and fertilizers as directed, and keep them away from ditches, gutters and storm drains. Store them in a covered area, off the ground, to prevent contact with water. For additional gardening questions, call the San Bernardino Master Gardeners at 387-2182.

Trimmin' the Garden...

Decaying organic materials that enter our storm drains, such as grass, leaves, yard clippings, and pet waste, will use up oxygen in nearby streams, stressing aquatic life. Prevent stormwater pollution by not blowing, sweeping, raking or hosing yard waste into the street, gutter, or storm drain. Alternatively, leave grass clippings on your lawn after mowing, or compost your clippings and yard waste. Pet waste should not be composted, but rather disposed of in the trash to prevent the potential spread of diseases.



Planting In The Yard

Produce less yard waste and save water by planting low maintenance trees and shrubs. Also, conserve water and minimize unwanted runoff by using drip irrigation, soaker hoses, or micro-spray systems to water vegetation.

For more information, call your city's stormwater representative

HOME REPAIR & REMODELING

Paints, solvents, adhesives, dusts, sediments, pesticides and household toxics commonly associated with home repair and remodeling activities often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

Household Hazardous Wastes...

Common household cleaners, paint products, and wallpaper & tile adhesives contain toxic substances. Dispose of these products properly. REMEMBER: Toxic wastes should never enter the storm drain system. For disposal information, call 1-800-OILY-CAT.

Construction...

Keep all construction debris away from the street, gutter and storm drain, and if possible, schedule grading and excavation projects for dry weather. Cover excavated material and stockpiles of asphalt, sand, etc. with plastic tarps, and prevent erosion by planting fast-growing annual and perennial grasses, which will shield and bind the soil.

Landscape & Gardening...

Use fertilizers and pesticides as directed. Keep them away from ditches, gutters and storm drains, and store them in a covered area to prevent contact with rain water. Also, minimize runoff and conserve water by using drip irrigation, soaker hoses, or micro-spray systems. REMEMBER: Do not deposit leaves into the street, gutter, or storm drain.

Painting...

CLEANUP... Avoid cleaning brushes or rinsing paint containers into a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible, and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

REMOVAL... Paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. Sweep them up and call 1-800-OILY-CAT for disposal information.

RECYCLING... Recycle or reuse leftover paint by using it for touch-ups, or by giving it to someone who can us it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 1-800-OILY-CAT for disposal information.

Concrete & Masonry...

Store bags of cement and plaster away from gutters and storm drains, and under cover, protected from rainfall, runoff and wind. REMEMBER: Never dispose of cement washout or concrete dust onto driveways, streets, gutters or storm drains.

For more information, call your city's stormwater representative

PAINTING

Paints, solvents, adhesives, and toxic chemicals from painting operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

General Business Practices...

Keep all paint products and wastes away from the street, gutter, and storm drains. Reuse paint thinner by setting used thinner aside in a closed, labeled jar to settle out 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.

Water-Based Paints...

Purchase water-based paints whenever possible. Look for products labeled "latex" or "clean up with water."

Recycle or Reuse Paints...

Recycle/reuse leftover paint by using it for touch-ups, or by giving it to someone who can use it, such as a theatre group, school, city or other community organization. If you're unable to give it away, contact 386-8401 for information on hazardous waste pick-up.

Paint Cleanup...

Avoid cleaning brushes and rinsing paint containers in a street, gutter, or storm drain. For water-based paints, "brush out" as much paint as possible and and rinse in the sink. For oil-based paints, "brush out" as much paint as possible, clean with thinner, and then filter and reuse thinner or solvent.

Paint Removal...

Chemical paint stripping residue, chips & dust from marine paints, and paints containing lead or tributyl tin are hazardous wastes. For disposal information, call 386-8401. Also, when stripping or cleaning building exteriors with high-pressure water, block storm drains and divert the washwater onto a designated dirt area. Check with your local wastewater treatment authority to find out if you can collect building cleaning water and discharge it to the sewer.

For more information, call your city's stormwater representative

ROADWORK & PAVING

Asphalt, saw-cut slurry, and excavated materials from Road paving, surfacing and pavement removal operations often make their way into the San Bernardino County storm drain system and DO NOT GET TREATED before reaching the Santa Ana River. These wastes pollute our drinking water, and make our waters unhealthy and unsafe for people and wildlife.

Follow these practices to help prevent stormwater pollution...

During Construction...

Cover catch basins and maintenance holes when applying seal coat, slurry seal, fog seal, etc. Use check dams, ditches or berms around excavations, and avoid over-application of water for dust control. REMEMBER: Never wash excess materials from exposed aggregate or concrete into a street, gutter, or storm drain; collect and recycle them.

Asphalt & Concrete Removal...

Barricade storm drain openings during saw-cutting, and after breaking up paving, be sure to remove all chunks and pieces and recycle them at a crushing company. For recycling information, call 386-8401.

Equipment Maintenance...

Maintain all vehicles and equipment by inspecting them frequently for leaks. Also, conduct maintenance and refueling at one location -- away from storm drains, and perform major equipment repairs and washings off site.

Spills...

Be ready for unexpected spills by preparing and using spill containment and cleanup kits. Kits should include safety equipment and cleanup materials such as kitty litter, sawdust or cornmeal. Prevent drips from paver machines by catching fluids with drip pans or by placing absorbent material (cloth, rags, etc....) underneath the machines when they're not in use. To report serious spills, call 1-800-33-TOXIC.

General Business Practices...

Schedule excavation and grading work during dry weather, and develop and implement erosion and sediment control plans for excavated embankments. In case it rains, cover exposed piles of soil and other construction materials with plastic sheeting to prevent contact with rain water.

For more information, call your city's stormwater representative

Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL 1-800-506-2555

A Citizen's Guide to Understanding Stormwater

EPA 833-B-03-002
January 2003

United States
Environmental Protection
Agency

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

For more information contact:

After the Storm

What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution

Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.
- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.

Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

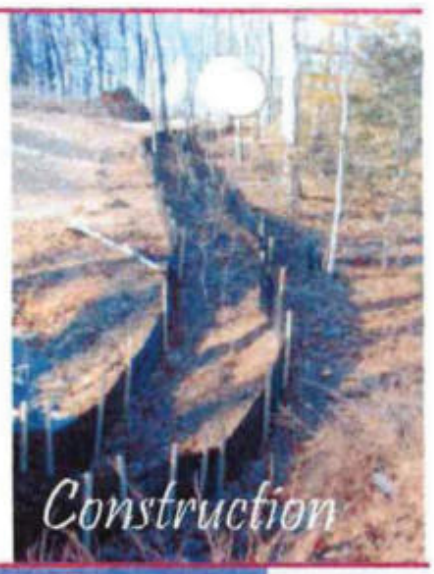
Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

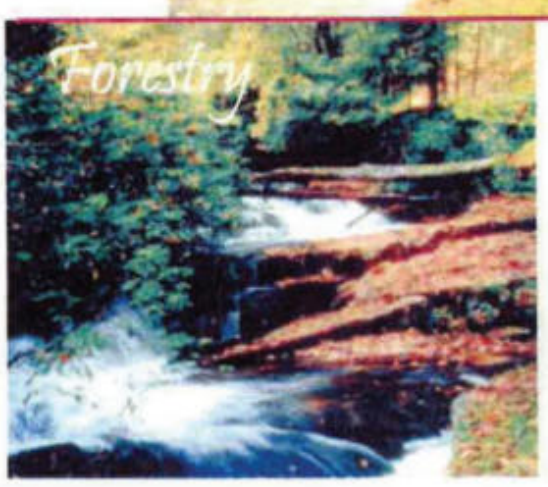
Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be washed into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



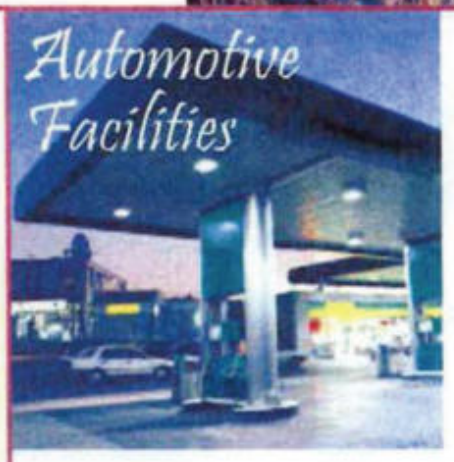
Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.

- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Stormwater Pollution from Construction Activities

The two most common sources of stormwater pollution problems associated with construction activities are ***erosion*** and ***sedimentation***. Failure to maintain adequate erosion and sediment controls at construction sites often results in sediment discharges into the storm drain system, creating multiple problems once it enters local waterways.

Construction vehicles and heavy equipment can also track significant amounts of mud and sediment onto adjacent streets. Additionally, wind may transport construction materials and wastes into streets storm drains, or directly into our local waterways.

Resources

State Water Resources Control Board
Division of Water Quality
1001 I Street
Sacramento CA 95814
(916) 341-5455
www.swrcb.ca.gov/stormwtr/

Colorado River Basin Regional Water
Quality Control Board - Region 7
73-720 Fred Waring Drive, Suite 100
Palm Desert, CA 92260
(760) 346-7491
www.swrcb.ca.gov/~rwqcb7/

Santa Ana Regional Water
Quality Control Board - Region 8
3737 Main Street, Suite 500
Riverside, CA 92501-3348
(909) 782-4130
www.swrcb.ca.gov/~rwqcb8/

San Diego Regional Water
Quality Control Board - Region 9
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124
(858) 467-2952
www.swrcb.ca.gov/~rwqcb9/

To report a hazardous materials spill, call:

Riverside County Hazardous Materials
Emergency Response Team
(909) 358-5055 8:00 a.m. – 5:00 p.m.
(909) 358-5245 after 5:00 p.m.

In an emergency call: **911**

For recycling and hazardous waste disposal, call:

(909) 358-5055

To report an illegal dumping or a clogged storm drain, call:

1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, please call (909) 955-1200 or visit the StormWater/CleanWater Protection Program website at:
www.co.riverside.ca.us/depts/flood/waterquality/npdes.asp

The StormWater/CleanWater Protection Program gratefully acknowledges the Santa Clara Valley Nonpoint Pollution Control Program, Alameda Countywide CleanWater Program and the City of Los Angeles Stormwater Management Division for information provided in this brochure.

StormWater CleanWater
PROTECTION PROGRAM

StormWater Pollution

What you should know for...

General Construction & Site Supervision

Best Management Practices (BMPs) for:

Developers
General Contractors
Home Builders
Construction Inspectors
Anyone in the construction business

StormWater Pollution . . . What You Should Know

Riverside County has two drainage systems - sewers and storm drains. The storm drain system was designed to reduce flooding by carrying excess rainwater away from streets and developed areas. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our local waterways.

Unlike sanitary sewers, storm drains are not connected to a wastewater treatment plant – they flow directly to our local streams, rivers and lakes.

Stormwater runoff is a part of the natural hydrologic process. However, land development and construction activities can significantly alter natural drainage processes and introduce pollutants into stormwater runoff. Polluted stormwater runoff from construction sites has been identified as a major source of water pollution in California. It jeopardizes the quality of our local waterways and can pose a serious threat to the health of our aquatic ecosystems.

The Cities and County of Riverside StormWater/CleanWater Protection Program

Because preventing pollution is much easier and less costly than cleaning up "after the fact," the Cities and County of Riverside StormWater/CleanWater Protection Program informs residents and businesses on pollution prevention activities. This pamphlet describes various Best Management Practices (BMPs) that construction site operators can use to prevent stormwater pollution.

In accordance with applicable federal and state law, the Cities and County of Riverside have adopted ordinances for stormwater management and discharge control that **prohibit** the discharge of pollutants into the storm drain system or local surface waters. This includes discharges from construction sites containing sediment, concrete, mortar, paint, solvents, lubricants, vehicle fluids, fuel, pesticides, and construction debris.

PLEASE NOTE: The Federal, State and local regulations strictly prohibit the discharge of sediment and pollutants into the streets, the storm drain system or waterways. As an owner, operator or supervisor of a construction site, you may be held financially responsible for any environmental damage caused by your subcontractors or employees.

What Should You Do?

Advance Planning to Prevent Pollution

- ❑ Remove existing vegetation only as needed.
- ❑ Schedule excavation, grading, and paving operations for dry weather periods, if possible.
- ❑ Designate a specific area of the construction site, well away from storm drain inlets or watercourses, for material storage and equipment maintenance.
- ❑ Develop and implement an effective combination of erosion and sediment controls for the construction site.
- ❑ Practice source reduction by ordering only the amount of materials that are needed to finish the project.
- ❑ Educate your employees and subcontractors about stormwater management requirements and their pollution prevention responsibilities.
- ❑ Control the amount of surface runoff at the construction site by impeding internally generated flows and using berms or drainage ditches to direct incoming offsite flows to go around the site. ***Note:*** *Consult local drainage policies for more information.*

Best Management Practices

The following Best Management Practices (BMPs) can significantly reduce pollutant discharges from your construction site. Compliance with stormwater regulations can be as simple as minimizing stormwater contact with potential pollutants by providing covers and secondary containment for construction materials, designating areas away from storm drain systems for storing equipment and materials and implementing good housekeeping practices at the construction site.

- ❑ Protect all storm drain inlets and streams located near the construction site to prevent sediment-laden water from entering the storm drain system.
- ❑ Limit access to and from the site. Stabilize construction entrances/exits to minimize the track out of dirt and mud onto adjacent streets. Conduct frequent street sweeping.
- ❑ Protect stockpiles and construction materials from winds and rain by storing them under a roof, secured impermeable tarp or plastic sheeting.
- ❑ Avoid storing or stockpiling materials near storm drain inlets, gullies or streams.
- ❑ Phase grading operations to limit disturbed areas and duration of exposure.
- ❑ Perform major maintenance and repairs of vehicles and equipment offsite.
- ❑ Wash out concrete mixers only in designated washout areas at the construction site.
- ❑ Set-up and operate small concrete mixers on tarps or heavy plastic drop cloths.
- ❑ Keep construction sites clean by removing trash, debris, wastes, etc. on a regular basis.
- ❑ Clean-up spills immediately using dry clean-up methods (e.g., absorbent materials such as cat litter, sand or rags for liquid spills; sweeping for dry spills such as cement, mortar or fertilizer) and by removing the contaminated soil from spills on dirt areas. .
- ❑ Prevent erosion by implementing any or a combination of soil stabilization practices such as mulching, surface roughening, permanent or temporary seeding.
- ❑ Maintain all vehicles and equipment in good working condition. Inspect frequently for leaks, and repair promptly.
- ❑ Practice proper waste disposal. Many construction materials and wastes, including solvents, water-based paint, vehicle fluids, broken asphalt and concrete, wood, and cleared vegetation can be recycled. Materials that cannot be recycled must be taken to an appropriate landfill or disposed of as hazardous waste.
- ❑ Cover open dumpsters with secured tarps or plastic sheeting. Never clean out a dumpster by washing it down on the construction site.
- ❑ Arrange for an adequate debris disposal schedule to insure that dumpsters do not overflow.

General Construction Activities Stormwater Permit

(Construction Activities General Permit)

The State Water Resources Control Board (SWRCB) adopted a new Construction Activities General Permit (WQ Order No. 99-08DWQ) on August 19, 1999, superseding the now expired SWRCB statewide General Permit (WQ Order No. 92-08DWQ). This permit is administered and enforced by the SWRCB and the local Regional Water Quality Control Boards (RWQCB). The updated Construction Activities General Permit establishes a number of new stormwater management requirements for construction site operator.

NOTE: *Some construction activies stormwater permits are issued on a regional basis. Consult your local RWQCB to find out if your project requires coverage under any of these permits.*

Frequently Asked Questions:

Does my construction site require coverage under the Construction Activities General Permit?

Yes, if construction activity results in the disturbance of five or more acres of total land area or is part of a common plan of development that results in the disturbance of five or more acres.

How do I obtain coverage under the Construction Activities General Permit?

Obtain the permit package and submit the completed Notice of Intent (NOI) form to the SWRCB prior to grading or disturbing soil at the construction site. For ongoing construction activity involving a change of ownership, the new owner must submit a new NOI within 30 days of the date of change of ownership. The completed NOI along with the required fee should be mailed to the SWRCB.

What must I do to comply with the requirements of the Construction Activities General Permit?

- ● Implement BMPs for non-stormwater discharges year-round.
- ● Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) prior to commencing construction activities.
- ● Keep a copy of the SWPPP at the construction site for the entire duration of the project.
- ● Calculate the anticipated stormwater run-off.
- ● Implement an effective combination of erosion and sediment control on all soil disturbed areas.
- ● Conduct site inspections prior to anticipated storm events, every 24-hours during extended storm events, and after actual storm event.
- ● Perform repair and maintenance of BMPs as soon as possible after storm events depending upon worker safety.
- ● Update the SWPPP as needed, to manage pollutants or reflect changes in site conditions.
- ● Include description of post construction BMPs at the construction site, including parties responsible for long-term maintenance.

NOTE: *Please refer to the Construction Activities General Permit for detailed information. You may contact the SWRCB, your local RWQCB, or visit the SWRCB website at www.swrcb.ca.gov/stormwtr/ to obtain a State Construction Activities Stormwater General Permit packet.*

How long is this Construction Activities General Permit in effect?

The Permit coverage stays in effect untilyou submit a Notice of Termination (NOT) to the SWRCB. For the purpose of submitting a NOT, all soil disturbing activities have to be completed and one of the three following criteria has to be met:

1. Change of ownership;
2. A uniform vegetative cover with 70 percent coverage has been established; or,
3. Equivalent stabilization measures such as the use of reinforced channel liners, soil cement, fiber matrices, geotextiles, etc., have been employed.

For Information:

For more information on the General Industrial Storm Water Permit contact:

State Water Resources Control Board (SWRCB)
(916) 657-1146 or www.swrcb.ca.gov/ or, at your Regional Water Quality Control Board (RWQCB).

Santa Ana Region (8)
California Tower
3737 Main Street, Ste. 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region (9)
9771 Clairemont Mesa Blvd., Ste. A
San Diego, CA 92124
(619) 467-2952

Colorado River Basin Region (7)
73-720 Fred Waring Dr., Ste. 100
Palm Desert, CA 92260
(760) 346-7491

SPILL RESPONSE AGENCY:
HAZ-MAT: (909) 358-5055
HAZARDOUS WASTE DISPOSAL: (909) 358-5055
RECYCLING INFORMATION: 1-800-366-SAVE
TO REPORT ILLEGAL DUMPING OR A CLOGGED STORM DRAIN: 1-800-506-2555

To order additional brochures or to obtain information on other pollution prevention activities, call:
(909) 955-1111.

StormWater
CleanWater
PROTECTION PROGRAM

Riverside County gratefully acknowledges the State Water Quality Control Board and the American Public Works Association, Storm Water Quality Task Force for the information provided in this brochure.

DID YOU KNOW . . .

YOUR FACILITY MAY NEED A STORM WATER PERMIT?

any industrial fa ilities and manufa turin o erations must o tain o era e under the ndustrial ti ities Storm Water eneral Permit

FIND OUT
IF YOUR FACILITY MUST OBTAIN A PERMIT

StormWater Pollution . . . What you should know

Riverside County has two drainage systems - sanitary sewers and storm drains. The storm drain system is designed to help prevent flooding by carrying excess rainwater away from streets. Since the storm drain system does not provide for water treatment, it also serves the *unintended* function of transporting pollutants directly to our waterways.

Unlike sanitary sewers, storm drains are not connected to a treatment plant - they flow directly to our local streams, rivers and lakes.

In recent years, awareness of the need to protect water quality has increased. As a result, federal, state, and local programs have been established to reduce polluted stormwater discharges to our waterways. The emphasis of these programs is to prevent stormwater pollution since it's much easier, and less costly, than cleaning up "after the fact."

National Pollutant Discharge Elimination System (NPDES)

In 1987, the Federal Clean Water Act was amended to establish a framework for regulating industrial stormwater discharges under the NPDES permit program. In California, NPDES permits are issued by the State Water Resources Control Board (SWRCB) and the nine (9) Regional Water Quality Control Boards (RWQCB). In general, certain industrial facilities and manufacturing operations must obtain coverage under the Industrial Activities Storm Water General Permit if the type of facilities or operations falls into one of the several categories described in this brochure.

How Do I Know If I Need A Permit?

Following are ***general descriptions*** of the industry categories types that are regulated by the Industrial Activities Storm Water General Permit. Contact your local Region Water Quality Control Board to determine if your facility/operation requires coverage under the Permit.

➜ Facilities such as cement manufacturing; feedlots; fertilizer manufacturing; petroleum refining; phosphate manufacturing; steam electric power generation; coal mining; mineral mining and processing; ore mining and dressing; and asphalt emulsion;

➜ Facilities classified as lumber and wood products (except wood kitchen cabinets); pulp, paper, and paperboard mills; chemical producers (except some pharmaceutical and biological products); petroleum and coal products; leather production and products; stone, clay and glass products; primary metal industries; fabricated structural metal; ship and boat building and repairing;

➜ Active or inactive mining operations and oil and gas exploration, production, processing, or treatment operations;

➜ Hazardous waste treatment, storage, or disposal facilities;

➜ Landfills, land application sites and open dumps that receive or have received any industrial waste; unless there is a new overlying land use such as a golf course, park, etc., and there is no discharge associated with the landfill;

➜ Facilities involved in the recycling of materials, including metal scrap yards, battery reclaimers, salvage yards, and automobile junkyards;

➜ Steam electric power generating facilities, facilities that generate steam for electric power by combustion;

➜ Transportation facilities that have vehicle maintenance shops, fueling facilities, equipment cleaning operations, or airport deicing operations. This includes school bus maintenance facilities operated by a school district;

➜ Sewage treatment facilities;

➜ Facilities that have areas where material handling equipment or activities, raw materials, intermediate products, final products, waste materials, by-products, or industrial machinery are exposed to storm water.

How do I obtain coverage under the Industrial Activities Storm Water General Permit?

Obtain a permit application package from your local Regional Water Quality Control Board listed on the back of this brochure or the State Water Resources Control Board (SWRCB). Submit a completed Notice of Intent (NOI) form, site map and the appropriate fee ($250 or $500) to the SWRCB. Facilities must submit an NOI thirty (30) days prior to beginning operation. Once you submit the NOI, the State Board will send you a letter acknowledging receipt of your NOI and will assign your facility a waste discharge identification number (WDID No.). You will also receive an annual fee billing. These billings should roughly coincide with the date the State Board processed your original NOI submittal.

What are the requirements of the Industrial Activities Storm Water General Permit?

The basic requirements of the Permit are:

1. The facility must eliminate any non-stormwater discharges or obtain a separate permit for such discharges.

2. The facility must develop and implement a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP must identify sources of pollutants that may be exposed to stormwater. Once the sources of pollutants have been identified, the facility operator must develop and implement Best Management Practices (BMPs) to minimize or prevent polluted runoff.

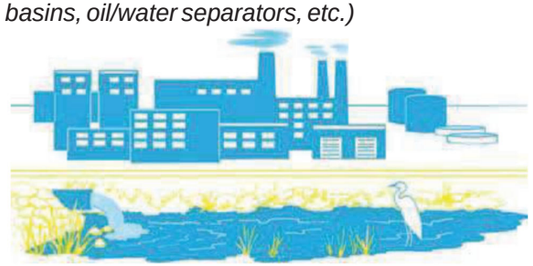
   Guidance in preparing a SWPPP is available from a document prepared by the California Storm Water Quality Task Force called the California Storm Water Best Management Practice Handbook.

3. The facility must develop and implement a Monitoring Program that includes conducting visual observations and collecting samples of the facility's storm water discharges associated with industrial activity. The General Permit requires that the analysis be conducted by a laboratory that is certified by the State of California.

4. The facility must submit to the Regional Board, every July 1, an annual report that includes the results of its monitoring program.

A Non-Storm Water Discharge is... *any discharge to a storm drain system that is not composed entirely of storm water. The following non-storm water discharges are authorized by the General Permit: fire hydrant flushing; potable water sources, including potable water related to the operation, maintenance, or testing of potable water systems; drinking fountain water; atmospheric condensates including refrigeration, air conditioning, and compressor condensate; irrigation drainage; landscape watering; springs; non-contaminated ground water; foundation or footing drainage; and sea water infiltration where the sea waters are discharged back into the sea water source.*

A BMP is . . . *a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge. BMPs may include simple, non-structural methods such as good housekeeping, staff training and preventive maintenance. Additionally, BMPs may include structural modifications such as the installation of berms, canopies or treatment control (e.g. setting basins, oil/water separators, etc.)*



WARNING*: There are significant penalties for non-compliance: a minimum fine of $5,000 for failing to obtain permit coverage, and, up to $10,000 per day, per violation plus $10 per gallon of discharge in excess of 1,000 gallons.*

Attachment D
Infiltration Report

January 31, 2023
(Revised February 13, 2023)

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Mojave Drive Industrial Park
14180 Dallas Parkway, Suite 730
Dallas, Texas 75254

Attention: Mr. Brandon Gallup
Acquisitions & Asset Management

Project No.: **22G268-2R**

Subject: **Results of Infiltration Testing**
Mojave Drive Industrial Park Buildings 3 & 4
SEC Onyx Road and Cactus Road
Victorville, California

Reference: Geotechnical Investigation, Mojave Drive Industrial Park Buildings 3 & 4, SEC Onyx Road and Cactus Road, Victorville, California, prepared by Southern California Geotechnical, Inc. (SCG) for Mr. Brandon Gallup SCG Project No. 22G268-1R.

Mr. Gallup:

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

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 22P404, dated November 3, 2022 and Change Order No. 22G268-CO2 dated January 11, 2023. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the preliminary infiltration rates of the on-site soils. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, prepared for the Riverside County Department of Environmental Health (RCDEH), dated December, 2013. The San Bernardino County standards defer to the guidelines published by the RCDEH.

Site and Project Description

The overall project is located at the southeast corner of Onyx Road and a dirt road (future Cactus Road), in Victorville, California. The project consists of two sites, identified as the Building 3 and Building 4 sites, adjacently located in the southern and northern portions of the overall project area, respectively. The overall project is bounded to the north, west, south and east by dirt roads and vacant lots. The general locations of the sites are illustrated on the Site Location Map, enclosed as Plate 1 in Appendix A of this report.

Building 3 (Southern) Site

The southern site consists of one (1) rectangular-shaped parcel and portions of two square-shaped parcels, totaling 61.5± acres in size. The site is currently vacant and undeveloped. Ground surface cover consists of exposed soil with sparse to moderate native brush and weed growth. Occasional debris is scattered throughout the site. Drainage channels drain from the southwest to northeast.

Building 4 (Northern) Site

The northern site consists of two (2) rectangular-shaped parcels, totaling 36± acres in size. The site is currently vacant and undeveloped. Ground surface cover consists of exposed soil with sparse to moderate native brush and weed growth. Occasional debris is scattered throughout the site.

General

Detailed topographic information was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the subsurface investigation, the overall project topography slopes downward to the northeast at a gradient of 1± percent with an elevation change of 19 to 21± feet.

Proposed Development

The most current conceptual site plans for the northern and southern sites have been provided to our office by the client. Based on these plans, the sites will be developed as follows:

Building 3 (Southern) Site

Based on the site plan provided, the southern site will be developed with one (1) industrial building. The proposed building, identified as Building 3, will be 1,159,000± ft² in size. The building will be constructed with dock-high doors along a portion of the east and west building walls.

Building 4 (Northern) Site

The northern site will be developed with one (1) industrial building. The proposed building, identified as Building 4, will be 675,000± ft² in size. The building will be constructed with dock-high doors along a portion of the north and south building walls.

General

The buildings are expected to be surrounded by asphaltic concrete (AC) pavements in the parking and drive areas, Portland cement concrete (PCC) pavements in the loading dock areas, and concrete flatwork and landscaped planters throughout the sites.

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

No significant amounts of below-grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of up to 9± feet are expected to be necessary to achieve the proposed site grades. It should be noted that this estimate does not include any remedial grading recommendations which are presented in a subsequent section of this report.

The proposed development will likely use on-site storm water infiltration. The type, depth, and locations of the infiltration systems were not available at the time of this report. However, based on our experience with similar projects in the area, we assume that the infiltration area will be located in the truck-court areas of the proposed buildings. It is expected that the infiltration systems will consist of below-grade chambers extending to depths of 10 to 12± feet.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, referenced above. As a part of this study, fifteen (15) borings (identified as Boring Nos. B-5 through B-21) were advanced to depths of 10 to 25± feet below the existing site grades.

Native alluvium was encountered at the ground surface at the boring locations, extending to at least the maximum depth explored of 25± feet below the existing grades. The alluvium generally consists of medium dense to dense silty sands, clayey sands and sandy silts, with occasional very dense silty sands, clayey sands and sandy silts, and very stiff to hard sandy clays. Boring No. B-5 encountered a stratum consisting of very dense gravelly sands at a depth of 5½ to 10± feet. Boring No. B-11 encountered a stratum consisting of loose silty sands at the ground surface, extending to a depth of 3± feet. Boring No. B-21 encountered a stratum consisting of very dense sands at a depth of 22 to 25± feet. Some of the encountered soils possess varying amounts of calcareous veining and nodules and occasional porosity.

Groundwater

Free water was not encountered during the drilling of the borings. Based on the lack of water within the borings and the moisture contents of the recovered soil samples, the static groundwater is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As a part of our research, we reviewed available groundwater data in order to determine groundwater levels for the site. Water level data was obtained from the California Department of Water Resources Water Data Library website, https://wdl.water.ca.gov/waterdatalibrary/. One (1) monitoring well on record (identified as State Well Name: 05N05W13D001S) is located 1± mile east-southeast from the overall project area. Water level readings within this monitoring well indicates a high groundwater level of 70± feet below the ground surface in January 1917.

Subsurface Exploration

Scope of Exploration

The subsurface exploration conducted for the infiltration testing consisted of five (5) infiltration test borings, advanced to depths of 10 to 12± feet below the existing site grades. The infiltration borings were advanced using a truck-mounted drilling rig, equipped with 8-inch-diameter hollow-stem augers and were logged during drilling by a member of our staff. The approximate locations of the infiltration test borings (identified as I-3 through I-7) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Upon the completion of the infiltration borings, the bottom of each test boring was covered with 2± inches of clean ¾-inch gravel. A sufficient length of 3-inch-diameter perforated PVC casing was then placed into each test hole so that the PVC casing extended from the bottom of the test hole to the ground surface. Clean ¾-inch gravel was then installed in the annulus surrounding the PVC casing.

Geotechnical Conditions

Native alluvium was encountered at the ground surface at all infiltration boring locations, extending to at least the maximum depth explored of 12± feet below ground surface. The alluvial soils generally consist of medium dense to very dense silty fine sands, silty fine to coarse sands, fine sandy silts, fine to medium sandy silts, hard fine sandy clays and silty clays. The alluvium generally possess trace to little calcareous nodules and veining.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the proposed storm water infiltration systems within the project site. As previously mentioned, the infiltration testing was performed in general accordance with the guidelines published in Riverside County – Low Impact Development BMP Design Handbook – Section 2.3 of Appendix A, which apply to San Bernardino County.

Pre-soaking

In accordance with the county infiltration standards for sandy soils, all infiltration test borings were pre-soaked 2 hours prior to the infiltration testing or until all of the water had percolated through the test holes. The pre-soaking process consisted of filling test borings by inverting a full 5-gallon bottle of clear water supported over each hole so that the water flow into the hole holds constant at a level at least 5 times the hole's radius above the gravel at the bottom of each hole. Pre-soaking was completed after all of the water had percolated through the test holes.

Infiltration Testing

Following the pre-soaking process of the infiltration test borings, SCG performed the infiltration testing. Each test hole was filled with water to a depth of at least 5 times the hole's radius above the gravel at the bottom of the test holes. In accordance with the Riverside County guidelines, since "sandy soils" were encountered at the bottom of Infiltration Test Nos. I-3, I-4, I-5 and I-6

(where 6 inches of water infiltrated into the surrounding soils for two consecutive 25-minute readings), readings were taken at 10-minute intervals for 1 hour. At Infiltration Test No. I-7, 6 inches of water did not infiltrate into the surrounding soils for two consecutive 25-minute readings, so readings were taken in 30-minute intervals for a total of 3 hours. After each reading, water was added to the borings so that the depth of the water was at least 5 times the radius of the hole. The water level readings are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on the spreadsheets.

The infiltration rates from the tests are tabulated in inches per hour. In accordance with the typically accepted practice, it is recommended that the most conservative reading from the latter part of the infiltration tests be used as the design infiltration rate. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Measured Infiltration Rate (inches/hour)
I-3	10	Fine to medium Sandy Silt, little Clay, trace coarse Sand	2.5
I-4	10	Silty fine to coarse Sand, little fine to coarse Gravel	3.5
I-5	12	Fine Sandy Silt, little Clay	5.3
I-6	12	Silty Clay, little fine Sand, trace medium Sand	4.0
I-7	12	Fine Sandy Silt, little Clay	0.2

Laboratory Testing

Moisture Content

The moisture contents for the recovered soil samples within the borings were determined in accordance with ASTM D-2216 and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Grain Size Analysis

The grain size distribution of selected soils collected from the base of each infiltration test boring have been determined using a range of wire mesh screens. These tests were performed in general accordance with ASTM D-422 and/or ASTM D-1140. The weight of the portion of the sample retained on each screen is recorded and the percentage finer or coarser of the total weight is calculated. The results of these tests are presented on Plates C-1 through C-5 of this report.

Design Recommendations

Five (5) infiltration tests were performed at the subject site. As noted above, the infiltration rates at these locations vary from 0.2 to 5.3 inches per hour. The major factor affecting the difference in infiltration rates at the infiltration test locations is the presence of silts and clays in the soils at the tested depths. Based on the infiltration test results, we recommend the following infiltration rates:

- An average infiltration rate of 3.0 inches per hour is recommended to be used in the design of the infiltration system located west of the proposed Building 3.
- An average infiltration rate of 4.7 inches per hour is recommended to be used in the design of the infiltration system located east of the proposed Building 3.

It should be noted that the infiltration rates recommended above are applicable if the bottom of the proposed infiltration system extends to depths of 10 to 12± feet below the existing site grades.

- Based on the preliminary infiltration rate for Infiltration Boring No. I-7, infiltration is not recommended for the system located north of proposed Building 4.

It should be noted that the provided infiltration rate for proposed Building 5 is preliminary in nature since the type, location and depth of the proposed infiltration system is unknown at the time of this report. Additional infiltration testing is recommended to verify the actual infiltration rates once detailed information of the proposed infiltration systems is provided by the client or civil engineer.

The design of the storm water infiltration systems should be performed by the project civil engineer, in accordance with the City of Victorville and/or County of San Bernardino guidelines. It is recommended that the systems be constructed so as to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the systems. The presence of such materials would decrease the effective infiltration rates. **It is recommended that the project civil engineer apply an appropriate factor of safety. The infiltration rates recommended above is based on the assumption that only clean water will be introduced to the subsurface profile. Any fines, debris, or organic materials could significantly impact the infiltration rates.** It should be noted that the recommended infiltration rates are based on infiltration testing at five (5) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Infiltration Rate Considerations

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

Infiltration rates are based on unsaturated flow. As water is introduced into soils by infiltration, the soils become saturated and the wetting front advances from the unsaturated zone to the saturated zone. Once the soils become saturated, infiltration rates become zero, and water can only move through soils by hydraulic conductivity at a rate determined by pressure head and soil permeability. Changes in soil moisture content will affect the infiltration rate. Infiltration rates should be expected to decrease until the soils become saturated. Soil permeability values will

then govern groundwater movement. Permeability values may be on the order of 10 to 20 times less than infiltration rates. The system designer should incorporate adequate factors of safety and allow for overflow design into appropriate traditional storm drain systems, which would transport storm water off-site.

Construction Considerations

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

We recommend that a representative from the geotechnical engineer be on-site during the construction of the proposed infiltration systems to identify the soil classification at the base of each system. The infiltration rate of the system will likely vary significantly if the composition of the soil located beneath the system is not consistent with the tested soils.

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

Chamber Maintenance

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

Location of Infiltration Systems

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

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

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

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

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

Closure

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

Respectfully Submitted,

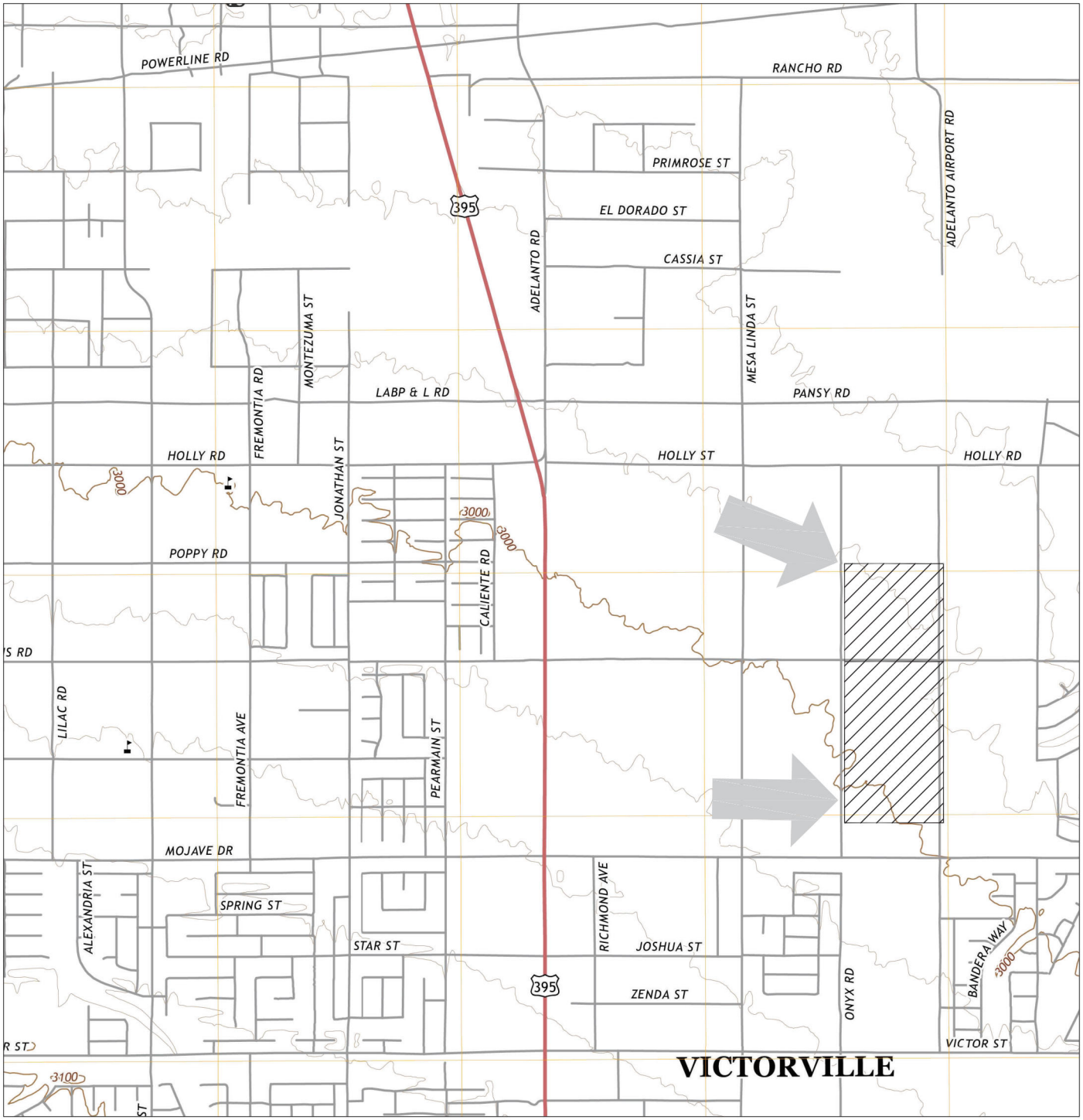
SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Jamie Hayward
Staff Geologist

Robert G. Trazo, GE 2655
Principal Engineer

Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2 - Infiltration Test Location Plan
Boring Log Legend and Logs (7 pages)
Infiltration Test Results Spreadsheets (5 pages)
Grain Size Distribution Graphs (5 pages)



SITE LOCATION MAP
MOJAVE DRIVE INDUSTRIAL PARK BUILDINGS 3 & 4
VICTORVILLE, CALIFORNIA
SCALE: 1" = 2000'
DRAWN: MK CHKD: RGT
SCG PROJECT 22G268-2R
PLATE 1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

GEOTECHNICAL LEGEND

- APPROXIMATE INFILTRATION TEST LOCATION
- APPROXIMATE BORING LOCATION FROM CONCURRENT STUDY (SCG PROJECT NO. 22G268-1)

NORTH

NOTE: CONCEPTUAL SITE PLAN PROVIDED BY THE CLIENT.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

INFILTRATION TEST LOCATION PLAN

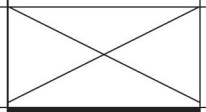
MOJAVE DRIVE INDUSTRIAL PARK BUILDINGS 3 & 4

VICTORVILLE, CALIFORNIA

SCALE: 1" = 400'	
DRAWN: AG CHKD: RGT	
SCG PROJECT 22G268-2R	
PLATE 2	

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL

BORING LOG LEGEND

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

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

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

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

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

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

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

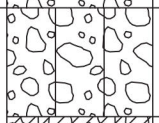
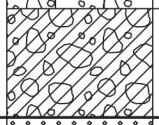
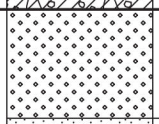
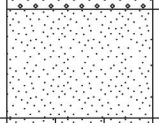
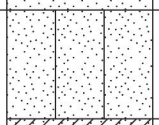
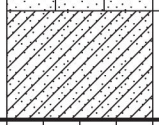
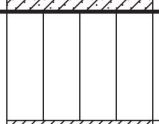
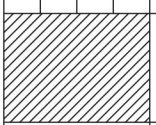
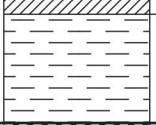
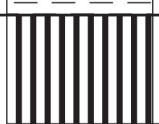
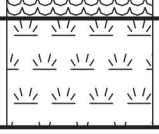
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

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

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

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

SOIL CLASSIFICATION CHART

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

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-3

JOB NO.: 22G268-2R | DRILLING DATE: 11/28/22 | WATER DEPTH: Dry
PROJECT: Mojave Drive Industrial Park Bldgs 3 & 4 | DRILLING METHOD: Hollow Stem Auger | CAVE DEPTH: ---
LOCATION: Victorville, California | LOGGED BY: Michelle Krizek | READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to coarse Sand, trace fine to coarse Gravel, trace Iron oxide staining, medium dense-dry to damp							
		23					2					
5												
		64	4.5		Brown fine Sandy Clay, little Silt, some Calcareous veining, hard-damp		8					
		48			Gray Brown fine to medium Sandy Silt, little Clay, trace coarse Sand, trace Calcareous veining, dense-damp		3			57		
10												
					Boring Terminated at 10'							

TBL 22G268-2.GPJ SOCALGEO.GDT 1/23/23

TEST BORING LOG **PLATE B-1**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-4

JOB NO.: 22G268-2R
PROJECT: Mojave Drive Industrial Park Bldgs 3 & 4
LOCATION: Victorville, California
DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek
WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine Sandy Clay, trace Silt, trace to little Calcareous veining, moderately cemented, hard-damp							
		37					5					
5												
		39			Brown Silty fine Sand, trace fine Gravel, trace Calcareous veining, trace Clay, dense-damp		4					
		50/3"			Brown Silty fine to coarse Sand, little fine to coarse Gravel, very dense-dry to damp		2			16		
10												
					Boring Terminated at 10'							

TBL 22G268-2.GPJ SOCALGEO.GDT 1/23/23

TEST BORING LOG **PLATE B-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-5

JOB NO.: 22G268-2R
PROJECT: Mojave Drive Industrial Park Bldgs 3 & 4
LOCATION: Victorville, California

DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek

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

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown Silty fine to medium Sand, trace coarse Sand, trace Calcarous veining, medium dense to dense-damp							
		38					3					
5												
		24					3					
					Light Gray Brown fine Sandy Silt, little Clay, trace Calcareous veining, dense-damp							
		31					4					
10												
		61			@ 10½ feet, little medium Sand, very dense		5			65		
					Boring Terminated at 12'							

TBL 22G268-2.GPJ SOCALGEO.GDT 1/23/23

TEST BORING LOG **PLATE B-3**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-6

JOB NO.: 22G268-2R
PROJECT: Mojave Drive Industrial Park Bldgs 3 & 4
LOCATION: Victorville, California
DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek
WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine Sandy Silt, little Clay, trace medium Sand, trace Calcareous veining, medium dense to very dense-damp							
		54					4					
5		47					4					
		28					4					
10		37			Light Gray Brown Silty Clay, little fine Sand, trace medium Sand, trace Calcareous veins, hard-damp		8			73		
					Boring Terminated at 12'							

TBL 22G268-2.GPJ SOCALGEO.GDT 1/23/23

TEST BORING LOG **PLATE B-4**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. I-7

JOB NO.: 22G268-2R
PROJECT: Mojave Drive Industrial Park Bldgs 3 & 4
LOCATION: Victorville, California
DRILLING DATE: 11/28/22
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Michelle Krizek
WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					ALLUVIUM: Brown fine Sandy Silt, trace medium Sand, medium dense-damp							
		21					5					
5					Brown Silty fine Sand to fine Sandy Silt, little Clay, little Calcareous veining, dense to very dense-damp							
		31					7					
		56			@ 8½ feet, Dark Brown		7					
10												
		88			Brown fine Sandy Silt, little Clay, little Calcareous veining, very dense-damp		6			56		
					Boring Terminated at 12'							

TBL 22G268-2.GPJ SOCALGEO.GDT 1/23/23

TEST BORING LOG **PLATE B-5**

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buildings 3 & 4
Project Location	Victorville, California
Project Number	22G268-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	10.00	(ft)

Infiltration Test Hole: I-3

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	9:26 AM	25.00	7.00	24.00	YES	SANDY SOILS
	Final	9:51 AM		9.00			
2	Initial	9:53 AM	25.00	7.00	17.40	YES	SANDY SOILS
	Final	10:18 AM		8.45			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	10:19 AM	10.00	7.00	0.63	2.69	2.65
	Final	10:29 AM		7.63			
2	Initial	10:30 AM	10.00	7.00	0.63	2.69	2.65
	Final	10:40 AM		7.63			
3	Initial	10:40 AM	10.00	7.00	0.63	2.69	2.65
	Final	10:50 AM		7.63			
4	Initial	10:51 AM	10.00	7.00	0.63	2.69	2.65
	Final	11:01 AM		7.63			
5	Initial	11:01 AM	10.00	7.00	0.62	2.69	2.59
	Final	11:11 AM		7.62			
6	Initial	11:12 AM	10.00	7.00	0.59	2.70	2.48
	Final	11:22 AM		7.59			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buildings 3 & 4
Project Location	Victorville, California
Project Number	22G268-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	10.00	(ft)

Infiltration Test Hole	I-4

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	11:14 AM	25.00	7.00	26.40	YES	SANDY SOILS
	Final	11:39 AM		9.20			
2	Initial	11:39 AM	25.00	7.00	21.36	YES	SANDY SOILS
	Final	12:04 PM		8.78			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	12:06 PM	10.00	7.00	0.88	2.56	3.89
	Final	12:16 PM		7.88			
2	Initial	12:18 PM	10.00	7.00	0.82	2.59	3.55
	Final	12:28 PM		7.82			
3	Initial	12:30 PM	10.00	7.00	0.82	2.59	3.55
	Final	12:40 PM		7.82			
4	Initial	12:42 PM	10.00	7.00	0.82	2.59	3.55
	Final	12:52 PM		7.82			
5	Initial	12:52 PM	10.00	7.00	0.80	2.60	3.48
	Final	1:02 PM		7.80			
6	Initial	1:02 PM	10.00	7.00	0.80	2.60	3.48
	Final	1:12 PM		7.80			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buildings 3 & 4
Project Location	Victorville, California
Project Number	22G268-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	12.00	(ft)

Infiltration Test Hole: I-5

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	12:32 PM	25.00	8.00	25.20	YES	SANDY SOILS
	Final	12:57 PM		10.10			
2	Initial	12:59 PM	25.00	8.00	20.76	YES	SANDY SOILS
	Final	1:24 PM		9.73			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	1:25 PM	10.00	8.00	1.62	3.19	5.79
	Final	1:35 PM		9.62			
2	Initial	1:37 PM	10.00	8.00	1.60	3.20	5.71
	Final	1:47 PM		9.60			
3	Initial	1:48 PM	10.00	8.00	1.53	3.24	5.40
	Final	1:58 PM		9.53			
4	Initial	2:00 PM	10.00	8.00	1.53	3.24	5.40
	Final	2:10 PM		9.53			
5	Initial	2:10 PM	10.00	8.00	1.51	3.24	5.33
	Final	2:20 PM		9.51			
6	Initial	2:21 PM	10.00	8.00	1.51	3.24	5.33
	Final	2:31 PM		9.51			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buildings 3 & 4
Project Location	Victorville, California
Project Number	22G268-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	12.00	(ft)

Infiltration Test Hole: I-6

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	7:42 AM	25.00	8.70	26.40	YES	SANDY SOILS
	Final	8:07 AM		10.90			
2	Initial	8:10 AM	25.00	8.70	21.96	YES	SANDY SOILS
	Final	8:35 AM		10.53			

Test Data

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	8:35 AM	10.00	8.70	1.19	2.71	4.95
	Final	8:45 AM		9.89			
2	Initial	8:46 AM	10.00	8.70	1.06	2.77	4.31
	Final	8:56 AM		9.76			
3	Initial	8:57 AM	10.00	8.70	1.00	2.80	4.03
	Final	9:07 AM		9.70			
4	Initial	9:07 AM	10.00	8.70	1.00	2.80	4.03
	Final	9:17 AM		9.70			
5	Initial	9:17 AM	10.00	8.70	0.98	2.81	3.96
	Final	9:27 AM		9.68			
6	Initial	9:27 AM	10.00	8.70	0.98	2.81	3.96
	Final	9:37 AM		9.68			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

INFILTRATION CALCULATIONS

Project Name	Mojave Drive Industrial Park Buildings 3 & 4
Project Location	Victorville, California
Project Number	22G268-2R
Engineer	Caleb Brackett

Test Hole Radius	4	(in)
Test Depth	12.00	(ft)

Infiltration Test Hole: I-7

Soil Criteria Test

Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (in)	Did 6 inches of water seep away in less than 25 minutes?	Sandy Soils or Non-Sandy Soils?
1	Initial	8:05 AM	25.00	7.90	26.40	YES	SANDY SOILS
	Final	8:30 AM		10.10			
2	Initial	8:31 AM	25.00	7.90	4.20	NO	NON-SANDY SOILS
	Final	8:56 AM		8.25			

Test Data

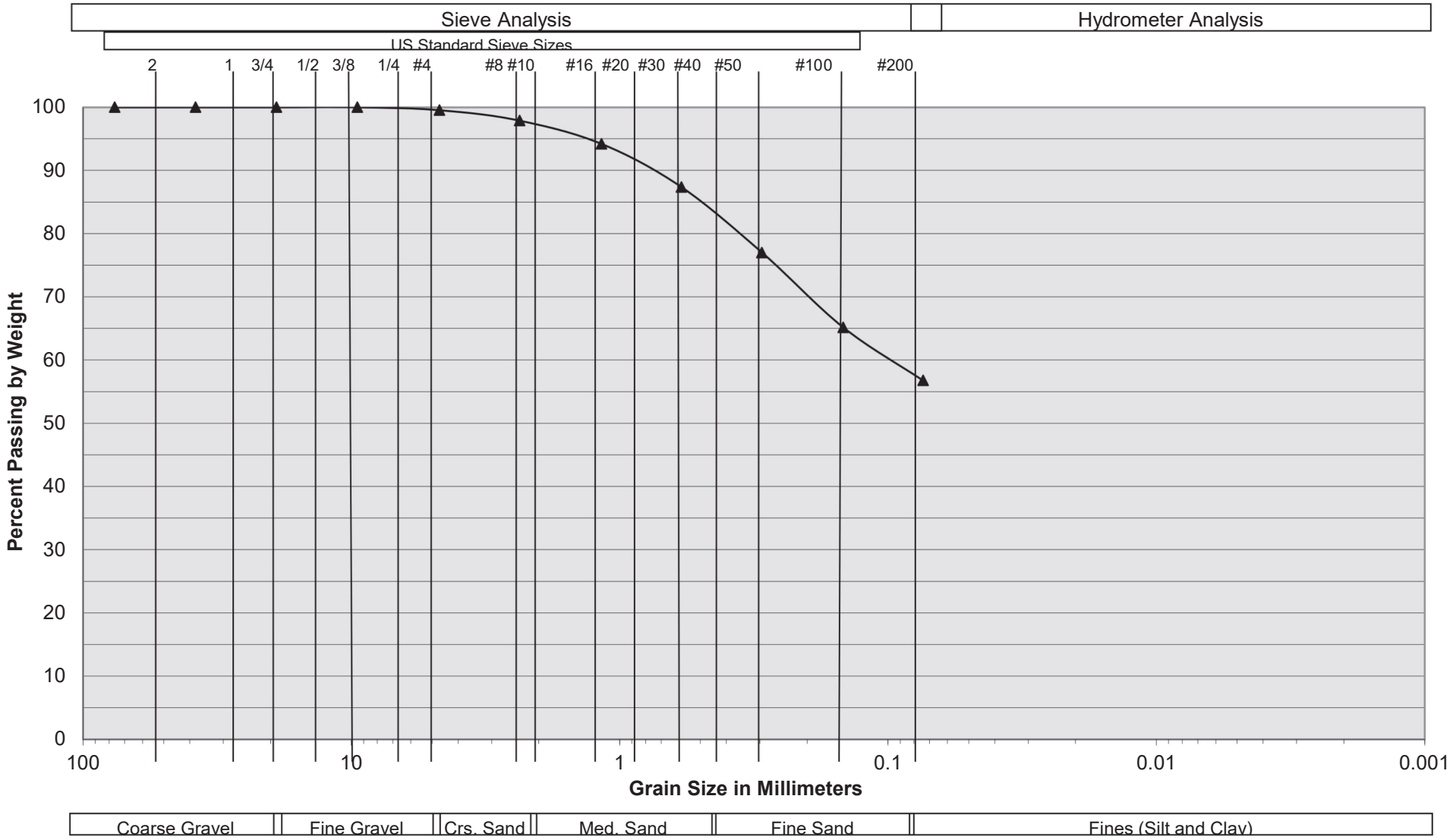
Interval Number		Time	Time Interval (min)	Water Depth (ft)	Change in Water Level (ft)	Average Head Height (ft)	Infiltration Rate Q (in/hr)
1	Initial	9:00 AM	30.00	7.90	0.32	3.94	0.31
	Final	9:30 AM		8.22			
2	Initial	9:30 AM	30.00	7.90	0.23	3.99	0.22
	Final	10:00 AM		8.13			
3	Initial	10:01 AM	30.00	7.90	0.22	3.99	0.21
	Final	10:31 AM		8.12			
4	Initial	10:32 AM	30.00	7.90	0.22	3.99	0.21
	Final	11:02 AM		8.12			
5	Initial	11:02 AM	30.00	7.90	0.21	4.00	0.20
	Final	11:32 AM		8.11			
6	Initial	11:33 AM	30.00	7.90	0.21	4.00	0.20
	Final	12:03 PM		8.11			

Per County Standards, Infiltration Rate calculated as follows:

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

Where:
- Q = Infiltration Rate (in inches per hour)
- ΔH = Change in Height (Water Level) over the time interval
- r = Test Hole (Borehole) Radius
- Δt = Time Interval
- H_{avg} = Average Head Height over the time interval

Grain Size Distribution

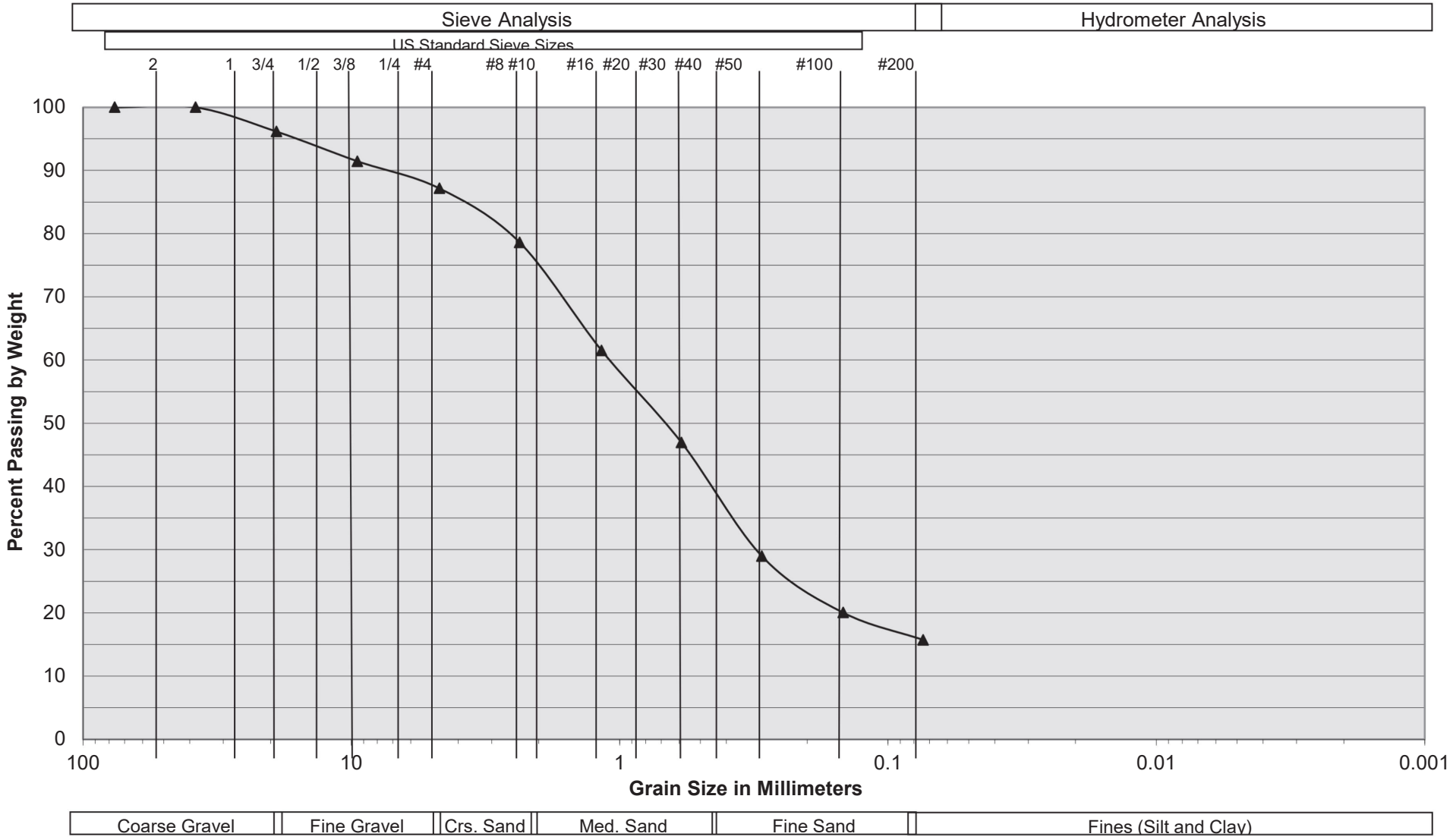


Sample Description	I-3 @ 8½'
Soil Classification	Fine to medium Sandy Silt, little Clay, trace coarse Sand

Mojave Drive Industrial Park Buildings 3 & 4
Victorville, California
Project No. 22G268-2R
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

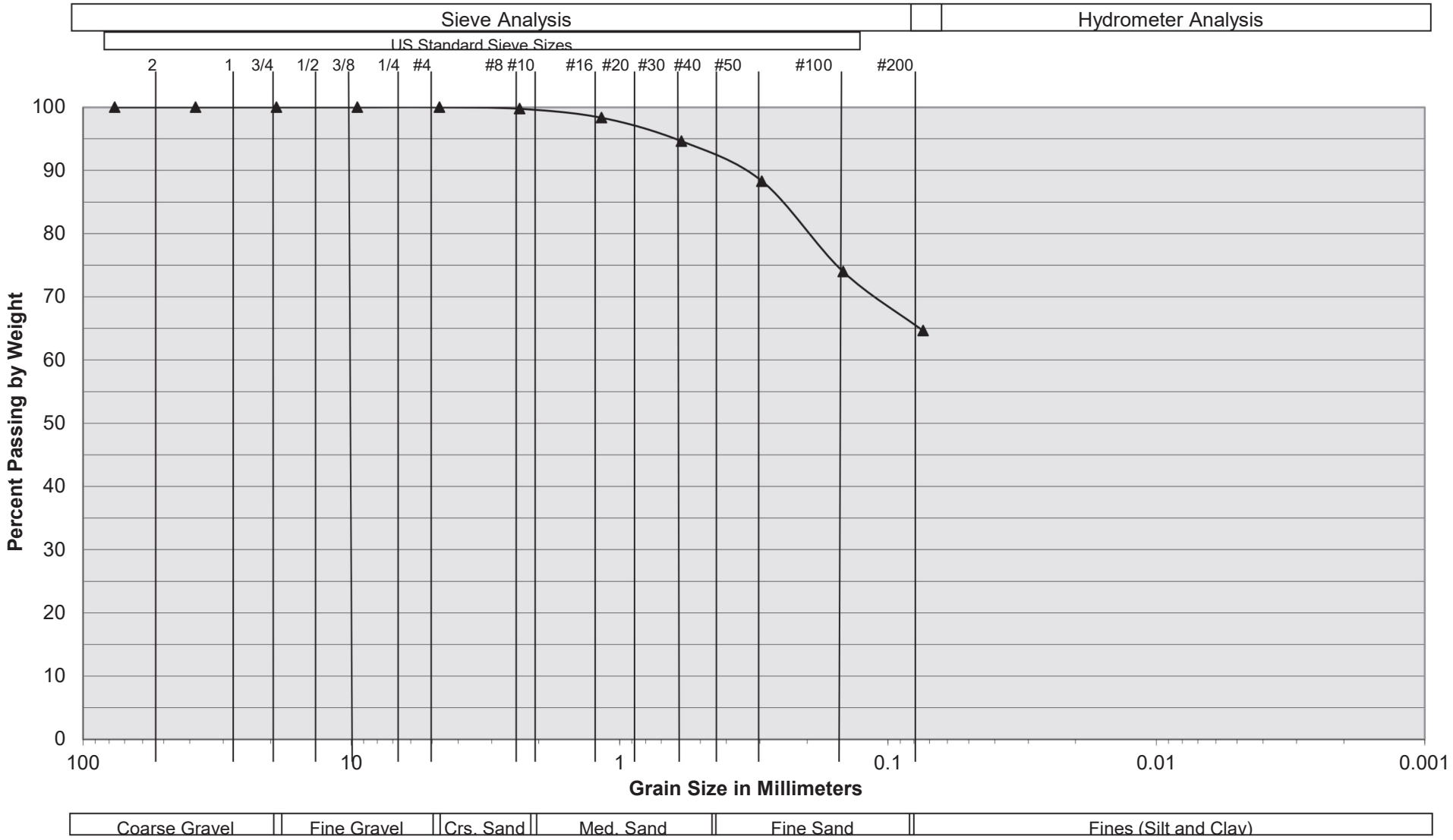


Sample Description	I-4 @ 8½
Soil Classification	Silty fine to coarse Sand, little fine to coarse Gravel

Mojave Drive Industrial Park Buildings 3 & 4
Victorville, California
Project No. 22G268-2R
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

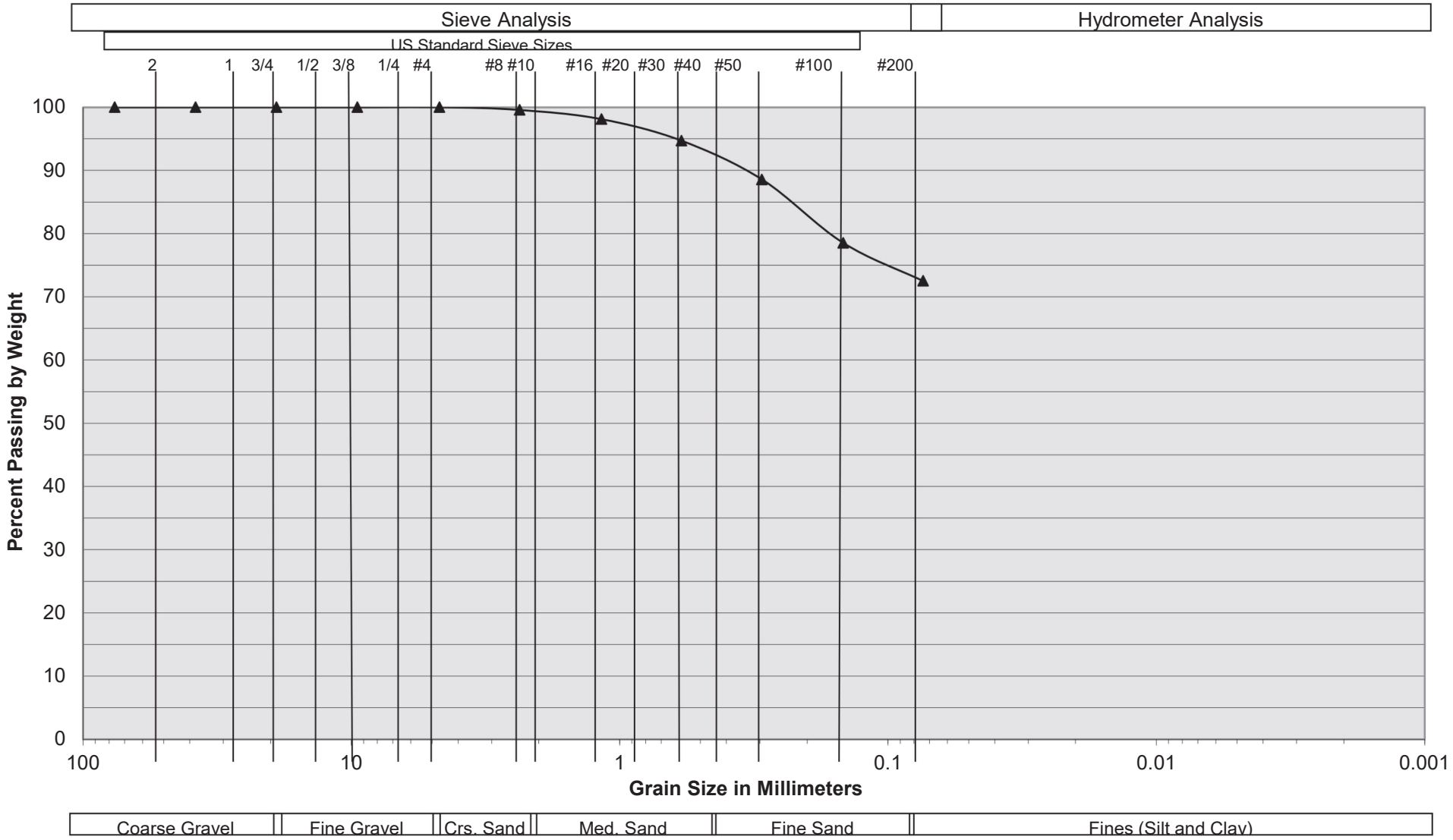


Sample Description	I-5 @ 10½'
Soil Classification	Fine Sandy Silt, little Clay, little medium Sand

Mojave Drive Industrial Park Buildings 3 & 4
Victorville, California
Project No. 22G268-2R
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

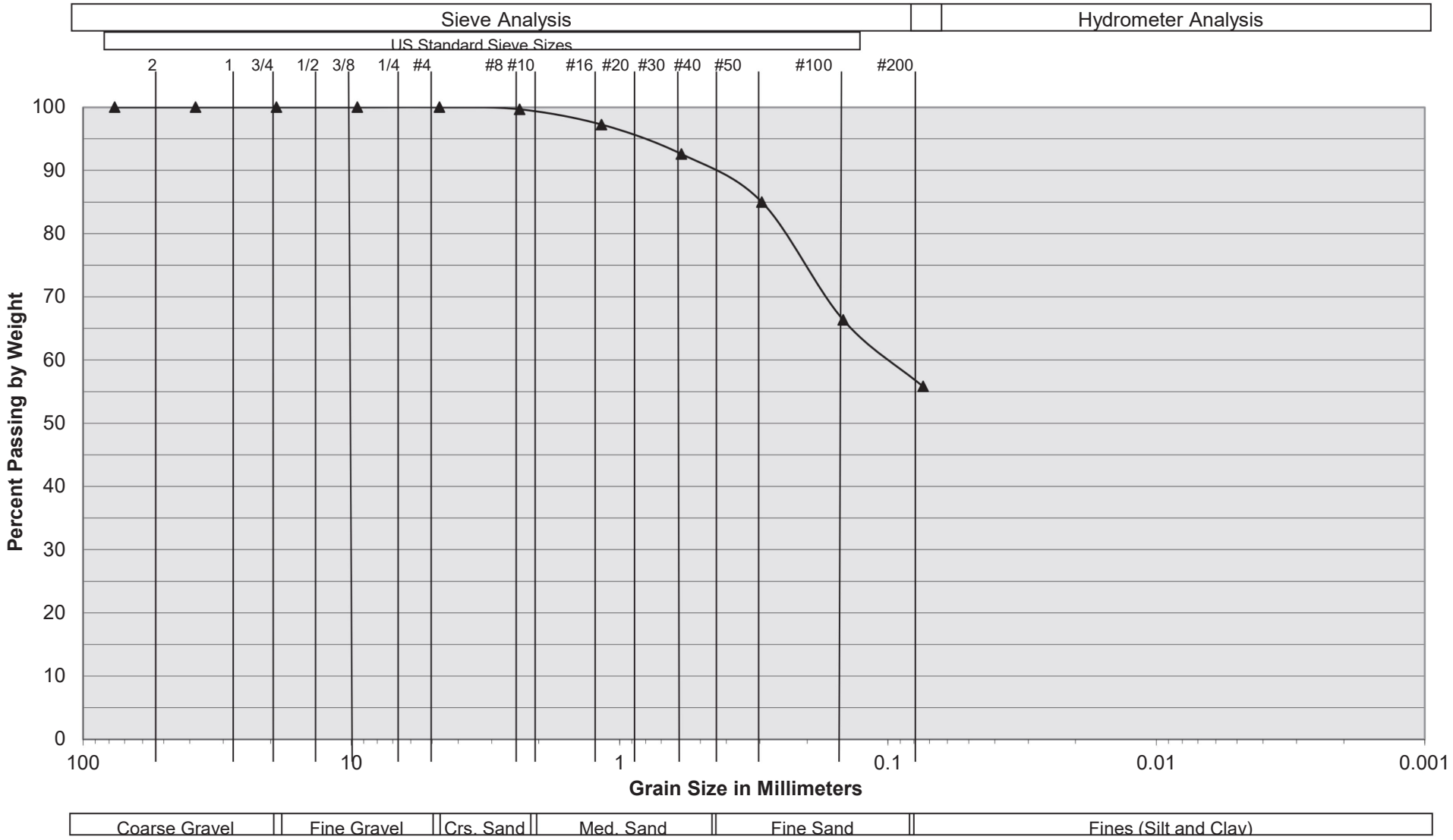


Sample Description	I-6 @ 10½'
Soil Classification	Silty Clay, little fine Sand, trace medium Sand

Mojave Drive Industrial Park Buildings 3 & 4
Victorville, California
Project No. 22G268-2R
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-7 @ 10½'
Soil Classification	Fine Sandy Silt, little Clay, little medium Sand

Mojave Drive Industrial Park Buildings 3 & 4
Victorville, California
Project No. 22G268-2R
PLATE C- 5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Attachment E
Hydromodification

Project: COVINGTON - MIP BUILDING 3

Detention/ Infiltration System Routing Study Summary

Stage Storage Number	Storage Depth (ft)	Elevation (ft)	Area (ft^2)	Incremental volume (ft^3)	Total Volume (ft^3)	Total Volume (acre-ft)	Outflow Q (cfs)	Notes
1	0.0	2,965.00	55,590	0	0	0	0	**Bottom of Infiltration System Rock**
2	0.5	2,965.50	55,590	11,118	11,118	0.255	2.27	**108" CMP Invert**
3	1.5	2,966.50	55,590	32,868	43,986	1.010	2.27	
4	2.5	2,967.50	55,590	40,569	84,555	1.941	2.27	
5	3.00	2,968.00	55,590	21,831	106,386	2.442	2.27	
6	4.25	2,969.25	55,590	57,154	163,541	3.754	2.27	System Releases Water @ 2969.25
7	6.00	2,971.00	55,590	81,959	245,500	5.636	13.11	
8	6.50	2,971.50	55,590	23,006	268,505	6.164	15.85	
9	7.50	2,972.50	55,590	44,349	312,854	7.182	20.12	
10	8.50	2,973.50	55,590	40,569	353,423	8.113	23.55	
11	9.50	2,974.50	55,590	32,868	386,291	8.868	26.50	
12	10.00	2,975.00	55,590	11,118	397,409	9.123	27.84	**Top of Infiltration/ Detention System**
13	11.00	2,976.00	55,590	0	397,409	9.123	30.34	
14	12.0	2,977.00	55,590	0	397,409	9.123	32.64	

108" CMP system with 6" rock top & bottom

Infiltration System Bottom Area Discharge ($Q_{out,bottom}$)			
Infiltration Rate per Geo Tech Report (in/hr)		=	5.3
Factor of Safety			3
Unit Conversion (ft/sec)	$\frac{6.8\frac{in}{hr}}{3.25} \times \frac{1\ ft}{12\ in} \times \frac{1\ hr}{60\ min} \times \frac{1\ min}{60\ sec} =$		0.0000409
Infiltration System Footprint (ft^2)	654 ft x 85 ft	=	55,590
$Q_{out,bottom}$ (cfs)		=	**2.27**

*WQMP Design Capture Volume (DCV) is 130,209 CF

Basin Routing Summary Table

	100 YR 24 HR	10 YR 24 HR
Proposed Q100(cfs) 75.9 ac	169.07	93.04
Q (cfs) after Routing	26.38	8.27
WSE (ft)	2974.46	2970.22

note: 2.27 cfs to infiltration

Storm Drain System Net Drainage (Q_{net})		
One 21-inch Outlet Pipe + Infiltration $Q_{out,bottom}$		
Orifice Eqn	$= C * A * \sqrt{2gh} + Q_{out,bottom}$	
	$= 0.6 \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$	
A: Outlet pipe cross sectional area		
h: WSE - outlet pipe centerline elevation		
Example: WSE @ 1113.23 ft		
Q_{net}	$= C \times A\sqrt{2 \times 32.2 \times h} + Q_{out,bottom}$	
C		0.6
A (ft^2) = πr^2		2.41
WSE (ft)		2,976.00
Outlet Centerline (ft)		2970.125
h (ft)		5.875
$Q_{out,bottom\ (cfs)}$		2.27
Q_{net}	=	**30.34**

HUITT-ZOLLARS

COVINGTON - MIP UNIT HYDROGRAPH AND STORM WATER MITIGATION SUMMARY									
	EXISTING Q TRIBUTARY TO STREAM (CFS) (47 AC)		PROPOSED Q PRIOR TO MITIGATION (CFS)		PROPOSED Q AFTER MITIGATION (CFS)		Q_{out} DUE TO INFILTRATION (CFS)	PROPOSED Q AFTER MITIGATION TO PUBLIC SD (CFS)	
	10 YR	100 YR	10 YR	100 YR	10 YR	100 YR		10 YR	100 YR
BUILDING 1 (6.2 AC)			10.19	17.79	1.20	3.19	0.30	0.90	2.89
BUILDING 2 (5.7 AC)			9.84	17.18	1.03	3.39	0.34	0.69	3.05
BUILDING 3 (61.1 AC)			93.04	169.07	8.27	26.38	2.27	6.00	24.11
TOTAL	14.29	33.24	113.07	204.04	10.5	32.96		7.59	30.05
IS Q AFTER ROUTING LESS THAN OR EQUAL TO EXISTING Q TRIBUTARY TO STREAM?								YES	YES

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

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Study date 04/28/23

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

Program License Serial Number 6145

COVINGTON - MIP
10 YEAR STORM EVENT EXISTING TRIBUTARY TO OUTLET
5712Q10E
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
47.00	1	0.62
Rainfall data for year 10		
47.00	6	1.27
Rainfall data for year 10		
47.00	24	2.32

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
86.0	86.0	47.00	1.000	0.265	1.000	0.265

Area-averaged adjusted loss rate Fm (In/Hr) = 0.265

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

Area	Area	SCS CN	SCS CN	S	Pervious

(Ac.)	Fract	(AMC2)	(AMC2)		Yield Fr
47.00	1.000	86.0	86.0	1.63	0.473

Area-averaged catchment yield fraction, Y = 0.473
Area-averaged low loss fraction, Yb = 0.527
++
Watercourse length = 2070.00(Ft.)
Length from concentration point to centroid = 1190.00(Ft.)
Elevation difference along watercourse = 22.40(Ft.)
Mannings friction factor along watercourse = 0.350
Watershed area = 47.00(Ac.)
Catchment Lag time = 1.549 hours
Unit interval = 5.000 minutes
Unit interval percentage of lag time = 5.3799
Hydrograph baseflow = 0.00(CFS)
Average maximum watershed loss rate(Fm) = 0.265(In/Hr)
Average low loss rate fraction (Yb) = 0.527 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall = 0.295(In)
Computed peak 30-minute rainfall = 0.504(In)
Specified peak 1-hour rainfall = 0.621(In)
Computed peak 3-hour rainfall = 0.963(In)
Specified peak 6-hour rainfall = 1.270(In)
Specified peak 24-hour rainfall = 2.320(In)

Rainfall depth area reduction factors:
Using a total area of 47.00(Ac.) (Ref: fig. E-4)

5-minute factor = 0.998 Adjusted rainfall = 0.294(In)
30-minute factor = 0.998 Adjusted rainfall = 0.503(In)
1-hour factor = 0.998 Adjusted rainfall = 0.620(In)
3-hour factor = 1.000 Adjusted rainfall = 0.963(In)
6-hour factor = 1.000 Adjusted rainfall = 1.270(In)
24-hour factor = 1.000 Adjusted rainfall = 2.320(In)

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

Interval Number	'S' Graph Mean values	Unit Hydrograph ((CFS))
(K = 568.41 (CFS))		
1	0.237	1.346
2	0.710	2.691
3	1.282	3.251
4	2.163	5.009
5	3.094	5.290
6	4.338	7.072
7	5.673	7.585
8	7.257	9.008
9	9.065	10.275
10	11.281	12.593
11	14.653	19.170
12	18.248	20.431
13	23.363	29.077
14	28.871	31.305
15	33.876	28.449
16	38.481	26.176
17	42.772	24.388
18	46.255	19.802
19	49.644	19.259

20	52.553	16.535
21	55.347	15.885
22	57.717	13.468
23	59.783	11.743
24	61.735	11.097
25	63.424	9.601
26	65.078	9.397
27	66.538	8.302
28	67.957	8.068
29	69.299	7.624
30	70.590	7.339
31	71.813	6.952
32	72.894	6.142
33	73.955	6.034
34	74.920	5.484
35	75.867	5.379
36	76.786	5.226
37	77.690	5.137
38	78.528	4.763
39	79.241	4.053
40	79.951	4.037
41	80.661	4.037
42	81.369	4.025
43	81.994	3.551
44	82.575	3.303
45	83.156	3.303
46	83.737	3.303
47	84.309	3.251
48	84.833	2.976
49	85.349	2.936
50	85.866	2.936
51	86.382	2.936
52	86.865	2.744
53	87.296	2.450
54	87.726	2.446
55	88.157	2.446
56	88.584	2.429
57	88.938	2.013
58	89.261	1.835
59	89.584	1.835
60	89.906	1.835
61	90.225	1.813
62	90.529	1.723
63	90.830	1.712
64	91.131	1.712
65	91.432	1.712
66	91.714	1.604
67	91.973	1.468
68	92.231	1.468
69	92.489	1.468
70	92.747	1.462
71	92.989	1.376
72	93.225	1.346
73	93.462	1.346
74	93.699	1.346
75	93.924	1.281
76	94.110	1.058
77	94.293	1.040
78	94.476	1.040
79	94.659	1.040
80	94.842	1.040
81	95.025	1.040
82	95.208	1.040

83	95.391	1.040
84	95.571	1.024
85	95.720	0.846
86	95.860	0.795
87	95.999	0.795
88	96.139	0.795
89	96.279	0.795
90	96.419	0.795
91	96.559	0.795
92	96.699	0.795
93	96.839	0.795
94	96.954	0.658
95	97.051	0.550
96	97.148	0.550
97	97.245	0.550
98	97.342	0.550
99	97.439	0.550
100	97.535	0.550
101	97.632	0.550
102	97.729	0.550
103	97.813	0.478
104	97.868	0.312
105	97.922	0.306
106	97.976	0.306
107	98.030	0.306
108	98.083	0.306
109	98.137	0.306
110	98.191	0.306
111	98.245	0.306
112	98.300	0.313
113	98.363	0.359
114	98.427	0.367
115	98.492	0.367
116	98.557	0.367
117	98.621	0.367
118	98.686	0.367
119	98.750	0.367
120	98.815	0.367
121	98.879	0.367
122	98.944	0.367
123	99.009	0.367
124	99.073	0.367
125	99.138	0.367
126	99.202	0.367
127	99.267	0.367
128	99.331	0.367
129	99.396	0.367
130	99.460	0.367
131	99.513	0.298
132	99.547	0.192
133	99.580	0.191
134	99.614	0.191
135	99.648	0.191
136	99.681	0.191
137	99.715	0.191
138	99.748	0.191
139	99.782	0.191
140	99.816	0.191
141	99.849	0.191
142	99.883	0.191
143	99.917	0.191
144	99.950	0.191
145	100.000	0.096

Total soil rain loss = 1.07(In)
Total effective rainfall = 1.25(In)
Peak flow rate in flood hydrograph = 14.29(CFS)

++

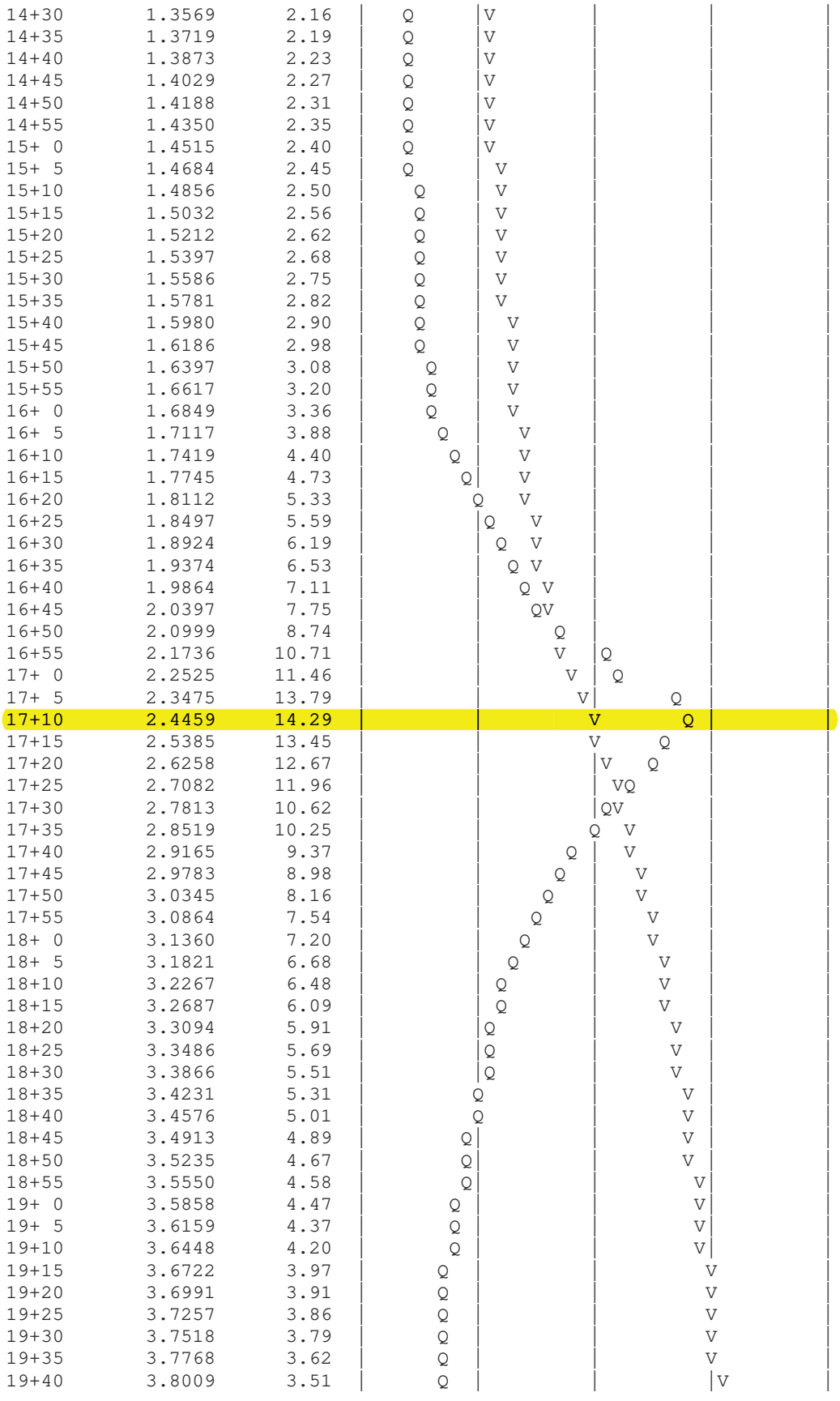
24 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	5.0	10.0	15.0	20.0
0+ 5	0.0000	0.00	Q				
0+10	0.0001	0.01	Q				
0+15	0.0001	0.01	Q				
0+20	0.0003	0.02	Q				
0+25	0.0005	0.03	Q				
0+30	0.0008	0.04	Q				
0+35	0.0011	0.05	Q				
0+40	0.0016	0.07	Q				
0+45	0.0022	0.09	Q				
0+50	0.0029	0.11	Q				
0+55	0.0039	0.14	Q				
1+ 0	0.0051	0.17	Q				
1+ 5	0.0066	0.22	Q				
1+10	0.0085	0.28	Q				
1+15	0.0108	0.32	Q				
1+20	0.0133	0.37	Q				
1+25	0.0161	0.41	Q				
1+30	0.0192	0.44	Q				
1+35	0.0224	0.48	Q				
1+40	0.0259	0.51	VQ				
1+45	0.0296	0.53	VQ				
1+50	0.0334	0.56	VQ				
1+55	0.0374	0.58	VQ				
2+ 0	0.0415	0.60	VQ				
2+ 5	0.0458	0.62	VQ				
2+10	0.0501	0.63	VQ				
2+15	0.0546	0.65	VQ				
2+20	0.0592	0.66	VQ				
2+25	0.0639	0.68	VQ				
2+30	0.0686	0.69	VQ				
2+35	0.0735	0.71	VQ				
2+40	0.0785	0.72	VQ				
2+45	0.0835	0.73	VQ				
2+50	0.0886	0.74	VQ				
2+55	0.0939	0.76	VQ				
3+ 0	0.0991	0.77	VQ				
3+ 5	0.1045	0.78	VQ				
3+10	0.1099	0.79	VQ				
3+15	0.1154	0.80	VQ				
3+20	0.1210	0.81	VQ				
3+25	0.1266	0.82	|Q				
3+30	0.1323	0.83	|Q				
3+35	0.1380	0.83	|Q				
3+40	0.1438	0.84	|Q				
3+45	0.1497	0.85	|Q				
3+50	0.1556	0.86	|Q				
3+55	0.1616	0.87	|Q				

4+ 0	0.1676	0.88	Q				
4+ 5	0.1737	0.88	Q				
4+10	0.1798	0.89	Q				
4+15	0.1860	0.90	Q				
4+20	0.1923	0.91	Q				
4+25	0.1985	0.91	Q				
4+30	0.2049	0.92	Q				
4+35	0.2113	0.93	Q				
4+40	0.2177	0.94	Q				
4+45	0.2242	0.94	Q				
4+50	0.2308	0.95	Q				
4+55	0.2374	0.96	Q				
5+ 0	0.2440	0.96	Q				
5+ 5	0.2507	0.97	QV				
5+10	0.2574	0.98	QV				
5+15	0.2642	0.98	QV				
5+20	0.2710	0.99	QV				
5+25	0.2778	1.00	QV				
5+30	0.2847	1.00	Q				
5+35	0.2917	1.01	Q				
5+40	0.2987	1.01	Q				
5+45	0.3057	1.02	Q				
5+50	0.3128	1.03	Q				
5+55	0.3199	1.03	Q				
6+ 0	0.3271	1.04	Q				
6+ 5	0.3343	1.05	Q				
6+10	0.3415	1.05	Q				
6+15	0.3488	1.06	Q				
6+20	0.3562	1.07	Q				
6+25	0.3636	1.07	Q				
6+30	0.3710	1.08	QV				
6+35	0.3784	1.08	QV				
6+40	0.3860	1.09	QV				
6+45	0.3935	1.10	QV				
6+50	0.4011	1.10	QV				
6+55	0.4088	1.11	QV				
7+ 0	0.4164	1.12	QV				
7+ 5	0.4242	1.12	QV				
7+10	0.4320	1.13	QV				
7+15	0.4398	1.14	QV				
7+20	0.4476	1.14	QV				
7+25	0.4556	1.15	QV				
7+30	0.4635	1.15	QV				
7+35	0.4715	1.16	QV				
7+40	0.4795	1.17	QV				
7+45	0.4876	1.17	QV				
7+50	0.4958	1.18	Q V				
7+55	0.5040	1.19	Q V				
8+ 0	0.5122	1.19	Q V				
8+ 5	0.5205	1.20	Q V				
8+10	0.5288	1.21	Q V				
8+15	0.5371	1.21	Q V				
8+20	0.5456	1.22	Q V				
8+25	0.5540	1.23	Q V				
8+30	0.5625	1.24	Q V				
8+35	0.5711	1.24	Q V				
8+40	0.5797	1.25	Q V				
8+45	0.5884	1.26	Q V				
8+50	0.5971	1.26	Q V				
8+55	0.6058	1.27	Q V				
9+ 0	0.6146	1.28	Q V				
9+ 5	0.6235	1.29	Q V				
9+10	0.6324	1.29	Q V				

9+15	0.6413	1.30	Q V			
9+20	0.6503	1.31	Q V			
9+25	0.6594	1.32	Q V			
9+30	0.6685	1.32	Q V			
9+35	0.6777	1.33	Q V			
9+40	0.6869	1.34	Q V			
9+45	0.6962	1.35	Q V			
9+50	0.7056	1.36	Q V			
9+55	0.7150	1.37	Q V			
10+ 0	0.7245	1.37	Q V			
10+ 5	0.7340	1.38	Q V			
10+10	0.7436	1.39	Q V			
10+15	0.7532	1.40	Q V			
10+20	0.7630	1.41	Q V			
10+25	0.7727	1.42	Q V			
10+30	0.7826	1.43	Q V			
10+35	0.7925	1.44	Q V			
10+40	0.8025	1.45	Q V			
10+45	0.8126	1.46	Q V			
10+50	0.8227	1.47	Q V			
10+55	0.8329	1.48	Q V			
11+ 0	0.8432	1.49	Q V			
11+ 5	0.8536	1.50	Q V			
11+10	0.8640	1.51	Q V			
11+15	0.8745	1.53	Q V			
11+20	0.8851	1.54	Q V			
11+25	0.8957	1.55	Q V			
11+30	0.9065	1.56	Q V			
11+35	0.9173	1.57	Q V			
11+40	0.9282	1.58	Q V			
11+45	0.9392	1.60	Q V			
11+50	0.9503	1.61	Q V			
11+55	0.9615	1.62	Q V			
12+ 0	0.9728	1.64	Q V			
12+ 5	0.9842	1.65	Q V			
12+10	0.9956	1.66	Q V			
12+15	1.0072	1.68	Q V			
12+20	1.0188	1.69	Q V			
12+25	1.0305	1.70	Q V			
12+30	1.0423	1.72	Q V			
12+35	1.0543	1.73	Q V			
12+40	1.0663	1.74	Q V			
12+45	1.0784	1.76	Q V			
12+50	1.0906	1.77	Q V			
12+55	1.1028	1.78	Q V			
13+ 0	1.1152	1.79	Q V			
13+ 5	1.1276	1.80	Q V			
13+10	1.1401	1.81	Q V			
13+15	1.1527	1.83	Q V			
13+20	1.1653	1.84	Q V			
13+25	1.1781	1.85	Q V			
13+30	1.1909	1.87	Q V			
13+35	1.2039	1.88	Q V			
13+40	1.2170	1.90	Q V			
13+45	1.2302	1.92	Q V			
13+50	1.2436	1.94	Q V			
13+55	1.2571	1.96	Q V			
14+ 0	1.2708	1.99	Q V			
14+ 5	1.2847	2.01	Q V			
14+10	1.2987	2.04	Q V			
14+15	1.3129	2.07	Q V			
14+20	1.3274	2.09	Q V			
14+25	1.3420	2.13	Q V			

14+30	1.3569	2.16	
14+35	1.3719	2.19	
14+40	1.3873	2.23	
14+45	1.4029	2.27	
14+50	1.4188	2.31	
14+55	1.4350	2.35	
15+ 0	1.4515	2.40	
15+ 5	1.4684	2.45	
15+10	1.4856	2.50	
15+15	1.5032	2.56	
15+20	1.5212	2.62	
15+25	1.5397	2.68	
15+30	1.5586	2.75	
15+35	1.5781	2.82	
15+40	1.5980	2.90	
15+45	1.6186	2.98	
15+50	1.6397	3.08	
15+55	1.6617	3.20	
16+ 0	1.6849	3.36	
16+ 5	1.7117	3.88	
16+10	1.7419	4.40	
16+15	1.7745	4.73	
16+20	1.8112	5.33	
16+25	1.8497	5.59	
16+30	1.8924	6.19	
16+35	1.9374	6.53	
16+40	1.9864	7.11	
16+45	2.0397	7.75	
16+50	2.0999	8.74	
16+55	2.1736	10.71	
17+ 0	2.2525	11.46	
17+ 5	2.3475	13.79	
17+10	2.4459	14.29	
17+15	2.5385	13.45	
17+20	2.6258	12.67	
17+25	2.7082	11.96	
17+30	2.7813	10.62	
17+35	2.8519	10.25	
17+40	2.9165	9.37	
17+45	2.9783	8.98	
17+50	3.0345	8.16	
17+55	3.0864	7.54	
18+ 0	3.1360	7.20	
18+ 5	3.1821	6.68	
18+10	3.2267	6.48	
18+15	3.2687	6.09	
18+20	3.3094	5.91	
18+25	3.3486	5.69	
18+30	3.3866	5.51	
18+35	3.4231	5.31	
18+40	3.4576	5.01	
18+45	3.4913	4.89	
18+50	3.5235	4.67	
18+55	3.5550	4.58	
19+ 0	3.5858	4.47	
19+ 5	3.6159	4.37	
19+10	3.6448	4.20	
19+15	3.6722	3.97	
19+20	3.6991	3.91	
19+25	3.7257	3.86	
19+30	3.7518	3.79	
19+35	3.7768	3.62	
19+40	3.8009	3.51	

19+45	3.8248	3.47	Q		V	
19+50	3.8484	3.43	Q		V	
19+55	3.8716	3.37	Q		V	
20+ 0	3.8940	3.26	Q		V	
20+ 5	3.9161	3.21	Q		V	
20+10	3.9379	3.17	Q		V	
20+15	3.9595	3.13	Q		V	
20+20	3.9804	3.03	Q		V	
20+25	4.0005	2.92	Q		V	
20+30	4.0203	2.88	Q		V	
20+35	4.0399	2.85	Q		V	
20+40	4.0592	2.80	Q		V	
20+45	4.0774	2.65	Q		V	
20+50	4.0952	2.57	Q		V	
20+55	4.1127	2.54	Q		V	
21+ 0	4.1300	2.52	Q		V	
21+ 5	4.1471	2.48	Q		V	
21+10	4.1638	2.43	Q		V	
21+15	4.1804	2.40	Q		V	
21+20	4.1968	2.38	Q		V	
21+25	4.2130	2.35	Q		V	
21+30	4.2288	2.29	Q		V	
21+35	4.2442	2.24	Q		V	
21+40	4.2594	2.21	Q		V	
21+45	4.2745	2.19	Q		V	
21+50	4.2894	2.17	Q		V	
21+55	4.3040	2.12	Q		V	
22+ 0	4.3184	2.09	Q		V	
22+ 5	4.3327	2.07	Q		V	
22+10	4.3468	2.05	Q		V	
22+15	4.3606	2.00	Q		V	
22+20	4.3738	1.93	Q		V	
22+25	4.3869	1.90	Q		V	
22+30	4.3999	1.88	Q		V	
22+35	4.4128	1.87	Q		V	
22+40	4.4255	1.85	Q		V	
22+45	4.4381	1.83	Q		V	
22+50	4.4507	1.82	Q		V	
22+55	4.4630	1.80	Q		V	
23+ 0	4.4752	1.77	Q		V	
23+ 5	4.4870	1.71	Q		V	
23+10	4.4985	1.68	Q		V	
23+15	4.5100	1.66	Q		V	
23+20	4.5213	1.65	Q		V	
23+25	4.5326	1.63	Q		V	
23+30	4.5438	1.62	Q		V	
23+35	4.5548	1.61	Q		V	
23+40	4.5658	1.59	Q		V	
23+45	4.5766	1.57	Q		V	
23+50	4.5870	1.52	Q		V	
23+55	4.5972	1.48	Q		V	
24+ 0	4.6072	1.46	Q		V	
24+ 5	4.6172	1.45	Q		V	
24+10	4.6271	1.43	Q		V	
24+15	4.6368	1.41	Q		V	
24+20	4.6464	1.39	Q		V	
24+25	4.6559	1.37	Q		V	
24+30	4.6651	1.34	Q		V	
24+35	4.6740	1.30	Q		V	
24+40	4.6825	1.23	Q		V	
24+45	4.6908	1.20	Q		V	
24+50	4.6988	1.17	Q		V	
24+55	4.7066	1.13	Q		V	

25+ 0	4.7140	1.08	Q			V
25+ 5	4.7211	1.03	Q			V
25+10	4.7278	0.97	Q			V
25+15	4.7341	0.92	Q			V
25+20	4.7401	0.87	Q			V
25+25	4.7459	0.84	Q			V
25+30	4.7514	0.80	Q			V
25+35	4.7566	0.76	Q			V
25+40	4.7617	0.73	Q			V
25+45	4.7665	0.70	Q			V
25+50	4.7711	0.67	Q			V
25+55	4.7756	0.65	Q			V
26+ 0	4.7799	0.63	Q			V
26+ 5	4.7841	0.61	Q			V
26+10	4.7881	0.59	Q			V
26+15	4.7920	0.57	Q			V
26+20	4.7958	0.55	Q			V
26+25	4.7995	0.53	Q			V
26+30	4.8030	0.52	Q			V
26+35	4.8065	0.50	Q			V
26+40	4.8098	0.49	Q			V
26+45	4.8131	0.47	Q			V
26+50	4.8162	0.45	Q			V
26+55	4.8191	0.42	Q			V
27+ 0	4.8217	0.38	Q			V
27+ 5	4.8242	0.36	Q			V
27+10	4.8266	0.35	Q			V
27+15	4.8289	0.34	Q			V
27+20	4.8312	0.33	Q			V
27+25	4.8334	0.32	Q			V
27+30	4.8356	0.31	Q			V
27+35	4.8376	0.30	Q			V
27+40	4.8396	0.29	Q			V
27+45	4.8416	0.28	Q			V
27+50	4.8435	0.27	Q			V
27+55	4.8453	0.26	Q			V
28+ 0	4.8470	0.25	Q			V
28+ 5	4.8485	0.21	Q			V
28+10	4.8498	0.18	Q			V
28+15	4.8510	0.17	Q			V
28+20	4.8521	0.17	Q			V
28+25	4.8532	0.16	Q			V
28+30	4.8543	0.15	Q			V
28+35	4.8553	0.15	Q			V
28+40	4.8562	0.14	Q			V
28+45	4.8572	0.14	Q			V
28+50	4.8581	0.13	Q			V
28+55	4.8590	0.13	Q			V
29+ 0	4.8598	0.12	Q			V
29+ 5	4.8606	0.12	Q			V
29+10	4.8614	0.11	Q			V
29+15	4.8621	0.11	Q			V
29+20	4.8629	0.11	Q			V
29+25	4.8636	0.10	Q			V
29+30	4.8642	0.10	Q			V
29+35	4.8649	0.09	Q			V
29+40	4.8655	0.09	Q			V
29+45	4.8661	0.09	Q			V
29+50	4.8667	0.08	Q			V
29+55	4.8673	0.08	Q			V
30+ 0	4.8678	0.08	Q			V
30+ 5	4.8684	0.08	Q			V
30+10	4.8689	0.07	Q			V

30+15	4.8693	0.07	Q	|	|	|	V|
30+20	4.8698	0.07	Q	|	|	|	V|
30+25	4.8703	0.07	Q	|	|	|	V|
30+30	4.8707	0.06	Q	|	|	|	V|
30+35	4.8711	0.06	Q	|	|	|	V|
30+40	4.8715	0.06	Q	|	|	|	V|
30+45	4.8719	0.06	Q	|	|	|	V|
30+50	4.8723	0.05	Q	|	|	|	V|
30+55	4.8726	0.05	Q	|	|	|	V|
31+ 0	4.8730	0.05	Q	|	|	|	V|
31+ 5	4.8733	0.05	Q	|	|	|	V|
31+10	4.8736	0.05	Q	|	|	|	V|
31+15	4.8739	0.04	Q	|	|	|	V|
31+20	4.8742	0.04	Q	|	|	|	V|
31+25	4.8745	0.04	Q	|	|	|	V|
31+30	4.8748	0.04	Q	|	|	|	V|
31+35	4.8750	0.04	Q	|	|	|	V|
31+40	4.8753	0.04	Q	|	|	|	V|
31+45	4.8755	0.03	Q	|	|	|	V|
31+50	4.8758	0.03	Q	|	|	|	V|
31+55	4.8760	0.03	Q	|	|	|	V|
32+ 0	4.8762	0.03	Q	|	|	|	V|
32+ 5	4.8764	0.03	Q	|	|	|	V|
32+10	4.8766	0.03	Q	|	|	|	V|
32+15	4.8768	0.03	Q	|	|	|	V|
32+20	4.8770	0.03	Q	|	|	|	V|
32+25	4.8771	0.03	Q	|	|	|	V|
32+30	4.8773	0.02	Q	|	|	|	V|
32+35	4.8775	0.02	Q	|	|	|	V|
32+40	4.8776	0.02	Q	|	|	|	V|
32+45	4.8778	0.02	Q	|	|	|	V|
32+50	4.8779	0.02	Q	|	|	|	V|
32+55	4.8781	0.02	Q	|	|	|	V|
33+ 0	4.8782	0.02	Q	|	|	|	V|
33+ 5	4.8783	0.02	Q	|	|	|	V|
33+10	4.8785	0.02	Q	|	|	|	V|
33+15	4.8786	0.02	Q	|	|	|	V|
33+20	4.8787	0.02	Q	|	|	|	V|
33+25	4.8788	0.02	Q	|	|	|	V|
33+30	4.8789	0.02	Q	|	|	|	V|
33+35	4.8790	0.02	Q	|	|	|	V|
33+40	4.8791	0.01	Q	|	|	|	V|
33+45	4.8792	0.01	Q	|	|	|	V|
33+50	4.8793	0.01	Q	|	|	|	V|
33+55	4.8794	0.01	Q	|	|	|	V|
34+ 0	4.8795	0.01	Q	|	|	|	V|
34+ 5	4.8796	0.01	Q	|	|	|	V|
34+10	4.8796	0.01	Q	|	|	|	V|
34+15	4.8797	0.01	Q	|	|	|	V|
34+20	4.8798	0.01	Q	|	|	|	V|
34+25	4.8798	0.01	Q	|	|	|	V|
34+30	4.8799	0.01	Q	|	|	|	V|
34+35	4.8799	0.01	Q	|	|	|	V|
34+40	4.8800	0.01	Q	|	|	|	V|
34+45	4.8800	0.01	Q	|	|	|	V|
34+50	4.8800	0.00	Q	|	|	|	V|
34+55	4.8801	0.00	Q	|	|	|	V|
35+ 0	4.8801	0.00	Q	|	|	|	V|
35+ 5	4.8801	0.00	Q	|	|	|	V|
35+10	4.8801	0.00	Q	|	|	|	V|
35+15	4.8802	0.00	Q	|	|	|	V|
35+20	4.8802	0.00	Q	|	|	|	V|
35+25	4.8802	0.00	Q	|	|	|	V|

35+30	4.8802	0.00	Q	|	|	|	V|
35+35	4.8802	0.00	Q	|	|	|	V|
35+40	4.8802	0.00	Q	|	|	|	V|
35+45	4.8802	0.00	Q	|	|	|	V|
35+50	4.8802	0.00	Q	|	|	|	V|
35+55	4.8803	0.00	Q	|	|	|	V|
36+ 0	4.8803	0.00	Q	|	|	|	V

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

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Study date 05/01/23

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

Program License Serial Number 6145

COVINGTON - MIP BUILDING 3
10 YEAR STORM EVENT PROPOSED UNIT HYDROGRAPH BUILDING 3
5712Q10PUH3
DS

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

English Units used in output format

Area averaged rainfall intensity isohyetal data:

Sub-Area (Ac.)	Duration (hours)	Isohyetal (In)
Rainfall data for year 10		
61.10	1	0.62
Rainfall data for year 10		
61.10	6	1.27
Rainfall data for year 10		
61.10	24	2.32

++

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

SCS curve No.(AMCII)	SCS curve NO.(AMC 2)	Area (Ac.)	Area Fraction	Fp(Fig C6) (In/Hr)	Ap (dec.)	Fm (In/Hr)
69.0	69.0	61.10	1.000	0.548	0.100	0.055

Area-averaged adjusted loss rate Fm (In/Hr) = 0.055

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

Area	Area	SCS CN	SCS CN	S	Pervious

```
 (Ac.)      Fract          (AMC2)     (AMC2)           Yield Fr
    6.11   0.100          69.0       69.0       4.49     0.147
   54.99   0.900          98.0       98.0       0.20     0.902

Area-averaged catchment yield fraction, Y =  0.826
Area-averaged low loss fraction, Yb =  0.174
User entry of time of concentration  =   0.182 (hours)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Watershed area =      61.10(Ac.)
Catchment Lag time =   0.145 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 57.3605
Hydrograph baseflow =     0.00(CFS)
Average maximum watershed loss rate(Fm) =  0.055(In/Hr)
Average low loss rate fraction (Yb) = 0.174 (decimal)
DESERT S-Graph Selected
Computed peak 5-minute rainfall =  0.295(In)
Computed peak 30-minute rainfall =  0.504(In)
Specified peak 1-hour rainfall =  0.621(In)
Computed peak 3-hour rainfall =  0.963(In)
Specified peak 6-hour rainfall =  1.270(In)
Specified peak 24-hour rainfall =  2.320(In)


Rainfall depth area reduction factors:
Using a total area of      61.10(Ac.) (Ref: fig. E-4)

5-minute factor = 0.997     Adjusted rainfall =  0.294(In)
30-minute factor = 0.997    Adjusted rainfall =  0.503(In)
1-hour factor = 0.997       Adjusted rainfall =  0.619(In)
3-hour factor = 1.000       Adjusted rainfall =  0.963(In)
6-hour factor = 1.000       Adjusted rainfall =  1.270(In)
24-hour factor = 1.000      Adjusted rainfall =  2.320(In)
--------------------------------------------------------------------------

                    U n i t  H y d r o g r a p h
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Interval          'S' Graph          Unit Hydrograph
Number            Mean values             ((CFS))
--------------------------------------------------------------------------
              (K =       738.93 (CFS))

  1                5.104                  37.712
  2               38.756                 248.667
  3               66.340                 203.830
  4               78.133                  87.142
  5               85.016                  50.858
  6               89.586                  33.767
  7               92.669                  22.785
  8               94.921                  16.641
  9               96.558                  12.095
 10               97.670                   8.213
 11               98.340                   4.949
 12               99.016                   4.996
 13               99.599                   4.313
 14              100.000                   2.960
--------------------------------------------------------------------------
--------------------------------------------------------------------------
--------------------------------------------------------------------------
Total soil rain loss =      0.34(In)
Total effective rainfall =      1.98(In)
Peak flow rate in flood hydrograph =     93.04(CFS)
--------------------------------------------------------------------------
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24 - H O U R S T O R M

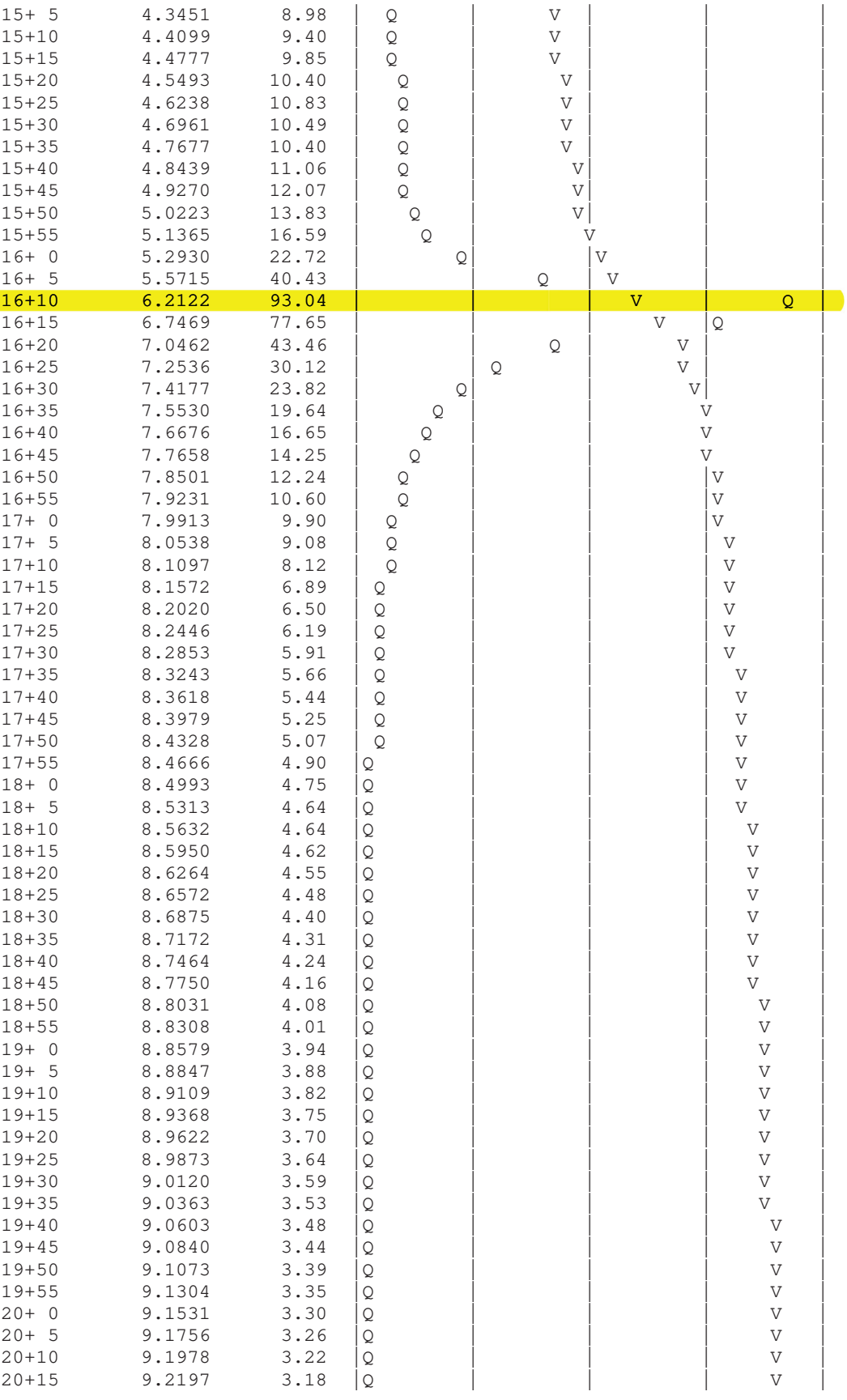
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m)	Volume Ac.Ft	Q(CFS)	0	25.0	50.0	75.0	100.0
0+ 5	0.0008	0.11	Q				
0+10	0.0065	0.83	Q				
0+15	0.0163	1.42	Q				
0+20	0.0278	1.68	Q				
0+25	0.0404	1.83	Q				
0+30	0.0537	1.93	Q				
0+35	0.0676	2.01	Q				
0+40	0.0817	2.06	Q				
0+45	0.0962	2.10	Q				
0+50	0.1109	2.13	Q				
0+55	0.1257	2.15	Q				
1+ 0	0.1407	2.17	Q				
1+ 5	0.1558	2.19	Q				
1+10	0.1710	2.21	Q				
1+15	0.1862	2.21	Q				
1+20	0.2015	2.22	Q				
1+25	0.2169	2.23	Q				
1+30	0.2323	2.24	Q				
1+35	0.2477	2.24	Q				
1+40	0.2632	2.25	QV				
1+45	0.2788	2.26	QV				
1+50	0.2944	2.26	QV				
1+55	0.3100	2.27	QV				
2+ 0	0.3257	2.28	QV				
2+ 5	0.3415	2.29	QV				
2+10	0.3573	2.29	QV				
2+15	0.3731	2.30	QV				
2+20	0.3890	2.31	QV				
2+25	0.4050	2.32	QV				
2+30	0.4210	2.33	QV				
2+35	0.4371	2.33	QV				
2+40	0.4532	2.34	QV				
2+45	0.4694	2.35	QV				
2+50	0.4856	2.36	QV				
2+55	0.5019	2.37	QV				
3+ 0	0.5183	2.38	Q V				
3+ 5	0.5347	2.38	Q V				
3+10	0.5512	2.39	Q V				
3+15	0.5677	2.40	Q V				
3+20	0.5843	2.41	Q V				
3+25	0.6010	2.42	Q V				
3+30	0.6177	2.43	Q V				
3+35	0.6345	2.44	Q V				
3+40	0.6513	2.45	Q V				
3+45	0.6682	2.45	Q V				
3+50	0.6852	2.46	Q V				
3+55	0.7022	2.47	Q V				
4+ 0	0.7193	2.48	Q V				
4+ 5	0.7365	2.49	Q V				
4+10	0.7537	2.50	QV				
4+15	0.7710	2.51	Q V				
4+20	0.7884	2.52	Q V				
4+25	0.8058	2.53	Q V				
4+30	0.8233	2.54	Q V				

4+35	0.8409	2.55	Q V			
4+40	0.8585	2.56	Q V			
4+45	0.8762	2.57	Q V			
4+50	0.8940	2.58	Q V			
4+55	0.9119	2.59	Q V			
5+ 0	0.9298	2.60	Q V			
5+ 5	0.9478	2.62	Q V			
5+10	0.9659	2.63	Q V			
5+15	0.9841	2.64	Q V			
5+20	1.0024	2.65	Q V			
5+25	1.0207	2.66	Q V			
5+30	1.0391	2.67	Q V			
5+35	1.0576	2.68	Q V			
5+40	1.0761	2.70	Q V			
5+45	1.0948	2.71	Q V			
5+50	1.1135	2.72	Q V			
5+55	1.1323	2.73	Q V			
6+ 0	1.1512	2.75	Q V			
6+ 5	1.1702	2.76	Q V			
6+10	1.1893	2.77	Q V			
6+15	1.2085	2.78	Q V			
6+20	1.2277	2.80	Q V			
6+25	1.2471	2.81	Q V			
6+30	1.2665	2.82	Q V			
6+35	1.2861	2.84	Q V			
6+40	1.3057	2.85	Q V			
6+45	1.3254	2.86	Q V			
6+50	1.3453	2.88	Q V			
6+55	1.3652	2.89	Q V			
7+ 0	1.3852	2.91	Q V			
7+ 5	1.4054	2.92	Q V			
7+10	1.4256	2.94	Q V			
7+15	1.4460	2.95	Q V			
7+20	1.4664	2.97	Q V			
7+25	1.4870	2.98	Q V			
7+30	1.5076	3.00	Q V			
7+35	1.5284	3.02	Q V			
7+40	1.5493	3.03	Q V			
7+45	1.5703	3.05	Q V			
7+50	1.5914	3.07	Q V			
7+55	1.6127	3.08	Q V			
8+ 0	1.6340	3.10	Q V			
8+ 5	1.6555	3.12	Q V			
8+10	1.6771	3.14	Q V			
8+15	1.6989	3.16	Q V			
8+20	1.7207	3.18	Q V			
8+25	1.7427	3.19	Q V			
8+30	1.7649	3.21	Q V			
8+35	1.7871	3.23	Q V			
8+40	1.8095	3.25	Q V			
8+45	1.8321	3.27	Q V			
8+50	1.8548	3.29	Q V			
8+55	1.8776	3.31	Q V			
9+ 0	1.9006	3.34	Q V			
9+ 5	1.9237	3.36	Q V			
9+10	1.9470	3.38	Q V			
9+15	1.9704	3.40	Q V			
9+20	1.9940	3.43	Q V			
9+25	2.0178	3.45	Q V			
9+30	2.0417	3.47	Q V			
9+35	2.0658	3.50	Q V			
9+40	2.0900	3.52	Q V			
9+45	2.1145	3.55	Q V			

9+50	2.1391	3.57	Q	V			
9+55	2.1639	3.60	Q	V			
10+ 0	2.1889	3.63	Q	V			
10+ 5	2.2140	3.65	Q	V			
10+10	2.2394	3.68	Q	V			
10+15	2.2650	3.71	Q	V			
10+20	2.2907	3.74	Q	V			
10+25	2.3167	3.77	Q	V			
10+30	2.3429	3.80	Q	V			
10+35	2.3693	3.83	Q	V			
10+40	2.3959	3.87	Q	V			
10+45	2.4227	3.90	Q	V			
10+50	2.4498	3.93	Q	V			
10+55	2.4771	3.97	Q	V			
11+ 0	2.5047	4.00	Q	V			
11+ 5	2.5325	4.04	Q	V			
11+10	2.5605	4.07	Q	V			
11+15	2.5889	4.11	Q	V			
11+20	2.6175	4.15	Q	V			
11+25	2.6463	4.19	Q	V			
11+30	2.6755	4.23	Q	V			
11+35	2.7049	4.27	Q	V			
11+40	2.7347	4.32	Q	V			
11+45	2.7647	4.36	Q	V			
11+50	2.7951	4.41	Q	V			
11+55	2.8258	4.46	Q	V			
12+ 0	2.8568	4.51	Q	V			
12+ 5	2.8881	4.54	Q	V			
12+10	2.9188	4.46	Q	V			
12+15	2.9492	4.41	Q	V			
12+20	2.9796	4.42	Q	V			
12+25	3.0102	4.45	Q	V			
12+30	3.0412	4.49	Q	V			
12+35	3.0724	4.54	Q	V			
12+40	3.1041	4.59	Q	V			
12+45	3.1361	4.65	Q	V			
12+50	3.1686	4.72	Q	V			
12+55	3.2015	4.78	Q	V			
13+ 0	3.2350	4.85	Q	V			
13+ 5	3.2689	4.93	Q	V			
13+10	3.3034	5.01	Q	V			
13+15	3.3384	5.09	Q	V			
13+20	3.3740	5.17	Q	V			
13+25	3.4103	5.26	Q	V			
13+30	3.4472	5.36	Q	V			
13+35	3.4847	5.46	Q	V			
13+40	3.5231	5.56	Q	V			
13+45	3.5621	5.67	Q	V			
13+50	3.6020	5.79	Q	V			
13+55	3.6427	5.91	Q	V			
14+ 0	3.6843	6.04	Q	V			
14+ 5	3.7268	6.18	Q	V			
14+10	3.7705	6.34	Q	V			
14+15	3.8152	6.50	Q	V			
14+20	3.8612	6.68	Q	V			
14+25	3.9084	6.85	Q	V			
14+30	3.9570	7.05	Q	V			
14+35	4.0069	7.25	Q	V			
14+40	4.0585	7.49	Q	V			
14+45	4.1117	7.72	Q	V			
14+50	4.1668	8.00	Q	V			
14+55	4.2239	8.29	Q	V			
15+ 0	4.2833	8.63	Q	V			

15+ 5	4.3451	8.98	
15+10	4.4099	9.40	
15+15	4.4777	9.85	
15+20	4.5493	10.40	
15+25	4.6238	10.83	
15+30	4.6961	10.49	
15+35	4.7677	10.40	
15+40	4.8439	11.06	
15+45	4.9270	12.07	
15+50	5.0223	13.83	
15+55	5.1365	16.59	
16+ 0	5.2930	22.72	
16+ 5	5.5715	40.43	
16+10	6.2122	93.04	
16+15	6.7469	77.65	
16+20	7.0462	43.46	
16+25	7.2536	30.12	
16+30	7.4177	23.82	
16+35	7.5530	19.64	
16+40	7.6676	16.65	
16+45	7.7658	14.25	
16+50	7.8501	12.24	
16+55	7.9231	10.60	
17+ 0	7.9913	9.90	
17+ 5	8.0538	9.08	
17+10	8.1097	8.12	
17+15	8.1572	6.89	
17+20	8.2020	6.50	
17+25	8.2446	6.19	
17+30	8.2853	5.91	
17+35	8.3243	5.66	
17+40	8.3618	5.44	
17+45	8.3979	5.25	
17+50	8.4328	5.07	
17+55	8.4666	4.90	
18+ 0	8.4993	4.75	
18+ 5	8.5313	4.64	
18+10	8.5632	4.64	
18+15	8.5950	4.62	
18+20	8.6264	4.55	
18+25	8.6572	4.48	
18+30	8.6875	4.40	
18+35	8.7172	4.31	
18+40	8.7464	4.24	
18+45	8.7750	4.16	
18+50	8.8031	4.08	
18+55	8.8308	4.01	
19+ 0	8.8579	3.94	
19+ 5	8.8847	3.88	
19+10	8.9109	3.82	
19+15	8.9368	3.75	
19+20	8.9622	3.70	
19+25	8.9873	3.64	
19+30	9.0120	3.59	
19+35	9.0363	3.53	
19+40	9.0603	3.48	
19+45	9.0840	3.44	
19+50	9.1073	3.39	
19+55	9.1304	3.35	
20+ 0	9.1531	3.30	
20+ 5	9.1756	3.26	
20+10	9.1978	3.22	
20+15	9.2197	3.18	

20+20	9.2413	3.15	Q				V
20+25	9.2627	3.11	Q				V
20+30	9.2839	3.07	Q				V
20+35	9.3049	3.04	Q				V
20+40	9.3256	3.01	Q				V
20+45	9.3461	2.98	Q				V
20+50	9.3663	2.94	Q				V
20+55	9.3864	2.91	Q				V
21+ 0	9.4063	2.88	Q				V
21+ 5	9.4259	2.86	Q				V
21+10	9.4454	2.83	Q				V
21+15	9.4647	2.80	Q				V
21+20	9.4838	2.78	Q				V
21+25	9.5028	2.75	Q				V
21+30	9.5215	2.72	Q				V
21+35	9.5401	2.70	Q				V
21+40	9.5586	2.68	Q				V
21+45	9.5768	2.65	Q				V
21+50	9.5949	2.63	Q				V
21+55	9.6129	2.61	Q				V
22+ 0	9.6307	2.59	Q				V
22+ 5	9.6484	2.57	Q				V
22+10	9.6659	2.55	Q				V
22+15	9.6833	2.52	Q				V
22+20	9.7006	2.51	Q				V
22+25	9.7177	2.49	Q				V
22+30	9.7347	2.47	Q				V
22+35	9.7515	2.45	Q				V
22+40	9.7683	2.43	Q				V
22+45	9.7849	2.41	Q				V
22+50	9.8014	2.39	Q				V
22+55	9.8178	2.38	Q				V
23+ 0	9.8340	2.36	Q				V
23+ 5	9.8502	2.34	Q				V
23+10	9.8662	2.33	Q				V
23+15	9.8821	2.31	Q				V
23+20	9.8980	2.30	Q				V
23+25	9.9137	2.28	Q				V
23+30	9.9293	2.27	Q				V
23+35	9.9448	2.25	Q				V
23+40	9.9602	2.24	Q				V
23+45	9.9755	2.22	Q				V
23+50	9.9907	2.21	Q				V
23+55	10.0059	2.20	Q				V
24+ 0	10.0209	2.18	Q				V
24+ 5	10.0351	2.06	Q				V
24+10	10.0442	1.33	Q				V
24+15	10.0493	0.73	Q				V
24+20	10.0526	0.48	Q				V
24+25	10.0548	0.33	Q				V
24+30	10.0564	0.23	Q				V
24+35	10.0575	0.16	Q				V
24+40	10.0582	0.11	Q				V
24+45	10.0587	0.07	Q				V
24+50	10.0591	0.05	Q				V
24+55	10.0593	0.04	Q				V
25+ 0	10.0595	0.02	Q				V
25+ 5	10.0595	0.01	Q				V

FLOOD HYDROGRAPH ROUTING PROGRAM
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Study date: 05/01/23

COVINGTON - MIP BUILDING 3
10 YEAR STORM EVENT BASIN ROUTING BUILDING 3
5712Q10ROUTING3
DS

Program License Serial Number 6145

********** HYDROGRAPH INFORMATION **********

From study/file name: 5712Q10PUH3.rte
**********HYDROGRAPH DATA**********
Number of intervals = 301
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 93.036 (CFS)
Total volume = 10.060 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

****

++
Process from Point/Station 0.000 to Point/Station 0.000
**** RETARDING BASIN ROUTING ****
_____

User entry of depth-outflow-storage data

Total number of inflow hydrograph intervals = 301
Hydrograph time unit = 5.000 (Min.)
Initial depth in storage basin = 0.00(Ft.)

Initial basin depth = 0.00 (Ft.)
Initial basin storage = 0.00 (Ac.Ft)
Initial basin outflow = 0.00 (CFS)

Depth vs. Storage and Depth vs. Discharge data:

Basin Depth (Ft.)	Storage (Ac.Ft)	Outflow (CFS)	(S-O*dt/2) (Ac.Ft)	(S+O*dt/2) (Ac.Ft)
0.000	0.000	0.000	0.000	0.000
0.500	0.255	2.270	0.247	0.263
1.500	1.010	2.270	1.002	1.018
2.500	1.941	2.270	1.933	1.949
3.000	2.442	2.270	2.434	2.450
4.250	3.754	2.270	3.746	3.762
6.000	5.636	13.110	5.591	5.681

6.500	6.164	15.850	6.109	6.219
7.500	7.182	20.120	7.113	7.251
8.500	8.113	23.550	8.032	8.194
9.500	8.868	26.500	8.777	8.959
10.000	9.123	27.840	9.027	9.219
11.000	9.124	30.340	9.020	9.228
12.000	9.125	32.640	9.013	9.237

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)	.0	23.3	46.52	69.78	93.04	Depth (Ft.)
0.083	0.11	0.00	0.000	O	|	|	|	|	0.00
0.167	0.83	0.03	0.003	O	|	|	|	|	0.01
0.250	1.42	0.10	0.011	O	|	|	|	|	0.02
0.333	1.68	0.18	0.021	O	|	|	|	|	0.04
0.417	1.83	0.28	0.031	O	|	|	|	|	0.06
0.500	1.93	0.37	0.042	O	|	|	|	|	0.08
0.583	2.01	0.47	0.052	O	|	|	|	|	0.10
0.667	2.06	0.56	0.063	O	|	|	|	|	0.12
0.750	2.10	0.65	0.073	O	|	|	|	|	0.14
0.833	2.13	0.74	0.083	O	|	|	|	|	0.16
0.917	2.15	0.82	0.092	O	|	|	|	|	0.18
1.000	2.17	0.90	0.101	O	|	|	|	|	0.20
1.083	2.19	0.98	0.110	O	|	|	|	|	0.22
1.167	2.21	1.05	0.118	O	|	|	|	|	0.23
1.250	2.21	1.12	0.126	O	|	|	|	|	0.25
1.333	2.22	1.18	0.133	O	|	|	|	|	0.26
1.417	2.23	1.25	0.140	O	|	|	|	|	0.27
1.500	2.24	1.30	0.147	O	|	|	|	|	0.29
1.583	2.24	1.36	0.153	O	|	|	|	|	0.30
1.667	2.25	1.41	0.159	O	|	|	|	|	0.31
1.750	2.26	1.46	0.164	O	|	|	|	|	0.32
1.833	2.26	1.51	0.170	O	|	|	|	|	0.33
1.917	2.27	1.56	0.175	O	|	|	|	|	0.34
2.000	2.28	1.60	0.180	O	|	|	|	|	0.35
2.083	2.29	1.64	0.184	O	|	|	|	|	0.36
2.167	2.29	1.68	0.188	O	|	|	|	|	0.37
2.250	2.30	1.71	0.193	O	|	|	|	|	0.38
2.333	2.31	1.75	0.197	O	|	|	|	|	0.39
2.417	2.32	1.78	0.200	O	|	|	|	|	0.39
2.500	2.33	1.82	0.204	O	|	|	|	|	0.40
2.583	2.33	1.85	0.207	O	|	|	|	|	0.41
2.667	2.34	1.88	0.211	O	|	|	|	|	0.41
2.750	2.35	1.90	0.214	O	|	|	|	|	0.42
2.833	2.36	1.93	0.217	O	|	|	|	|	0.43
2.917	2.37	1.96	0.220	O	|	|	|	|	0.43
3.000	2.38	1.98	0.223	O	|	|	|	|	0.44
3.083	2.38	2.00	0.225	O	|	|	|	|	0.44
3.167	2.39	2.03	0.228	O	|	|	|	|	0.45
3.250	2.40	2.05	0.230	O	|	|	|	|	0.45
3.333	2.41	2.07	0.233	O	|	|	|	|	0.46
3.417	2.42	2.09	0.235	O	|	|	|	|	0.46
3.500	2.43	2.11	0.237	O	|	|	|	|	0.46
3.583	2.44	2.13	0.239	O	|	|	|	|	0.47
3.667	2.45	2.15	0.241	O	|	|	|	|	0.47
3.750	2.45	2.17	0.243	O	|	|	|	|	0.48
3.833	2.46	2.18	0.245	O	|	|	|	|	0.48
3.917	2.47	2.20	0.247	O	|	|	|	|	0.48
4.000	2.48	2.22	0.249	O	|	|	|	|	0.49

4.083	2.49	2.23	0.251	O				0.49
4.167	2.50	2.25	0.253	O				0.50
4.250	2.51	2.26	0.254	O				0.50
4.333	2.52	2.27	0.256	O				0.50
4.417	2.53	2.27	0.258	O				0.50
4.500	2.54	2.27	0.260	O				0.51
4.583	2.55	2.27	0.262	O				0.51
4.667	2.56	2.27	0.264	O				0.51
4.750	2.57	2.27	0.266	O				0.51
4.833	2.58	2.27	0.268	O				0.52
4.917	2.59	2.27	0.270	O				0.52
5.000	2.60	2.27	0.272	O				0.52
5.083	2.62	2.27	0.275	O				0.53
5.167	2.63	2.27	0.277	O				0.53
5.250	2.64	2.27	0.279	O				0.53
5.333	2.65	2.27	0.282	O				0.54
5.417	2.66	2.27	0.285	O				0.54
5.500	2.67	2.27	0.287	O				0.54
5.583	2.68	2.27	0.290	O				0.55
5.667	2.70	2.27	0.293	O				0.55
5.750	2.71	2.27	0.296	O				0.55
5.833	2.72	2.27	0.299	O				0.56
5.917	2.73	2.27	0.302	O				0.56
6.000	2.75	2.27	0.305	O				0.57
6.083	2.76	2.27	0.309	O				0.57
6.167	2.77	2.27	0.312	O				0.58
6.250	2.78	2.27	0.316	O				0.58
6.333	2.80	2.27	0.319	O				0.59
6.417	2.81	2.27	0.323	O				0.59
6.500	2.82	2.27	0.327	O				0.59
6.583	2.84	2.27	0.331	O				0.60
6.667	2.85	2.27	0.335	O				0.61
6.750	2.86	2.27	0.339	O				0.61
6.833	2.88	2.27	0.343	O				0.62
6.917	2.89	2.27	0.347	O				0.62
7.000	2.91	2.27	0.351	OI				0.63
7.083	2.92	2.27	0.356	OI				0.63
7.167	2.94	2.27	0.360	OI				0.64
7.250	2.95	2.27	0.365	OI				0.65
7.333	2.97	2.27	0.370	OI				0.65
7.417	2.98	2.27	0.375	OI				0.66
7.500	3.00	2.27	0.380	OI				0.67
7.583	3.02	2.27	0.385	OI				0.67
7.667	3.03	2.27	0.390	OI				0.68
7.750	3.05	2.27	0.395	OI				0.69
7.833	3.07	2.27	0.401	OI				0.69
7.917	3.08	2.27	0.406	OI				0.70
8.000	3.10	2.27	0.412	OI				0.71
8.083	3.12	2.27	0.418	OI				0.72
8.167	3.14	2.27	0.424	OI				0.72
8.250	3.16	2.27	0.430	OI				0.73
8.333	3.18	2.27	0.436	OI				0.74
8.417	3.19	2.27	0.442	OI				0.75
8.500	3.21	2.27	0.448	OI				0.76
8.583	3.23	2.27	0.455	OI				0.76
8.667	3.25	2.27	0.462	OI				0.77
8.750	3.27	2.27	0.469	OI				0.78
8.833	3.29	2.27	0.476	OI				0.79
8.917	3.31	2.27	0.483	OI				0.80
9.000	3.34	2.27	0.490	OI				0.81
9.083	3.36	2.27	0.497	OI				0.82
9.167	3.38	2.27	0.505	OI				0.83
9.250	3.40	2.27	0.513	OI				0.84

9.333	3.43	2.27	0.521	OI				0.85
9.417	3.45	2.27	0.529	OI				0.86
9.500	3.47	2.27	0.537	OI				0.87
9.583	3.50	2.27	0.545	OI				0.88
9.667	3.52	2.27	0.554	OI				0.90
9.750	3.55	2.27	0.562	OI				0.91
9.833	3.57	2.27	0.571	OI				0.92
9.917	3.60	2.27	0.580	OI				0.93
10.000	3.63	2.27	0.590	OI				0.94
10.083	3.65	2.27	0.599	OI				0.96
10.167	3.68	2.27	0.609	OI				0.97
10.250	3.71	2.27	0.619	OI				0.98
10.333	3.74	2.27	0.629	OI				0.99
10.417	3.77	2.27	0.639	OI				1.01
10.500	3.80	2.27	0.649	OI				1.02
10.583	3.83	2.27	0.660	OI				1.04
10.667	3.87	2.27	0.671	OI				1.05
10.750	3.90	2.27	0.682	OI				1.07
10.833	3.93	2.27	0.693	OI				1.08
10.917	3.97	2.27	0.705	OI				1.10
11.000	4.00	2.27	0.717	OI				1.11
11.083	4.04	2.27	0.729	OI				1.13
11.167	4.07	2.27	0.741	OI				1.14
11.250	4.11	2.27	0.753	OI				1.16
11.333	4.15	2.27	0.766	OI				1.18
11.417	4.19	2.27	0.779	OI				1.19
11.500	4.23	2.27	0.793	OI				1.21
11.583	4.27	2.27	0.806	OI				1.23
11.667	4.32	2.27	0.820	OI				1.25
11.750	4.36	2.27	0.835	OI				1.27
11.833	4.41	2.27	0.849	OI				1.29
11.917	4.46	2.27	0.864	OI				1.31
12.000	4.51	2.27	0.879	OI				1.33
12.083	4.54	2.27	0.895	OI				1.35
12.167	4.46	2.27	0.910	OI				1.37
12.250	4.41	2.27	0.925	OI				1.39
12.333	4.42	2.27	0.940	OI				1.41
12.417	4.45	2.27	0.955	OI				1.43
12.500	4.49	2.27	0.970	OI				1.45
12.583	4.54	2.27	0.985	OI				1.47
12.667	4.59	2.27	1.001	OI				1.49
12.750	4.65	2.27	1.017	OI				1.51
12.833	4.72	2.27	1.034	OI				1.53
12.917	4.78	2.27	1.051	OI				1.54
13.000	4.85	2.27	1.069	OI				1.56
13.083	4.93	2.27	1.087	OI				1.58
13.167	5.01	2.27	1.105	OI				1.60
13.250	5.09	2.27	1.124	OI				1.62
13.333	5.17	2.27	1.144	OI				1.64
13.417	5.26	2.27	1.164	OI				1.67
13.500	5.36	2.27	1.185	OI				1.69
13.583	5.46	2.27	1.207	OI				1.71
13.667	5.56	2.27	1.229	OI				1.74
13.750	5.67	2.27	1.252	OI				1.76
13.833	5.79	2.27	1.276	OI				1.79
13.917	5.91	2.27	1.301	O I				1.81
14.000	6.04	2.27	1.326	O I				1.84
14.083	6.18	2.27	1.353	O I				1.87
14.167	6.34	2.27	1.380	O I				1.90
14.250	6.50	2.27	1.409	O I				1.93
14.333	6.68	2.27	1.439	O I				1.96
14.417	6.85	2.27	1.470	O I				1.99
14.500	7.05	2.27	1.502	O I				2.03

14.583	7.25	2.27	1.535	O I	2.06
14.667	7.49	2.27	1.571	O I	2.10
14.750	7.72	2.27	1.607	O I	2.14
14.833	8.00	2.27	1.646	O I	2.18
14.917	8.29	2.27	1.686	O I	2.23
15.000	8.63	2.27	1.729	O I	2.27
15.083	8.98	2.27	1.774	O I	2.32
15.167	9.40	2.27	1.821	O I	2.37
15.250	9.85	2.27	1.872	O I	2.43
15.333	10.40	2.27	1.926	O I	2.48
15.417	10.83	2.27	1.984	O I	2.54
15.500	10.49	2.27	2.041	O I	2.60
15.583	10.40	2.27	2.098	O I	2.66
15.667	11.06	2.27	2.156	O I	2.71
15.750	12.07	2.27	2.220	O I	2.78
15.833	13.83	2.27	2.294	O I	2.85
15.917	16.59	2.27	2.383	O I	2.94
16.000	22.72	2.27	2.502	O I	3.06
16.083	40.43	2.27	2.704	O I	3.25
16.167	93.04	2.27	3.148	O I	3.67
16.250	77.65	2.27	3.720	O I	4.22
16.333	43.46	4.35	4.115	O I	4.59
16.417	30.12	5.61	4.334	O I	4.79
16.500	23.82	6.44	4.478	O I	4.92
16.583	19.64	7.03	4.581	O I	5.02
16.667	16.65	7.47	4.656	O I	5.09
16.750	14.25	7.78	4.710	O I	5.14
16.833	12.24	7.99	4.747	O I	5.17
16.917	10.60	8.12	4.770	OI	5.19
17.000	9.90	8.21	4.785	OI	5.21
17.083	9.08	8.26	4.793	OI	5.22
17.167	8.12	8.27	4.796	O	5.22
17.250	6.89	8.24	4.790	O	5.21
17.333	6.50	8.18	4.780	O	5.20
17.417	6.19	8.11	4.768	O	5.19
17.500	5.91	8.03	4.754	O	5.18
17.583	5.66	7.94	4.739	IO	5.17
17.667	5.44	7.85	4.722	IO	5.15
17.750	5.25	7.75	4.706	IO	5.13
17.833	5.07	7.65	4.688	IO	5.12
17.917	4.90	7.55	4.670	IO	5.10
18.000	4.75	7.44	4.652	IO	5.08
18.083	4.64	7.33	4.633	IO	5.07
18.167	4.64	7.23	4.615	IO	5.05
18.250	4.62	7.13	4.597	IO	5.03
18.333	4.55	7.03	4.580	IO	5.02
18.417	4.48	6.93	4.563	IO	5.00
18.500	4.40	6.83	4.546	IO	4.99
18.583	4.31	6.74	4.530	IO	4.97
18.667	4.24	6.64	4.513	IO	4.96
18.750	4.16	6.55	4.497	IO	4.94
18.833	4.08	6.45	4.480	IO	4.93
18.917	4.01	6.36	4.464	IO	4.91
19.000	3.94	6.27	4.448	IO	4.90
19.083	3.88	6.17	4.432	IO	4.88
19.167	3.82	6.08	4.416	IO	4.87
19.250	3.75	5.99	4.401	IO	4.85
19.333	3.70	5.91	4.385	IO	4.84
19.417	3.64	5.82	4.370	IO	4.82
19.500	3.59	5.73	4.355	O	4.81
19.583	3.53	5.65	4.341	O	4.80
19.667	3.48	5.57	4.326	O	4.78
19.750	3.44	5.48	4.312	O	4.77

19.833	3.39	5.40	4.298	|O	|	|	|	4.76
19.917	3.35	5.32	4.284	|O	|	|	|	4.74
20.000	3.30	5.25	4.271	|O	|	|	|	4.73
20.083	3.26	5.17	4.257	|O	|	|	|	4.72
20.167	3.22	5.09	4.244	|O	|	|	|	4.71
20.250	3.18	5.02	4.232	|O	|	|	|	4.69
20.333	3.15	4.95	4.219	|O	|	|	|	4.68
20.417	3.11	4.88	4.207	|O	|	|	|	4.67
20.500	3.07	4.81	4.195	|O	|	|	|	4.66
20.583	3.04	4.74	4.183	|O	|	|	|	4.65
20.667	3.01	4.67	4.171	|O	|	|	|	4.64
20.750	2.98	4.61	4.160	|O	|	|	|	4.63
20.833	2.94	4.54	4.149	|O	|	|	|	4.62
20.917	2.91	4.48	4.138	|O	|	|	|	4.61
21.000	2.88	4.42	4.127	IO	|	|	|	4.60
21.083	2.86	4.36	4.117	IO	|	|	|	4.59
21.167	2.83	4.30	4.107	IO	|	|	|	4.58
21.250	2.80	4.24	4.096	IO	|	|	|	4.57
21.333	2.78	4.19	4.087	IO	|	|	|	4.56
21.417	2.75	4.13	4.077	IO	|	|	|	4.55
21.500	2.72	4.08	4.068	IO	|	|	|	4.54
21.583	2.70	4.02	4.058	IO	|	|	|	4.53
21.667	2.68	3.97	4.049	IO	|	|	|	4.52
21.750	2.65	3.92	4.041	IO	|	|	|	4.52
21.833	2.63	3.87	4.032	IO	|	|	|	4.51
21.917	2.61	3.82	4.023	IO	|	|	|	4.50
22.000	2.59	3.77	4.015	IO	|	|	|	4.49
22.083	2.57	3.73	4.007	IO	|	|	|	4.49
22.167	2.55	3.68	3.999	IO	|	|	|	4.48
22.250	2.52	3.64	3.991	IO	|	|	|	4.47
22.333	2.51	3.59	3.984	IO	|	|	|	4.46
22.417	2.49	3.55	3.976	IO	|	|	|	4.46
22.500	2.47	3.51	3.969	IO	|	|	|	4.45
22.583	2.45	3.47	3.962	IO	|	|	|	4.44
22.667	2.43	3.43	3.955	IO	|	|	|	4.44
22.750	2.41	3.39	3.948	IO	|	|	|	4.43
22.833	2.39	3.35	3.942	IO	|	|	|	4.42
22.917	2.38	3.31	3.935	IO	|	|	|	4.42
23.000	2.36	3.28	3.929	IO	|	|	|	4.41
23.083	2.34	3.24	3.923	IO	|	|	|	4.41
23.167	2.33	3.21	3.916	IO	|	|	|	4.40
23.250	2.31	3.17	3.910	IO	|	|	|	4.40
23.333	2.30	3.14	3.905	IO	|	|	|	4.39
23.417	2.28	3.10	3.899	IO	|	|	|	4.38
23.500	2.27	3.07	3.893	IO	|	|	|	4.38
23.583	2.25	3.04	3.888	IO	|	|	|	4.37
23.667	2.24	3.01	3.882	IO	|	|	|	4.37
23.750	2.22	2.98	3.877	IO	|	|	|	4.36
23.833	2.21	2.95	3.872	IO	|	|	|	4.36
23.917	2.20	2.92	3.867	IO	|	|	|	4.36
24.000	2.18	2.89	3.862	O	|	|	|	4.35
24.083	2.06	2.86	3.857	O	|	|	|	4.35
24.167	1.33	2.82	3.849	O	|	|	|	4.34
24.250	0.73	2.75	3.837	O	|	|	|	4.33
24.333	0.48	2.66	3.822	O	|	|	|	4.31
24.417	0.33	2.58	3.807	O	|	|	|	4.30
24.500	0.23	2.49	3.792	O	|	|	|	4.28
24.583	0.16	2.40	3.776	O	|	|	|	4.27
24.667	0.11	2.31	3.761	O	|	|	|	4.26
24.750	0.07	2.27	3.746	O	|	|	|	4.24
24.833	0.05	2.27	3.731	O	|	|	|	4.23
24.917	0.04	2.27	3.715	O	|	|	|	4.21
25.000	0.02	2.27	3.700	O	|	|	|	4.20

25.083	0.01	2.27	3.684	O	|	|	|	|	4.18
25.167	0.00	2.27	3.669	O	|	|	|	|	4.17
25.250	0.00	2.27	3.653	O	|	|	|	|	4.15
25.333	0.00	2.27	3.637	O	|	|	|	|	4.14
25.417	0.00	2.27	3.622	O	|	|	|	|	4.12
25.500	0.00	2.27	3.606	O	|	|	|	|	4.11
25.583	0.00	2.27	3.590	O	|	|	|	|	4.09
25.667	0.00	2.27	3.575	O	|	|	|	|	4.08
25.750	0.00	2.27	3.559	O	|	|	|	|	4.06
25.833	0.00	2.27	3.544	O	|	|	|	|	4.05
25.917	0.00	2.27	3.528	O	|	|	|	|	4.03
26.000	0.00	2.27	3.512	O	|	|	|	|	4.02
26.083	0.00	2.27	3.497	O	|	|	|	|	4.00
26.167	0.00	2.27	3.481	O	|	|	|	|	3.99
26.250	0.00	2.27	3.465	O	|	|	|	|	3.97
26.333	0.00	2.27	3.450	O	|	|	|	|	3.96
26.417	0.00	2.27	3.434	O	|	|	|	|	3.95
26.500	0.00	2.27	3.418	O	|	|	|	|	3.93
26.583	0.00	2.27	3.403	O	|	|	|	|	3.92
26.667	0.00	2.27	3.387	O	|	|	|	|	3.90
26.750	0.00	2.27	3.372	O	|	|	|	|	3.89
26.833	0.00	2.27	3.356	O	|	|	|	|	3.87
26.917	0.00	2.27	3.340	O	|	|	|	|	3.86
27.000	0.00	2.27	3.325	O	|	|	|	|	3.84
27.083	0.00	2.27	3.309	O	|	|	|	|	3.83
27.167	0.00	2.27	3.293	O	|	|	|	|	3.81
27.250	0.00	2.27	3.278	O	|	|	|	|	3.80
27.333	0.00	2.27	3.262	O	|	|	|	|	3.78
27.417	0.00	2.27	3.246	O	|	|	|	|	3.77
27.500	0.00	2.27	3.231	O	|	|	|	|	3.75
27.583	0.00	2.27	3.215	O	|	|	|	|	3.74
27.667	0.00	2.27	3.200	O	|	|	|	|	3.72
27.750	0.00	2.27	3.184	O	|	|	|	|	3.71
27.833	0.00	2.27	3.168	O	|	|	|	|	3.69
27.917	0.00	2.27	3.153	O	|	|	|	|	3.68
28.000	0.00	2.27	3.137	O	|	|	|	|	3.66
28.083	0.00	2.27	3.121	O	|	|	|	|	3.65
28.167	0.00	2.27	3.106	O	|	|	|	|	3.63
28.250	0.00	2.27	3.090	O	|	|	|	|	3.62
28.333	0.00	2.27	3.075	O	|	|	|	|	3.60
28.417	0.00	2.27	3.059	O	|	|	|	|	3.59
28.500	0.00	2.27	3.043	O	|	|	|	|	3.57
28.583	0.00	2.27	3.028	O	|	|	|	|	3.56
28.667	0.00	2.27	3.012	O	|	|	|	|	3.54
28.750	0.00	2.27	2.996	O	|	|	|	|	3.53
28.833	0.00	2.27	2.981	O	|	|	|	|	3.51
28.917	0.00	2.27	2.965	O	|	|	|	|	3.50
29.000	0.00	2.27	2.949	O	|	|	|	|	3.48
29.083	0.00	2.27	2.934	O	|	|	|	|	3.47
29.167	0.00	2.27	2.918	O	|	|	|	|	3.45
29.250	0.00	2.27	2.903	O	|	|	|	|	3.44
29.333	0.00	2.27	2.887	O	|	|	|	|	3.42
29.417	0.00	2.27	2.871	O	|	|	|	|	3.41
29.500	0.00	2.27	2.856	O	|	|	|	|	3.39
29.583	0.00	2.27	2.840	O	|	|	|	|	3.38
29.667	0.00	2.27	2.824	O	|	|	|	|	3.36
29.750	0.00	2.27	2.809	O	|	|	|	|	3.35
29.833	0.00	2.27	2.793	O	|	|	|	|	3.33
29.917	0.00	2.27	2.777	O	|	|	|	|	3.32
30.000	0.00	2.27	2.762	O	|	|	|	|	3.30
30.083	0.00	2.27	2.746	O	|	|	|	|	3.29
30.167	0.00	2.27	2.731	O	|	|	|	|	3.27
30.250	0.00	2.27	2.715	O	|	|	|	|	3.26

30.333	0.00	2.27	2.699	O					3.25
30.417	0.00	2.27	2.684	O					3.23
30.500	0.00	2.27	2.668	O					3.22
30.583	0.00	2.27	2.652	O					3.20
30.667	0.00	2.27	2.637	O					3.19
30.750	0.00	2.27	2.621	O					3.17
30.833	0.00	2.27	2.606	O					3.16
30.917	0.00	2.27	2.590	O					3.14
31.000	0.00	2.27	2.574	O					3.13
31.083	0.00	2.27	2.559	O					3.11
31.167	0.00	2.27	2.543	O					3.10
31.250	0.00	2.27	2.527	O					3.08
31.333	0.00	2.27	2.512	O					3.07
31.417	0.00	2.27	2.496	O					3.05
31.500	0.00	2.27	2.480	O					3.04
31.583	0.00	2.27	2.465	O					3.02
31.667	0.00	2.27	2.449	O					3.01
31.750	0.00	2.27	2.434	O					2.99
31.833	0.00	2.27	2.418	O					2.98
31.917	0.00	2.27	2.402	O					2.96
32.000	0.00	2.27	2.387	O					2.94
32.083	0.00	2.27	2.371	O					2.93
32.167	0.00	2.27	2.355	O					2.91
32.250	0.00	2.27	2.340	O					2.90
32.333	0.00	2.27	2.324	O					2.88
32.417	0.00	2.27	2.308	O					2.87
32.500	0.00	2.27	2.293	O					2.85
32.583	0.00	2.27	2.277	O					2.84
32.667	0.00	2.27	2.262	O					2.82
32.750	0.00	2.27	2.246	O					2.80
32.833	0.00	2.27	2.230	O					2.79
32.917	0.00	2.27	2.215	O					2.77
33.000	0.00	2.27	2.199	O					2.76
33.083	0.00	2.27	2.183	O					2.74
33.167	0.00	2.27	2.168	O					2.73
33.250	0.00	2.27	2.152	O					2.71
33.333	0.00	2.27	2.137	O					2.70
33.417	0.00	2.27	2.121	O					2.68
33.500	0.00	2.27	2.105	O					2.66
33.583	0.00	2.27	2.090	O					2.65
33.667	0.00	2.27	2.074	O					2.63
33.750	0.00	2.27	2.058	O					2.62
33.833	0.00	2.27	2.043	O					2.60
33.917	0.00	2.27	2.027	O					2.59
34.000	0.00	2.27	2.011	O					2.57
34.083	0.00	2.27	1.996	O					2.55
34.167	0.00	2.27	1.980	O					2.54
34.250	0.00	2.27	1.965	O					2.52
34.333	0.00	2.27	1.949	O					2.51
34.417	0.00	2.27	1.933	O					2.49
34.500	0.00	2.27	1.918	O					2.47
34.583	0.00	2.27	1.902	O					2.46
34.667	0.00	2.27	1.886	O					2.44
34.750	0.00	2.27	1.871	O					2.42
34.833	0.00	2.27	1.855	O					2.41
34.917	0.00	2.27	1.839	O					2.39
35.000	0.00	2.27	1.824	O					2.37
35.083	0.00	2.27	1.808	O					2.36
35.167	0.00	2.27	1.793	O					2.34
35.250	0.00	2.27	1.777	O					2.32
35.333	0.00	2.27	1.761	O					2.31
35.417	0.00	2.27	1.746	O					2.29
35.500	0.00	2.27	1.730	O					2.27

35.583	0.00	2.27	1.714	O	|	|	|	|	2.26
35.667	0.00	2.27	1.699	O	|	|	|	|	2.24
35.750	0.00	2.27	1.683	O	|	|	|	|	2.22
35.833	0.00	2.27	1.667	O	|	|	|	|	2.21
35.917	0.00	2.27	1.652	O	|	|	|	|	2.19
36.000	0.00	2.27	1.636	O	|	|	|	|	2.17
36.083	0.00	2.27	1.621	O	|	|	|	|	2.16
36.167	0.00	2.27	1.605	O	|	|	|	|	2.14
36.250	0.00	2.27	1.589	O	|	|	|	|	2.12
36.333	0.00	2.27	1.574	O	|	|	|	|	2.11
36.417	0.00	2.27	1.558	O	|	|	|	|	2.09
36.500	0.00	2.27	1.542	O	|	|	|	|	2.07
36.583	0.00	2.27	1.527	O	|	|	|	|	2.06
36.667	0.00	2.27	1.511	O	|	|	|	|	2.04
36.750	0.00	2.27	1.496	O	|	|	|	|	2.02
36.833	0.00	2.27	1.480	O	|	|	|	|	2.00
36.917	0.00	2.27	1.464	O	|	|	|	|	1.99
37.000	0.00	2.27	1.449	O	|	|	|	|	1.97
37.083	0.00	2.27	1.433	O	|	|	|	|	1.95
37.167	0.00	2.27	1.417	O	|	|	|	|	1.94
37.250	0.00	2.27	1.402	O	|	|	|	|	1.92
37.333	0.00	2.27	1.386	O	|	|	|	|	1.90
37.417	0.00	2.27	1.370	O	|	|	|	|	1.89
37.500	0.00	2.27	1.355	O	|	|	|	|	1.87
37.583	0.00	2.27	1.339	O	|	|	|	|	1.85
37.667	0.00	2.27	1.324	O	|	|	|	|	1.84
37.750	0.00	2.27	1.308	O	|	|	|	|	1.82
37.833	0.00	2.27	1.292	O	|	|	|	|	1.80
37.917	0.00	2.27	1.277	O	|	|	|	|	1.79
38.000	0.00	2.27	1.261	O	|	|	|	|	1.77
38.083	0.00	2.27	1.245	O	|	|	|	|	1.75
38.167	0.00	2.27	1.230	O	|	|	|	|	1.74
38.250	0.00	2.27	1.214	O	|	|	|	|	1.72
38.333	0.00	2.27	1.198	O	|	|	|	|	1.70
38.417	0.00	2.27	1.183	O	|	|	|	|	1.69
38.500	0.00	2.27	1.167	O	|	|	|	|	1.67
38.583	0.00	2.27	1.152	O	|	|	|	|	1.65
38.667	0.00	2.27	1.136	O	|	|	|	|	1.64
38.750	0.00	2.27	1.120	O	|	|	|	|	1.62
38.833	0.00	2.27	1.105	O	|	|	|	|	1.60
38.917	0.00	2.27	1.089	O	|	|	|	|	1.58
39.000	0.00	2.27	1.073	O	|	|	|	|	1.57
39.083	0.00	2.27	1.058	O	|	|	|	|	1.55
39.167	0.00	2.27	1.042	O	|	|	|	|	1.53
39.250	0.00	2.27	1.027	O	|	|	|	|	1.52
39.333	0.00	2.27	1.011	O	|	|	|	|	1.50
39.417	0.00	2.27	0.995	O	|	|	|	|	1.48
39.500	0.00	2.27	0.980	O	|	|	|	|	1.46
39.583	0.00	2.27	0.964	O	|	|	|	|	1.44
39.667	0.00	2.27	0.948	O	|	|	|	|	1.42
39.750	0.00	2.27	0.933	O	|	|	|	|	1.40
39.833	0.00	2.27	0.917	O	|	|	|	|	1.38
39.917	0.00	2.27	0.901	O	|	|	|	|	1.36
40.000	0.00	2.27	0.886	O	|	|	|	|	1.34
40.083	0.00	2.27	0.870	O	|	|	|	|	1.31
40.167	0.00	2.27	0.855	O	|	|	|	|	1.29
40.250	0.00	2.27	0.839	O	|	|	|	|	1.27
40.333	0.00	2.27	0.823	O	|	|	|	|	1.25
40.417	0.00	2.27	0.808	O	|	|	|	|	1.23
40.500	0.00	2.27	0.792	O	|	|	|	|	1.21
40.583	0.00	2.27	0.776	O	|	|	|	|	1.19
40.667	0.00	2.27	0.761	O	|	|	|	|	1.17
40.750	0.00	2.27	0.745	O	|	|	|	|	1.15

40.833	0.00	2.27	0.729	O	|	|	|	|	1.13
40.917	0.00	2.27	0.714	O	|	|	|	|	1.11
41.000	0.00	2.27	0.698	O	|	|	|	|	1.09
41.083	0.00	2.27	0.683	O	|	|	|	|	1.07
41.167	0.00	2.27	0.667	O	|	|	|	|	1.05
41.250	0.00	2.27	0.651	O	|	|	|	|	1.02
41.333	0.00	2.27	0.636	O	|	|	|	|	1.00
41.417	0.00	2.27	0.620	O	|	|	|	|	0.98
41.500	0.00	2.27	0.604	O	|	|	|	|	0.96
41.583	0.00	2.27	0.589	O	|	|	|	|	0.94
41.667	0.00	2.27	0.573	O	|	|	|	|	0.92
41.750	0.00	2.27	0.558	O	|	|	|	|	0.90
41.833	0.00	2.27	0.542	O	|	|	|	|	0.88
41.917	0.00	2.27	0.526	O	|	|	|	|	0.86
42.000	0.00	2.27	0.511	O	|	|	|	|	0.84
42.083	0.00	2.27	0.495	O	|	|	|	|	0.82
42.167	0.00	2.27	0.479	O	|	|	|	|	0.80
42.250	0.00	2.27	0.464	O	|	|	|	|	0.78
42.333	0.00	2.27	0.448	O	|	|	|	|	0.76
42.417	0.00	2.27	0.432	O	|	|	|	|	0.74
42.500	0.00	2.27	0.417	O	|	|	|	|	0.71
42.583	0.00	2.27	0.401	O	|	|	|	|	0.69
42.667	0.00	2.27	0.386	O	|	|	|	|	0.67
42.750	0.00	2.27	0.370	O	|	|	|	|	0.65
42.833	0.00	2.27	0.354	O	|	|	|	|	0.63
42.917	0.00	2.27	0.339	O	|	|	|	|	0.61
43.000	0.00	2.27	0.323	O	|	|	|	|	0.59
43.083	0.00	2.27	0.307	O	|	|	|	|	0.57
43.167	0.00	2.27	0.292	O	|	|	|	|	0.55
43.250	0.00	2.27	0.276	O	|	|	|	|	0.53
43.333	0.00	2.27	0.260	O	|	|	|	|	0.51
43.417	0.00	2.18	0.245	O	|	|	|	|	0.48
43.500	0.00	2.05	0.231	O	|	|	|	|	0.45
43.583	0.00	1.93	0.217	O	|	|	|	|	0.43
43.667	0.00	1.82	0.204	O	|	|	|	|	0.40
43.750	0.00	1.71	0.192	O	|	|	|	|	0.38
43.833	0.00	1.61	0.180	O	|	|	|	|	0.35
43.917	0.00	1.51	0.170	O	|	|	|	|	0.33
44.000	0.00	1.42	0.160	O	|	|	|	|	0.31
44.083	0.00	1.34	0.150	O	|	|	|	|	0.29
44.167	0.00	1.26	0.141	O	|	|	|	|	0.28
44.250	0.00	1.18	0.133	O	|	|	|	|	0.26
44.333	0.00	1.11	0.125	O	|	|	|	|	0.24
44.417	0.00	1.05	0.117	O	|	|	|	|	0.23
44.500	0.00	0.98	0.110	O	|	|	|	|	0.22
44.583	0.00	0.92	0.104	O	|	|	|	|	0.20
44.667	0.00	0.87	0.098	O	|	|	|	|	0.19
44.750	0.00	0.82	0.092	O	|	|	|	|	0.18
44.833	0.00	0.77	0.086	O	|	|	|	|	0.17
44.917	0.00	0.72	0.081	O	|	|	|	|	0.16
45.000	0.00	0.68	0.076	O	|	|	|	|	0.15
45.083	0.00	0.64	0.072	O	|	|	|	|	0.14
45.167	0.00	0.60	0.068	O	|	|	|	|	0.13
45.250	0.00	0.57	0.064	O	|	|	|	|	0.12
45.333	0.00	0.53	0.060	O	|	|	|	|	0.12
45.417	0.00	0.50	0.056	O	|	|	|	|	0.11
45.500	0.00	0.47	0.053	O	|	|	|	|	0.10
45.583	0.00	0.44	0.050	O	|	|	|	|	0.10
45.667	0.00	0.42	0.047	O	|	|	|	|	0.09
45.750	0.00	0.39	0.044	O	|	|	|	|	0.09
45.833	0.00	0.37	0.041	O	|	|	|	|	0.08
45.917	0.00	0.35	0.039	O	|	|	|	|	0.08
46.000	0.00	0.33	0.037	O	|	|	|	|	0.07

46.083	0.00	0.31	0.034	O	|	|	|	|	0.07
46.167	0.00	0.29	0.032	O	|	|	|	|	0.06
46.250	0.00	0.27	0.030	O	|	|	|	|	0.06
46.333	0.00	0.26	0.029	O	|	|	|	|	0.06
46.417	0.00	0.24	0.027	O	|	|	|	|	0.05
46.500	0.00	0.23	0.025	O	|	|	|	|	0.05
46.583	0.00	0.21	0.024	O	|	|	|	|	0.05
46.667	0.00	0.20	0.022	O	|	|	|	|	0.04
46.750	0.00	0.19	0.021	O	|	|	|	|	0.04
46.833	0.00	0.18	0.020	O	|	|	|	|	0.04
46.917	0.00	0.17	0.019	O	|	|	|	|	0.04
47.000	0.00	0.16	0.018	O	|	|	|	|	0.03
47.083	0.00	0.15	0.017	O	|	|	|	|	0.03
47.167	0.00	0.14	0.016	O	|	|	|	|	0.03
47.250	0.00	0.13	0.015	O	|	|	|	|	0.03
47.333	0.00	0.12	0.014	O	|	|	|	|	0.03
47.417	0.00	0.11	0.013	O	|	|	|	|	0.03
47.500	0.00	0.11	0.012	O	|	|	|	|	0.02
47.583	0.00	0.10	0.011	O	|	|	|	|	0.02
47.667	0.00	0.10	0.011	O	|	|	|	|	0.02
47.750	0.00	0.09	0.010	O	|	|	|	|	0.02
47.833	0.00	0.08	0.010	O	|	|	|	|	0.02
47.917	0.00	0.08	0.009	O	|	|	|	|	0.02
48.000	0.00	0.07	0.008	O	|	|	|	|	0.02
48.083	0.00	0.07	0.008	O	|	|	|	|	0.02
48.167	0.00	0.07	0.007	O	|	|	|	|	0.01
48.250	0.00	0.06	0.007	O	|	|	|	|	0.01
48.333	0.00	0.06	0.007	O	|	|	|	|	0.01
48.417	0.00	0.06	0.006	O	|	|	|	|	0.01
48.500	0.00	0.05	0.006	O	|	|	|	|	0.01
48.583	0.00	0.05	0.005	O	|	|	|	|	0.01
48.667	0.00	0.05	0.005	O	|	|	|	|	0.01
48.750	0.00	0.04	0.005	O	|	|	|	|	0.01
48.833	0.00	0.04	0.005	O	|	|	|	|	0.01
48.917	0.00	0.04	0.004	O	|	|	|	|	0.01
49.000	0.00	0.04	0.004	O	|	|	|	|	0.01
49.083	0.00	0.03	0.004	O	|	|	|	|	0.01
49.167	0.00	0.03	0.004	O	|	|	|	|	0.01
49.250	0.00	0.03	0.003	O	|	|	|	|	0.01
49.333	0.00	0.03	0.003	O	|	|	|	|	0.01
49.417	0.00	0.03	0.003	O	|	|	|	|	0.01
49.500	0.00	0.02	0.003	O	|	|	|	|	0.01
49.583	0.00	0.02	0.003	O	|	|	|	|	0.01
49.667	0.00	0.02	0.002	O	|	|	|	|	0.00
49.750	0.00	0.02	0.002	O	|	|	|	|	0.00
49.833	0.00	0.02	0.002	O	|	|	|	|	0.00
49.917	0.00	0.02	0.002	O	|	|	|	|	0.00
50.000	0.00	0.02	0.002	O	|	|	|	|	0.00
50.083	0.00	0.02	0.002	O	|	|	|	|	0.00
50.167	0.00	0.02	0.002	O	|	|	|	|	0.00
50.250	0.00	0.01	0.002	O	|	|	|	|	0.00
50.333	0.00	0.01	0.002	O	|	|	|	|	0.00
50.417	0.00	0.01	0.001	O	|	|	|	|	0.00
50.500	0.00	0.01	0.001	O	|	|	|	|	0.00
50.583	0.00	0.01	0.001	O	|	|	|	|	0.00
50.667	0.00	0.01	0.001	O	|	|	|	|	0.00
50.750	0.00	0.01	0.001	O	|	|	|	|	0.00
50.833	0.00	0.01	0.001	O	|	|	|	|	0.00
50.917	0.00	0.01	0.001	O	|	|	|	|	0.00
51.000	0.00	0.01	0.001	O	|	|	|	|	0.00
51.083	0.00	0.01	0.001	O	|	|	|	|	0.00
51.167	0.00	0.01	0.001	O	|	|	|	|	0.00
51.250	0.00	0.01	0.001	O	|	|	|	|	0.00

51.333	0.00	0.01	0.001	O	|	|	|	|	0.00
51.417	0.00	0.01	0.001	O	|	|	|	|	0.00
51.500	0.00	0.01	0.001	O	|	|	|	|	0.00
51.583	0.00	0.01	0.001	O	|	|	|	|	0.00
51.667	0.00	0.01	0.001	O	|	|	|	|	0.00
51.750	0.00	0.00	0.001	O	|	|	|	|	0.00
51.833	0.00	0.00	0.001	O	|	|	|	|	0.00

**********HYDROGRAPH DATA**********

Number of intervals = 622
Time interval = 5.0 (Min.)
Maximum/Peak flow rate = 8.269 (CFS)
Total volume = 10.059 (Ac.Ft)

Status of hydrographs being held in storage

	Stream 1	Stream 2	Stream 3	Stream 4	Stream 5
Peak (CFS)	0.000	0.000	0.000	0.000	0.000
Vol (Ac.Ft)	0.000	0.000	0.000	0.000	0.000

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